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# The Efficacy of Equine Assisted Therapy in the Treatment of Autism Spectrum Disorders

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**THE EFFICACY OF EQUINE ASSISTED THERAPY IN THE TREATMENT OF  
AUTISM SPECTRUM DISORDERS**

By

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B.S. Bucknell University, 2008

M.S. University of Maine, 2010

A DISSERTATION

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

Interdisciplinary in Equine-Assisted Psychotherapies

The Graduate School

The University of Maine

August 2018

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# **THE EFFICACY OF EQUINE ASSISTED THERAPY**

By Amy Hofmann

Dissertation Advisor: Dr. Robert Causey

An Abstract of the Dissertation Presented  
in Partial Fulfillment of the Requirements for the  
Degree of Doctor of Philosophy  
Interdisciplinary in Equine-Assisted Psychotherapies

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This study examines the effects of equine-assisted psychotherapies in children with an autism spectrum disorder. The CARS-2 and Children's Sleep Habits Questionnaire parent-report questionnaires were used for evaluation, as well open-ended questions. A single researcher contacted and visited many PATH-certified centers in the United States. Facilities that participated were all located in the Mid-Atlantic to Northeast region. There were 16 participants, from 11 different farms, that completed both the initial and follow-up questionnaires which were given 7 weeks apart. A \$25 Amazon gift card was used as an incentive to increase participation. Participating facilities also completed a questionnaire.

Overall, results do not show a definitive trend towards worsening or improving. There was a possible age effect in participants who had an autism diagnosis, with improvements being seen in children older than 9 years. More research is needed to validate this claim. Those that improved or worsened on both questionnaires varied by age, gender, farm, and duration of equine therapy experience. No conclusions regarding the efficacy of equine-assisted psychotherapy could be made from these results.

Subjective responses in the questionnaires indicate that participants feel that equine-assisted therapeutic activities were enjoyable and beneficial to their children. Results also indicate that participants feel that they received the benefits that they expected to receive. There

were no reports of negative experiences in this study. It could be possible that those that did not perceive enjoyment or benefit from this therapy may have stopped participating and therefore dropped out. In the absence of any measured objective effects, it is not clear if the perceived benefits merely represent a placebo effect, or a valid treatment effect. It is possible that factors dealing with expectations and feelings are affecting growth and healing.

This study addresses future directions in this field. Growing interest in equine-assisted activities and therapies requires larger sample sizes to determine epidemiologic trends. However, the best way forward may not be through a randomized, double-blinded, heavily controlled approach. Instead, studies based on information accumulated in large patient registries and databases may allow us to assess the effectiveness of these therapies in the settings where they are traditionally practiced.

## **PREFACE**

This research examines the efficacy of equine-assisted psychotherapy. Originally the study focused on the effects of equine-assisted psychotherapy in veterans with posttraumatic stress disorder. However, due to regulatory difficulties, research collaborations could not be established in this area, and a new focus was sought. Given the increasing prevalence of autism, and the search for alternative treatments, the focus of the study shifted to assessing the benefits of equine-assisted psychotherapy in children with autism spectrum disorders. Data was collected in a preliminary and then an expanded clinical trial. The major goal has been to show if equine-assisted activities and therapies are effective forms of therapy in children on the autism spectrum.

An additional goal has been to apply a consistent methodology to multiple facilities and states. It is hoped that future studies can build upon these results, which were obtained in multiple facilities, and encourage different facilities to use similar forms of assessment for ease of comparison. This type of project can potentially evaluate objectively the effectiveness of equine-assisted activities and therapies on a large scale, thereby augmenting the extensive anecdotal evidence in the literature.

This dissertation first reviews the literature of social disconnection, its relationship to dysfunction of the autonomic nervous system, and management of disease in patients with PTSD and autism spectrum disorders. It then describes results of the preliminary and expanded trials of the efficacy of equine assisted psychotherapy in children with autism spectrum disorder, and in children with various other impairments of mental health, as well as future goals in the field.

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# **CHAPTER 1**

## **BACKGROUND LITERATURE REVIEW**

Psychological disorders that impair social interaction cause great distress to patients, friends, and family. This dissertation originated out of concern for individuals suffering from Posttraumatic Stress Disorder and Autism Spectrum Disorder, both conditions in which social interactions can be severely disrupted. In this literature review we will first examine the development of healthy social interactions in humans, how these relationships may be disrupted, and end with a description of the benefits that may be provided by using horses in a therapeutic setting. This will provide the background for the experimental work that follows.

### **1.1. The Development of Social Connection and Attachment in Human Relationships**

Humans are highly social beings and social interactions are crucial in human development throughout life (McDowell, 2009; Ross, 2009; Small, 2011). People first learn about social, interpersonal connections through interactions within their families. Families, especially parents, provide the first opportunities and experiences for social contact and emotional adaptation. It is believed that parents and other family members greatly impact a child's later interactions with peers and intimate partners. Family relationships also impact the quality of subsequent parent-child and family-child interactions. Early relationships thus become internalized, and are then externalized in behaviors which can play a beneficial or detrimental role in social development (Groh, 2014; McDowell, 2009; Ross, 2009; Yorke, 2013).

Parenting and sibling behaviors greatly impact a child's social behaviors, including social competence, interpersonal skills, emotional regulation, and aggression. For example, family and peer relationships can help teach a person about moral standards, rights, welfare, equality, and prosocial behaviors (McDowell, 2009; Ross, 2009). Children can learn about communication,

cooperation, and discussion. They can also learn about aggression (relational and physical) and psychological and behavioral control. What a child learns from their family can support or undermine their abilities to interact peacefully and productively with their peers, which greatly impacts the quality of these relationships and acceptance. Social development theorists have shown that specific parenting styles can be observed in the social behaviors of their children (Casas, 2006; Groh, 2014; McDowell, 2009; Ross, 2009; Updegraff, 2000). Furthermore, when parents are more negative in their interactions with their children, such as being over-controlling, the children tend to have more negative interactions with their peers. Likewise, more positive, warm, and nurturing parent-child interactions tend to lead to more positive, socially competent interactions with peers (McDowell, 2009; Ross, 2009).

The quality of the parent-child relationship is crucial in development of a child's attachment style. Attachment theorists say that attachment styles greatly impact all later social relationships, personality, and resilience (Cacioppo, 2008; Groh, 2014; Ross, 2009; Yorke, 2013). More securely attached children tend to be more popular amongst their peers and show greater empathy. These children usually have parents that are highly engaged, responsive, and teach them positive social and emotional communication skills. Children that develop resistant-insecure attachments with the parents tend to be unpopular and withdrawn, and are often victimized within their peer groups. Children that develop avoidant-insecure attachments tend to be unpopular and aggressive, and often bully their peers (Groh, 2014; Ross, 2009). Socially rejected/unpopular children often have experienced awkward, over-arousing, or distressing interactions with their parents. Most of the time, these children never learned appropriate social or emotional regulation skills (Casas, 2006; McDowell, 2009; Ross, 2009; Small, 2011). Attachment styles, as well as person's genetic composition, can set a tone for feelings of

loneliness and behavioral/emotional configuration and responsiveness in the future. They can also determine the type and extent to which an individual craves social connection (Cacioppo, 2008). Harsher parenting increases the risk for victimization, especially if the child has few friends or was not given the proper social experiences to know how to build positive peer relationships/friendships. Victimization and poor peer relations have also been associated with decreased parental responsiveness, increased intrusive demandingness, and intense closeness (Casas, 2006; McDowell, 2009; Mize, 1997; Ross, 2009).

Effective parents guide and socialize their children, thus preparing them for life outside of the family. Positive parental coaching and advising is crucial, especially when parents teach their children about right and wrong and the emotional needs of others. Parenting styles that include discussions and explanations about emotions and morality is prosocial and associated with more positive outcomes. As children begin to age, parents should continue to guide their children, but should also give them greater freedom to explore and test their surroundings (Casas, 2006; McDowell, 2009; Mize, 1997; Ross, 2009). Social imitation, expectations about relationships, and the ability to regulate negative emotions, all initially develop within family relationships (Ross, 2009). These behaviors within the family can then be linked to relationships with peers (Groh, 2014; Ross, 2009).

The relationships that children form with their siblings are also extremely important. Within the context of sibling relationships, parents can teach children what to expect from peers (Ross, 2009). Sibling relationships are inherently more similar to peer relationships because of the greater similarity in status and because play and companionship are important qualities in both (Ross, 2009; Updegraff, 2000). Overall, social development theorists argue that family environments can greatly impact and influence the socialization of a child and impact their peer



relationships (Groh, 2014; McDowell, 2009; Ross, 2009). As a child grows and begins to have more relationships with peers outside of the home, parents and other family members can continue to give advice about peer relationships. Parents thus guide their children through the dynamics of social interactions into adulthood, whether promoting positive interactions – or reinforcing negative social behaviors (McDowell, 2009; Ross, 2009).

Social-cognitive theory suggests that social cognitions and patterns are mechanisms that lead to social behaviors, which serve as a basis for social adjustment and evaluation. Certain social-cognitive styles or patterns can contribute to maladjustment and/or peer-rejection through mental steps that are triggered when specific social cues are encountered. More extensive social experiences can foster the development of more effective mental strategies. Although the sophistication of these patterns increases with age, they eventually stabilize. These mechanisms and patterns become models through which all social cues are processed and behaviors decided (Burgess, 2006; Crick, 1994). Social-cognitive theorists also suggest that some children come to social situations with biologically limited capabilities and a specific database of memories from past experiences. Generally, lower-accepted children have fewer strategies, lower quality relationships, and less maturity.

Early socialization from adults creates the first encodings of situational and relational cues (Burgess, 2006; Crick, 1994). The child internalizes messages from their family's behavior about emotions, morality, and appropriately interacting with others, and may then externalize them (Groh, 2014; Mize, 1997). Furthermore, a child can adopt, adapt, or re-evaluate these existing models positively or negatively based on social situations they experience. As a child grows, their working models of interpersonal relationships can become generalized but can also

be revised and further developed when the child moves outside of the home, applying their working models to a wider social network (Groh, 2014; McDowell, 2009; Ross, 2009).

Parents should provide their children with safe and monitored opportunities to interact with their peers, especially when the children are very young. Parents can choose the social environments and neighborhoods where they raise their child. Parents also can arrange social gatherings with peers, while supervising, coaching, and intervening as necessary. Parents can thus orchestrate positive or negative peer/social opportunities for their child, especially during the early formative years (McDowell, 2009; Mize, 1997; Ross, 2009).

In summary, family relationships/interactions involving parenting and attachment styles, sibling relationships, and reinforced social-cognitive processes can play a beneficial or detrimental role in a child's social development. A family is the first social environment that a person experiences and plays a critical role. Interactions with family members help form and reinforce particular working social models/patterns that teach a person how to appropriately navigate social situations throughout life (Groh, 2014).

In addition to these learned behavioral patterns, the sociability of humans stems from a deep-seated genetic predisposition. Social connection and attachment process are central to human emotional and social functions (Sable, 2012; Salter, 2015). Evolution has woven cooperative behavior into human DNA, such that humans have an inherent desire to connect with and feel accepted by other humans - to feel safe in the company of others but endangered when alone. Indeed, social connections have been critical in the evolution, survival, and prosperity of the human species (Cacioppo, 2008). Thus, social connections promote survival, whereas an inability to socialize can be extremely detrimental (Cacioppo, 2008; Eisenberger, 2003). Social support can also help buffer the stresses of everyday life (Parshall, 2003; Sable, 2012).

Humans are predisposed to form attachments and to respond to other members of the species, especially the young, like most other mammals (Brodie, 1999; Cacioppo, 2008). Most mammals seek proximity and/or contact in early infancy and seek out physical and emotional connections with familiars for psychological and physical protection (Salter, 2015). Human disconnection can be a problem if a child never learns how to socialize properly. Infrequent social contact or impoverished family networks can lead to feelings of disconnection (Sherry, 2008; Small, 2011). Attachment theorists and developmental psychologists describe how isolation, especially in young separated from their caretakers, is marked with the greatest danger and highest levels of stress. Aversion to loneliness and a predisposition towards attachment in humans is almost completely universal (Cacioppo, 2008). It is a basic part of the human existence to feel soothed in the presence of others and to feel distressed when left out.

Due to the importance of social connections and bonds within a species, specific neural networks have evolved in mammals. These networks involve pain and conflict pathways and help to promote the goals of social connectedness and survival. The networks are activated in situations to help promote the survival of a species, such as when a neonate cries or upon social separation or rejection. Social pain and disconnection thus has neurocognitive roots and can cause emotional, as well as physical pain (Eisenberger, 2003).

Perhaps due to this predisposition to sociability, humans readily form attachments to animals, especially pets that exhibit childlike behaviors (Brodie, 1999; Sable 2012). These relationships can help break patterns of loneliness, hopelessness, and social withdrawal. Additionally, animals can provide an unwavering source of companionship, including those who have difficulty maintaining relationships (Brodie, 1999; Lefkowitz, 2005; Sable, 2012). Relationships with animals can help a person feel loved, accepted, important, and needed

(Brodie, 1999; Lefkowitz, 2005). With a companion animal, a person can learn how to experience relationships in a safe, non-judgmental environment. The skills that a person learns through their relationship with animals can potentially be transferred to relationships with other people (Bass, 2009; Brodie, 1999; Burgon, 2003; Connor, 2000; Lefkowitz, 2005; Millhouse-Flourie, 2004; Stanley-Hermanns, 2002; Roberto, 2002).

### **1.1.1. Disruption of Relationships through Social Disconnection**

Social disconnection can severely impair a human's ability to build relationships and to live a healthy life. Disconnection can occur if one never learns to socialize or to regulate emotions (Small, 2011). The lack of support, acceptance, or friendship, which accompanies social disconnection, can lead to aggression, victimization, rejection, or depression (Sherry, 2008; Small, 2011). A person may also experience disconnection if they believe they fall short of others' expectations. Disconnection can therefore arise from a lack of interpersonal skills and from dysfunctional beliefs (Sherry, 2008).

Social disconnection is maladaptive from an evolutionary standpoint. Social bonds, attachments, and connections promote survival, while failure to form relationships with others can be detrimental (Cacioppo, 2008; Eisenberger, 2003). To feel soothed in the presence of others and distressed when alone appears to be an impulse deeply rooted in human evolution (Sherry, 2008). It is therefore no surprise that human disconnection is associated with poorer health and increased mortality (Sherry, 2008; Small, 2011).

Many factors outside one's control can lead to social disconnection. Genetics, personality, and other environmental influences, such as trauma or stress, can alter emotional regulation and cognitive development (Yorke, 2013). Family social structures can be disrupted by alcohol abuse, mental illness or family violence. Children with physical or intellectual

disability, infants with increased medical risk due to prematurity, low birth weight, drug dependency, or an overall failure to thrive are at especially high risk for social disconnection (Small, 2011). Social exclusion can occur following violence, immigration, mental illness or conditions which carry a social stigma. External factors may also lead to difficulties. For example, following exposure to trauma, the lack of a supportive social network can influence the development of PTSD with subsequent impairment of interpersonal relationships (Mahan, 2012). In addition, internal factors, such as disruptions within neural networks, may underlie psychological disorders leading to social disconnection (Small, 2011).

Of these internal factors, autism and autism spectrum disorders are among the most severe disruptors of social connection. Autism spectrum disorders include a range of neurodevelopmental impairments that are hallmarked by impaired social interaction, communication, engagement, expression, and interpretation. An individual on the autism spectrum may not understand how to appropriately interact with others. Impairments can range from mild to severe across the spectrum (American Psychiatric Association, 2000; Autism Research Institute, 2012; Christensen, 2016; Newschaffer, 2005; Rice, 2009). Autism spectrum disorders arise predominantly from a combination of genetic and environmental factors (CDC, 2016b; Dave, 2015; Gabriels, 2012; Newschaffer, 2005; Rice, 2009). Although a number of genes correlated with the disorder may exhibit abnormal levels of specific neurotransmitters, no specific genetic marker exists for autism spectrum disorder (Dave, 2015; Gabriels, 2012; Newschaffer, 2005; Rice, 2009). There is no cure for autism spectrum disorders, and little consensus on effective treatment methods (Butter, 2003; Gabriels, 2012; Hess, 2008).

Anecdotal reports suggest that individuals on the autism spectrum may develop strong and rewarding relationships with animals. The positive experience of an interspecies relationship may help show an individual on the autism spectrum how to connect with other humans (Brandt, 2004; Sable, 2012). People on the autism spectrum have been drawn to various equine therapies for decades. Although there is minimal quantitative evidence, a wealth of qualitative and anecdotal data suggests that animal-assisted therapies, including equine therapies, benefit those with autism spectrum disorders, mostly through helping to improve communication and social skills (Bachi, 2012; Bass, 2009; Farias-Tomaszewski, 2001; Lanning, 2014; Vidrine, 2002).

Equine and other animal-assisted therapies may indeed be beneficial for people with disorders associated with social disconnection (Bachi, 2012; Bass, 2009; Gabriels, 2012; Lanning, 2014; Lentini, 2015). These therapies can help improve communication, social and relational connectivity skills. Studies have shown that equine therapies can also improve physical strength, tone, endurance, memory (long, short, and working), knowledge, self-confidence, senses of mastery and control, communication gestures, understandings of safety, eye contact, behavioral control, sensory modulation, and social-emotional responsiveness (Bass, 2009). Participants learn to verbally control and direct a horse within equine-assisted therapeutic sessions, which helps improve verbal language and communication skills in children with an autism spectrum diagnosis or developmental disorders (Gabriels, 2012; Ghorban, 2013). Participants also learn to follow a trainer's commands while riding, which can improve listening, concentration, communication, and social interaction skills (Ghorban, 2013). In patients with autism spectrum disorders, studies have reported changes in measures of self-regulation (irritability, lethargy, stereotypic behavior, and hyperactivity), adaptive expressive language skills, motor skills, and verbal praxis/motor planning skills (Gabriels, 2012). Other studies with

equine therapies and autism have shown marked improvements in a participant's mood, eye contact, expressive language/conversation, animal care, cooperative social behaviors, and willingness to try new things (Bass, 2009; Gabriels, 2012; Lanning, 2014).

Horses may be able to connect with people in ways in which people cannot, such as reaching a person that is disconnected from society or themselves (Gabriels, 2012). In contrast, because humans tend to be judgmental, such interactions may be threatening to someone who has social difficulties. Horses, on the other hand, may be perceived as offering unconditional and non-judgmental affection, approval, acceptance, and attention. They tend to accept a person irrespective of appearance, belief, skill or unusual behaviors which might alienate other humans. Relationships with horses tend to be built on consistent behavior and mutual trust (Brodie, 1999; Connor, 2000; Lefkowitz, 2005; Roberto, 2002). Horses can increase self-confidence, and provide insights about one's own behavior, thus helping one to respond, regulate, and adapt themselves to a social world. People can form intimate connections with horses that have many of the same qualities as interpersonal human connections. Skills and practices developed through interaction with horses could potentially be transferred into relationships with people (Bachi, 2012; Bass, 2009; Brodie, 1999; Burgon, 2003; Connor, 2000; Lefkowitz, 2005; Millhouse-Flourie, 2004; Stanley-Hermanns, 2002; Roberto, 2002). In conclusion, inter-species social connections/relationships with horses may help a person develop healthy interpersonal relationships (Brandt, 2004).

## **1.2. Autonomic Nervous System and the Hypothalamic-Pituitary-Adrenal Axis**

The body's response to social interactions is rooted in complicated neuro-endocrine processes that are only partially understood. Person-to-person exchanges invoke evolved responses, such as changes in blood flow, heart rate etc. These complex responses all involve, at

some level, the autonomic nervous system. While the autonomic nervous system does not, by any means, account for the entirety of human behavior, it nevertheless contributes to all social responses. The autonomic nervous system therefore provides a window through which to study and perhaps influence responses to social stimuli.

The autonomic nervous system controls the physiological and behavioral adjustments necessary for life and healthy relationships (Asahina, 2013; Benarroch, 2007; Jänig, 2006; Peltier, 2012; Vinik, 2011). It is one of two major divisions of the peripheral nervous system, the other division being the somatic nervous system, which controls voluntary muscle movements. (Brodal, 2004; Kim, 2012). Parts of the brain (including the cerebral cortex, amygdala, hypothalamus, brain stem), spinal cord, and peripheral nerves comprise the neural infrastructure of the autonomic nervous system. The autonomic nervous system primarily innervates organs containing smooth-muscle and endocrine tissue at sites throughout the body (Asahina, 2013; Benarroch, 2007; Goldstein, 2013), including viscera, blood vessels, and endocrine glands (Benarroch, 2007; Brodal, 2004). The autonomic nervous system controls responses to exercise, digestion, emotion, and every day challenges (Benarroch, 2007).

Most of the activities of the autonomic nervous system occur “automatically” and are not subject to conscious control (Brodal, 2004). Alterations in heart rate, blood vessel dilation, blood pressure, perspiration, digestion, pupillary response etc. generally occur independently (Asahina, 2013; Benarroch, 2007; Freeman, 2006; Goldstein, 2013; Hsu, 2015; Jänig, 2006; Norcliffe-Kaufmann, 2013; Schmidt, 1989). However, some autonomic processes, such as breathing, swallowing, and sexual arousal, may permit some conscious regulation (Brodal, 2004).



The autonomic nervous system has three major subdivisions: the sympathetic, parasympathetic, and enteric nervous systems (Asahina, 2013; Axelrod, 2006; Benarroch, 2007; Brodal, 2004; Freeman, 2006; Kim, 2012). The peripheral sympathetic and parasympathetic nervous systems consist of two populations of neurons which converge at synapses in the periphery. Although these two systems tend to have opposing effects, they work cooperatively to respond to internal and external stimuli (Drew, 2012), complementing rather than antagonizing each other (Benarroch, 2007; Brodal, 2004; Jänig, 2006; Rosenwinkel, 2001). This can be seen in how the two systems control blood pressure. For example, when the sympathetic system is dominant, cardiac output increases while blood supply to visceral organs is reduced by vasoconstriction, thereby increasing blood pressure. Under parasympathetic control, the cardiac output is reduced, and visceral blood vessels dilate, causing blood pressure to fall (Drew, 2012). These two systems work in a balanced state within the body and cooperate in a reciprocal way (Freeman, 2006). The enteric system, the inherent nervous system of the digestive tract, may be influenced by both the sympathetic and parasympathetic nervous systems, but may also function independently. (Brodal, 2004). The enteric system regulates peristalsis of the gut wall and controls activity in secretory glands (Kim, 2012).

The sympathetic nervous system mobilizes the body during stressful situations such as “fight or flight” (Brodal, 2004; Freeman, 2006; Goldstein, 2013; Kim, 2012; Schmidt, 1989; Wallden, 2012). The sympathetic system is therefore activated by stressful situations such as threats, environmental stress, hunger, thirst, fear, isolation etc. This system specifically directs resources to the cardiovascular and musculoskeletal systems to prepare the body for mental or physical exertion needed to survive life-threatening challenges (Freeman, 2006). It also restricts flow to some viscera and peripheral vessels to prevent unnecessary blood pooling (Benarroch,

2007; Freeman, 2006). In contrast, the parasympathetic nervous system conserves and restores energy during “eat and sleep” phases. It generally does so by reducing heart rate and blood pressure, facilitating digestion, nutrient absorption, waste excretion, reproduction and sleep (Benarroch, 2007; Brodal, 2004; Freeman, 2006). In states of rest and relaxation, the parasympathetic nervous system therefore predominates (Drew, 2012).

The autonomic nervous system is essential to maintain homeostasis (Brodal, 2004; Goldstein, 2013; Rosenwinkel, 2001) by counteracting disturbances to equilibrium from physical and psychological stressors (Chrousos, 1992, Kudielka, 2007; Tsigos, 2002). In doing so the autonomic nervous system works closely with the endocrine organs in maintaining a constant internal state (Brodal, 2004; Goldstein, 2013). Disturbances invoke nervous and hormonal pathways which induce emotional and motivational changes, inducing behaviors which hopefully re-establish equilibrium (Goldstein, 2013). The hypothalamus plays a key role in regulating the autonomic, endocrine, and somatic motor processes in such behaviors (Brodal, 2004; Goldstein, 2013). Adaptive responses to the stressors that unsettle equilibrium, are vital for the survival of an organism (Dickerson, 2004; Tsigos, 2002).

The hypothalamic-pituitary-adrenal (HPA) axis is a neuro-endocrine system intimately associated with the autonomic nervous system. The HPA axis is composed of the hypothalamus, the pituitary gland, and the adrenal glands. One of its key functions is to mediate the release of corticotropin releasing hormone (CRH) from the hypothalamus, adrenocorticotrophic hormone (ACTH) from the pituitary, and corticosteroids (cortisol) from the adrenocortex (Sherin, 2011; Kalat, 2007). Effects of the HPA axis include regulation of carbohydrate metabolism, digestion, immune system responses, energy production/storage, and especially the stress response (Gruenewald, 2004; Kalat, 2007; Kudielka, 2007). The HPA axis influences emotion, cognition,

and behavior (Chrousos, 1992; Dickerson, 2004; Ito, 2005). The HPA axis thus serves as a bridge between the nervous system and endocrine systems (Chrousos, 1998; Dickerson, 2004; Kudielka, 2005). Stress up-regulates the HPA axis, induces increased levels of cortisol and catecholamines, resulting in characteristic cardiovascular and metabolic changes (Dickerson, 2004; Kalat, 2007; Schommer, 2003; Yorke, 2013).

In summary, almost all bodily functions and behaviors are dependent on the autonomic nervous system (Asahina, 2013; Benarroch, 2007; Jänig, 2006; Peltier, 2012; Vinik, 2011). Properly organized and functional neuro-endocrine pathways are necessary to regulate behavior and bodily functions and maintain homeostasis (Jänig, 2006). Subtle stimuli beneath the threshold of conscious awareness can invoke emotional reactions and physiological responses arising from the autonomic nervous system. It appears that the autonomic nervous system impacts emotions and important aspects of social connections and relationships (Kreibig, 2010).

### **1.2.1. Disruption of Homeostasis through Autonomic Dysfunction**

Autonomic dysfunction refers to abnormal adaptive reflexes of the sympathetic and parasympathetic nervous systems. These disturbances may arise within the brain and/or peripheral neurons (Axelrod, 2006; Baguley, 2012; Jänig, 2006; Lonsdale, 2011; Mustafa, 2012; Vernino, 2012). Specifically, autonomic dysfunction can also occur as the result of disorders of the hypothalamus, brain stem, spinal cord, autonomic ganglia, or peripheral nerves. Autonomic dysfunction can disrupt all aspects of physiology and behavior, and thus can greatly impair a person's quality of life (Axelrod, 2006; Baguley, 2012; Benarroch, 2007; Jänig, 2006; Mustafa, 2012; Vernino, 2012).

Significant morbidity and mortality can be attributed to autonomic imbalances between the sympathetic and parasympathetic nervous system (Axelrod, 2006; Baguley, 2012; Benarroch, 2007; Hsu, 2015; Jänig, 2006; Vernino, 2012; Vinik, 2011). Sympathetic nervous system failures may be manifested as orthostatic hypotension and anhidrosis (Vernino, 2012) or as changes in skin color, moisture, and temperature (Kaushik, 2012). Parasympathetic failures may be manifested as dry mouth, dry eyes, sexual dysfunction, constipation, impaired pupillary light response, and fixed heart rate (Vernino, 2012). Imbalances between the sympathetic and parasympathetic systems can cause numerous confounding problems, including issues with blood pressure, digestion, excretion, sexual arousal, sleep disturbances, thermoregulation, perspiration, vision, balance, muscle function etc. (Asahina, 2013; Benarroch, 2007; Baguley, 2012; Fang, 2012; Freeman, 1993; Hsu, 2015; Mustafa, 2012; Norcliffe-Kaufmann, 2010; Vernino, 2012; Vinik, 2011). Autonomic imbalance can therefore lead to life threatening conditions, including heart failure (Freeman, 2006; Hsu, 2015; Samara, 2013).

Autonomic dysfunctions may be difficult to diagnose. Clinical signs can range from mild to severe and symptom presentation/experience can vary widely. Prognosis depends on the severity, as well as the cause of the autonomic dysfunction (Baguley, 2012; Benarroch, 2007; Fang, 2012; Mustafa, 2012; Vernino, 2012). Not every patient will have an identifiable etiology, even after extensive investigation (Lonsdale, 2011; Peltier, 2012). Currently there appears to be a lack of adequate diagnostic criteria (Axelrod, 2006; Baguley, 2012; Vernino, 2012).

A diagnosis of autonomic dysfunction is usually made based on history, physical examination, laboratory tests, and brain imaging. Physical parameters which are closely linked to autonomic function include respiration, perspiration, heart rate, blood pressure, pupil dilation, skin temperature and color (Benarroch, 2007; Peltier, 2012; Tan, 2011). Formal testing of the

autonomic nervous system (sympathetic and parasympathetic) may be helpful to establish a more definitive diagnosis (Asahina, 2013; Baguley, 2012; Mustafa, 2012; Peltier, 2012). While researchers continue to investigate the underlying causes of autonomic dysfunctions, there can be no single cause or cure (Benarroch, 2007).

#### **1.2.1.1. Physiologic and Behavioral Disorders Caused by Autonomic Dysfunction**

Many different diseases and conditions have been linked to autonomic dysfunction, without a common etiology. Autonomic dysfunction can be the result of genetics, diseases, and/or trauma (Axelrod, 2006; Baguley, 2012; Lonsdale, 2011; Peltier, 2012; Vernino, 2012). Autonomic failures can also develop following viral infections, surgeries, routine immunizations, or in the context of more diffuse peripheral neuropathies (Vernino, 2012). Autonomic dysregulations and dysfunctions have been induced by issues such as immune disorders, mitochondrial diseases, cerebrovascular disease, brain injury, physical trauma or injury, such as spinal cord injuries and posttraumatic stress disorder, degenerative neurological diseases, such as Parkinson's disease, Lewy body dementia, and multiple system atrophy (Shy-Drager Syndrome), neurodevelopment disorders, such as autism spectrum disorders, hereditary conditions, such as Allgrove Syndrome and connective tissue diseases like Ehlers-Danlos syndrome, and other diseases/conditions, such as botulism, diabetes mellitus, Fabry's disease, Lyme disease, Guillain-Barré Syndrome (Axelrod, 2006; Benarroch, 2007; Fang, 2012; Freeman, 1993; Jansen, 2006; Mustafa, 2012; Norcliffe-Kaufmann, 2010; Peltier, 2012; Sherin, 2011; Tan, 2011; Vernino, 2012). Acute inflammatory demyelinating polyradiculoneuropathy and other acute inflammatory neuropathies, such as the aforementioned Guillain-Barré Syndrome and multiple sclerosis, may also induce or develop autonomic dysfunctions/dysregulations over the course of the disease (Peltier, 2012; Lonsdale, 2011; Freeman, 1993; Vernino, 2012). Subclinical autonomic

impairment is frequent in diabetes, impaired glucose tolerance, idiopathic small fiber polyneuropathy, and in association with connective tissue diseases, such as Sjögren's Syndrome, systematic lupus erythematosus, and mixed connective tissue disease (Peltier, 2012). Other conditions are associated with autonomic dysregulation and may also be considered forms of autonomic dysfunction. These associated conditions include postural orthostatic tachycardia syndrome, vasovagal syncope, pure autonomic failure, diabetic neuropathy, and orthostatic hypo/hypertension (Mustafa, 2012; Norcliffe-Kaufmann, 2010; Vernino, 2012; Vinik, 2011).

Furthermore, problems in the cardiovascular, gastrointestinal, sudomotor, endocrine, and/or genitourinary systems can be the result of autonomic dysfunction/dysregulation, pre-existing, and/or pharmacological issues (Asahina, 2013; Axelrod, 2006; Benarroch, 2007; Mustafa, 2012; Peltier, 2012). For example, some medical and pharmaceuticals can sometimes cause autonomic effects by interfering with the normal transmission of chemicals within the autonomic nervous system (Benarroch, 2007; Mustafa, 2012; Peltier, 2012). This is usually more common in elderly people because more medications are typically used and the autonomic nervous system is easier to disrupt with age as some autonomic nerve cells are lost (Benarroch, 2007). Pharmaceuticals can also interfere with the autonomic nervous system as shown by example that tricyclic antidepressants have often been related to hypotension, urinary retention, constipation, erectile dysfunction, and anhidrosis, etc. (Benarroch, 2007; Mustafa, 2012; Peltier, 2012). Research into the field of autonomic dysfunctions has been largely concentrated on adult disorders, leaving pediatric disorders underrepresented in the past. Familial dysautonomia is one of the few autonomic disorders that has been studied more extensively in children (Axelrod, 2006). The aforementioned disorders are, by no means, a complete list of all disorders associated with autonomic dysfunctions/dysregulation. The autonomic nervous system is

pervasive and integrates many bodily systems. Symptoms and effects of a dysfunction or dysregulation are usually widespread and possibly very confounding (Axelrod, 2006; Fang, 2012).

An autonomic dysfunction can range from mild to severe and symptom presentation/experience can vary widely. Similarly, prognosis depends on the severity, as well as the origins and diagnostic category of the autonomic dysfunction (Baguley, 2012; Benarroch, 2007; Mustafa, 2012; Vernino, 2012). Sometimes it can be difficult to establish a precise relationship between autonomic dysfunction and disorders because of certain system presentations and overlaps (Fang, 2012). There are hundreds of causes of an autonomic dysfunction and not every patient will have an identifiable etiology, even after extensive investigations (Lonsdale, 2011; Peltier, 2012). A major problem related to a diagnosis of autonomic dysfunction is that most of these symptoms are rather non-specific and can be related to multiple diagnoses. Also, there had been a relative lack of adequate diagnostic criteria within previous years (Axelrod, 2006; Baguley, 2012; Vernino, 2012). Although relatively under-diagnosed, autonomic dysfunctions are relatively common. The use of pertinent diagnostic criteria is starting to become more common in recent, on-going research (Baguley, 2012; Peltier, 2012). A diagnosis of an autonomic dysfunction is usually made based on an understanding of an individual's history, a physical examination, laboratory tests, brain imaging scans, and tests of the autonomic functions (i.e. perspiration, heart rate, blood pressure, pupil dilation, skin temperature and color, and generalized autonomic health) (Benarroch, 2007; Peltier, 2012; Tan, 2011). Formal autonomic testing can be helpful to establish a more accurate diagnosis (i.e. cardiovagal or parasympathetic tests, adrenergic or sympathetic tests, and/or sudomotor tests) (Asahina, 2013; Baguley, 2012; Mustafa, 2012; Peltier, 2012).

Currently, there is research that is attempting to find understandings about the brain mechanisms involved in the control of autonomic functions, in addition to the causes of the mechanisms underlying disorders within the system. Hopefully, this research will aid in the treatment of disorders associated with autonomic dysfunction and dysregulation, and in other similar conditions such as panic attacks, high blood pressure, and sudden cardiac death. However, there is no single cure for autonomic dysfunction (Benarroch, 2007).

### **1.3. Posttraumatic Stress Disorder**

According to the American Psychiatric Association (2000) within the “Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR,” PTSD is characterized as a stress or anxiety-related syndrome that arises from a traumatic experience. Traumatic situations can include combat, physical or sexual assault, natural disasters, and motor vehicle accidents. PTSD can arise when a person experiences actual or threatened injury to self or others, especially if the other individuals are family members or close friends. In response to the traumatic event, people usually experience intense feelings of fear, helplessness, and horror. PTSD is highly characterized by intrusive recollections, including flashbacks, nightmares, and an exaggerated startle response. Affected individuals may experience emotional hyper-arousal, numbness, sleep disorders, loss of memory, avoidance behavior, rage, depression, and anxiety (American Psychiatric Association, 2000; Bremner, 1993; Calhoun, 2012; Foa, 1992; Jaycox, 1998; Mahan, 2012; Ouimette, 1998; Sherin, 2011; Tan, 2011). Individuals with PTSD may also experience negative expectations about themselves, others, and the world. They may have a shortened view of the future, placing blame on themselves or others, and suffer pervasive negative emotions and



distorted memories (Calhoun, 2012; Hafstad, 2014). Survivors of trauma may lose interest in previously enjoyed activities, while experiencing deficits in learning and memory (Mahan, 2012).

Trauma often impacts behavior unconsciously (Atwoli, 2015; Porter-Wenzlaff, 2007). Fear can become generalized and conditioned which may be advantageous for survival in some circumstances. However, it can become harmful when it is over-generalized and invoked in situations that are safe, resulting in intrusive memories and flashbacks arising from sympathetic hyper-arousal (Mahan, 2012). This hyperarousal can result in physical symptoms, such as headaches, and other physical signs (Mahan, 2012). The traumatic experience and its interpretation can vary wildly, making presenting signs of PTSD highly individualized (Mahan, 2012; Porter-Wenzlaff, 2007).

A hallmark feature of PTSD is reduced hippocampal volume. However, it is not fully understood whether this is a result of the exposure to trauma or if hippocampal volume is small prior to the trauma (Sherin, 2011). The hippocampus is involved in the control of stress responses, declarative memory, and contextual aspects of fear conditioning. Brain imaging scans have also shown alterations in the hippocampus, amygdala, and cortical regions. These areas form a neural circuit which mediates adaptation to stress, and alterations in this circuit may predispose to the development of PTSD (Sherin, 2011; Shin, 2006).

The amygdala also plays a special role in emotional processing and mediation of fear responses. Although there is no evidence for structural changes in the amygdala in PTSD cases, brain-imaging studies have documented the amygdala to be hyper-responsive in PTSD during the presentation of traumatic cues (Sherin, 2011; Shin, 2006). It has been suggested that genetically predisposed increases in amygdala reactivity, reduced hippocampal volume, and imbalanced

neurobiological responses are risk factors for developing PTSD (Hariri, 2002; Sherin, 2011). Understanding the biological and genetic factors underlying PTSD can aid in susceptibility, prevention, and treatment (Mahan, 2012).

There is growing evidence in support of other risk factors for the development of PTSD. For example, prior traumatic brain injury may predispose to PTSD (Sherin, 2011). Furthermore, socioeconomic status, gender, and ethnicity may also play a role (Perilla, 2002; Pole, 2005). Although women appear to be more predisposed to PTSD than men, the underlying reason for this apparent gender disparity is not well understood (Bernat, 1998). It is possible that cultural upbringing, and the home environment, may play a critical role in the development of PTSD (Mahan, 2012; Perilla, 2002; Pole, 2005). Because life experiences vary widely between individuals, the reaction to trauma can vary greatly from person to person (Kessler, 1995; Mahan, 2012; Stein, 1997). Posttraumatic stress disorder (PTSD) is associated with autonomic dysregulation (Sherin, 2011; Tan, 2011).

### **1.3.1. Autonomic Dysfunction and Posttraumatic Stress Disorder**

A cardinal feature of posttraumatic stress disorder is sustained hyperactivity of the sympathetic branch of the autonomic nervous system (Sherin, 2011). PTSD can induce excessive sympathetic nervous system activity and/or ineffectual parasympathetic activity, leading to hyper-arousal, difficulties with stress responsiveness, and an impaired relaxation response (Mahan, 2012; Tan, 2011). This is evidenced by elevations in heart rate, blood pressure, skin conductance, hyper-arousal, exaggerated startle response, and other psychophysiological measures, especially in response to traumatic reminders (American Psychiatric Association, 2000; Bremner, 1993; Foa, 1992; Jaycox, 1998; Ouimette, 1998; Sherin, 2011; Tan, 2011). In addition, increased urinary excretion of catecholamines, and other metabolites associated with

fear conditioning and stress, has been found in combat veterans, abused women, and children with posttraumatic stress disorder (Sherin, 2011). These elevated psychophysiology responses are all suggestive of autonomic nervous system dysfunction (Sherin, 2011; Tan, 2011) probably involving the limbic system (amygdala, hippocampus, and prefrontal cortex), which regulates emotional processing (Mahan, 2012). Posttraumatic stress disorder is also associated with up-regulation of the HPA axis. Core neurochemical features of PTSD include abnormal regulation of catecholamine, serotonin, and opioid neurotransmitters, which all play a role in regulating the body's response to stress (Kalat, 2007, Schommer, 2003; Sherin, 2011). the stress response can become maladaptive in situations of prolonged stress. (Chrousos, 1998; Dickerson, 2004; Schommer, 2003; Sherin, 2011; Tsigos, 2002). Elevated sympathetic tone, with prolonged increases of corticosteroids and catecholamines can have long term consequences for cognition and behavior (Bremner, 1993; Chrousos, 1992; Schommer, 2003; Wallden, 2012). Patients with PTSD exhibit abnormal synaptic plasticity, resulting in learning and memory problems (Mahan, 2012). Dysregulated neural circuits can lead to intensified fear conditioning, consolidation of traumatic memories (Sherin, 2011), damaged hippocampal neurons and chronic disease (Dickerson, 2004).

Chronic activation of the stress response system is seen in individuals with PTSD, traumatic brain injuries and other neurobiological abnormalities (Sherin, 2011), resulting in many psychological and physiological manifestations (Chrousos, 1992, Dickerson, 2004; Kudielka, 2005; Kudielka, 2007; Tsigos, 2002). Melancholic depression, major depression, anorexia nervosa, obsessive compulsive disorder, panic disorder, anxiety, chronic excessive exercise, chronic alcoholism, malnutrition, and diabetes mellitus all have ties to dysfunctional hyperactivity in the HPA axis (Chrousos, 1992; Chrousos, 1998; Dickerson, 2004; Kudielka,

2005; Kudielka, 2007, Tsigos, 2002). Hyperactivity in the HPA axis has also been associated with immunosuppression and increased susceptibility to cardiovascular and infectious diseases (Dickerson, 2004; Kudielka, 2005; Kudielka, 2007). In contrast,

While hyperactivity of the stress response is the major hallmark of PTSD, there is some evidence that PTSD exhibits hypo-activity within the HPA axis (Majewska, 2002). Hypoactivity of the HPA axis has been associated with atypical depression, seasonal depression chronic fatigue syndrome, hypothyroidism, adrenal suppression, and attention deficit hyperactivity disorder, as well as in autoimmune problems such as lupus erythematosus, multiple sclerosis, neurodermatitis, and fibromyalgia (Chrousos, 1998; Majewska, 2002; Tsigos, 2002).

### **1.3.2. Diagnosis of Posttraumatic Stress Disorder**

In order to be diagnosed with Posttraumatic stress disorder, a person must meet the criteria outlined in the DSM-V. There is no empirical test to diagnose PTSD, which requires that a professional must make an official diagnosis based upon a person's clinical and traumatic histories (American Psychiatric Association, 2000). A diagnosis of PTSD stipulates that a person meet certain diagnostic criteria. Criteria A through H and other specifications are set forth in the DSM-V (American Psychiatric Association, 2013a; U.S. Department of Veterans Affairs, 2017).

The first criteria of a PTSD diagnosis after a traumatic experience are related to intrusion, avoidance, negative alterations in cognitions and moods, and alterations in arousal and reactivity. Criterion A is related to the traumatic stressor and requires that one condition be met. A person must have been exposed to death, threatened death, actual or threatened serious injury, or actual or threatened sexual violence. The person must have either had direct exposure to, witnessed, learned that a relative or close friend was exposed to a trauma, or had indirect exposure to

aversive details of trauma. Criterion B is related to intrusion symptoms and requires that one condition be met. Criterion B states that the traumatic event is persistently re-experienced in at least one of the following ways: intrusive thoughts, nightmares, dissociative reactions (e.g. flashbacks), emotional distress after exposure to traumatic reminders, or physical reactivity after exposure to traumatic reminders. Criterion C is related to avoidance symptoms and requires that one condition be met for a diagnosis. This criterion requires that the avoidance of trauma-related thoughts or feelings or the avoidance of trauma-related external reminders (e.g. people, places, conversations, activities, situations). Criterion D looks into negative alterations in cognitions and mood. After a traumatic event, negative thoughts or feelings may begin to worsen. Criterion D requires that two conditions be met. This may mean that a person experiences an inability to recall key elements of the trauma (not due to head injury, alcohol or drugs), overly negative thoughts and/or assumptions about themselves or the world, exaggerated blame of self or others for causing the trauma, negative affect, decreased interest in activities, feelings of isolation, or has difficulties in experiencing positive affect or an inability to experience positive emotions. Criterion E is related to alterations in arousal and reactivity. Experiences with trauma can result in alterations in arousal and activity that may begin or worsen after the trauma. Two alterations are required for a diagnosis. These alterations can be changes in: irritability or aggression, risky or destructive behavior, hypervigilance, heightened startle reactions, difficulties concentrating, and/or difficulties sleeping (American Psychiatric Association, 2013a; U.S. Department of Veterans Affairs, 2017).

The remaining criteria for a PTSD diagnosis concern duration of symptoms, functioning, and the clarification that symptoms are not attributable to substance or medical conditions. Criterion F stipulates duration requirements. Symptoms must last for more than 1 month.

Criterion G concerns functional significance. This criterion requires that symptoms must create distress or functional impairments, such as social or occupational. Finally, Criterion H concerns the exclusion of other conditions. In order for a diagnosis, symptoms must not be due to medication, substance use, or another illness (American Psychiatric Association, 2013a; U.S. Department of Veterans Affairs, 2017).

There are also further specifications within a PTSD diagnosis. There is a dissociative specification where, in addition to meeting the criteria for a diagnosis, an individual experiences high levels of depersonalization or derealization (American Psychiatric Association, 2013a; Lanius, 2012; U.S. Department of Veterans Affairs, 2017). There is also a delayed specification where full diagnostic criteria are not met until at least 6 months after the trauma. Most symptoms begin to occur immediately (American Psychiatric Association, 2013a; U.S. Department of Veterans Affairs, 2017).

There are certain structured and standardized interview-type assessments can be administered by clinicians in order to help assist them in possible PTSD diagnoses (American Psychiatric Association, 2013a; Blake, 1995). Many of these assessments, such as the Clinician-Administered PTSD Scale (CAPS-1), are being revised and validated according to the newly accepted definition and diagnosis of PTSD (American Psychiatric Association, 2013a; Calhoun, 2012). Updated screening instruments, such as the PTSD checklist (PCL), have not yet been directly compared to previously validated methods (Hoge, 2014).

The diagnosis of PTSD has been debated since it was first introduced in the DSM-III. It has also gone through several modifications over the years (Calhoun, 2012; Hafstad, 2014). The DSM-V was published in May 2013. Scientific research and clinical experience during the thirteen years between the DSM-IV-TR and the DSM-V editions prompted certain changes to the

working definition of PTSD (American Psychiatric Association, 2013a). Overall, the definitions and symptoms of PTSD between the two manuals are comparable. Without an encounter with a traumatic event, a person cannot be given a diagnosis of PTSD according to both the DSM-IV-TR and DSM-V (American Psychiatric Association, 2000; American Psychiatric Association, 2013a; Calhoun, 2012; Sherin, 2011). However, there are some noteworthy differences between the two manuals. Indirect exposure to trauma can also result in the development of PTSD, but the definition of what includes indirect exposure has been clarified and made more explicit in the DSM-V (American Psychiatric Association, 2013b; Calhoun, 2012). The DSM-V includes learning about the actual or threatened violent or accidental death/injury or sexual assault of a loved one. Natural or any unexpected death or illnesses cannot be considered as indirect trauma (Atwoli, 2015; Calhoun, 2012; U.S. Department of Veterans Affairs, 2017). Furthermore, under the DSM-V, symptoms can be linked to a combination of traumatic events rather than a single event (Norris, 2013).

Criterion A2 was removed for the DSM-V. This criterion had required that the response to a traumatic event involve intense fear, hopelessness, or horror. This criterion was removed because research had suggested that its inclusion did not improve diagnostic accuracy (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Calhoun, 2012; Friedman, 2011; U.S. Department of Veterans Affairs, 2017; Norris, 2013). Additionally, the three main clusters of the DSM-IV-TR symptoms are now divided into four clusters within the DSM-V. These four clusters in the DSM-V are intrusion, avoidance, negative alterations in cognitions and mood, and alternations in arousal and reactivity. The single criterion (C) in the DSM-IV-TR of avoidance and numbing was split into two separate criteria Criterion C (avoidance) and Criterion D (negative alternations in cognitions and mood). This change was

made based on the rationale that at least one avoidance symptom should be present for a PTSD diagnosis (American Psychiatric Association, 2013a; Calhoun, 2012; Hafstad, 2014; U.S. Department of Veterans Affairs, 2017; Norris, 2013). Finally, three new symptoms were also added to the PTSD diagnosis for the DSM-V. Symptoms were added and revised to clarify the expression and presentation of PTSD. In Criterion D, overly persistent and distorted negative thoughts and assumptions about oneself or the world and a negative affect component were added. Reckless or destructive behavior was also added to Criterion E in the DSM-V (American Psychiatric Association, 2013a; Calhoun, 2012; Friedman, 2011; Hafstad, 2014; U.S. Department of Veterans Affairs, 2017). No published studies have examined the number of symptoms required for Criterion D and E to have optimal diagnostic efficacy (Calhoun, 2012).

Today, in the DSM-V, there is a separate diagnostic criterion that is included for children ages six and younger (preschool subtype). This reflects the growing research in the area of interpersonal violence and mental health with children (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Scheeringa, 2011; U.S. Department of Veterans Affairs, 2017). A diagnosis of PTSD can occur at any age, including childhood, although the presentation of symptoms between children and adults may be slightly different (American Psychiatric Association, 2000).

In the DSM-V, PTSD (and Acute Stress Disorder) have now been re-classified. Previously forms of anxiety disorders, PTSD and Acute Stress Disorder have been moved to the new class of “trauma and stressor-related disorders” in the DSM-V (American Psychiatric Association, 2013a). This new classification was created due to the clinical recognition that expressions of distress are greatly varied following exposure to trauma, but the disorders are still closely related given the progression of chapters in the DSM-V (American Psychiatric



Association, 2013a; American Psychiatric Association, 2013b). Trauma still links the conditions within this new class, which include the homogeneous expression of anxiety or fear-based symptoms, dissociative symptoms, externalizing anger or aggressive symptoms, anhedonic and dysphoric symptoms, or some combination. The different conditions can help differentiate the diagnoses within this new class as well (American Psychiatric Association, 2013a).

### **1.3.3. Prevalence Posttraumatic Stress Disorder**

There is great variability in estimates of the prevalence of PTSD (Atwoli, 2015; Mahan, 2012). There is an estimated 1-14% prevalence of PTSD in the general population. Most studies report rates between 7.8% and 9.2%, though others have reported rates of 6.8%, depending on diagnostic criteria used, time frame, gender, and population (Gradus, 2017). Currently, the adult prevalence rate is approximately 7-8% of the general population (American Psychiatric Association, 2000), which is currently the accepted rate (U.S. Department of Veterans Affairs, 2015; Gradus, 2017). Of those that are diagnosed, about 60% become chronically affected (Ohayon, 2000). Prevalence rates highly depend on the population that is being sampled. For example, PTSD is much more common within veteran groups than non-veteran groups (Ohayon, 2000). Recent PTSD prevalence rates among active troops have suggested prevalence estimates around 16.7%, with rates of 24.5% in reservists (Tan, 2011). PTSD has also been found to be prevalent in countries emerging from conflict (Atwoli, 2015), and is more prevalent in women than in men (2:1) (Carmassi, 2014; Sherin, 2011; U.S. Department of Veterans Affairs, 2015). This gender-specific difference applies to almost all symptomatological criteria except reckless and self-destructive behavior (Carmassi, 2014). While women and men experience different amounts and types of trauma, frequency and severity alone cannot explain the observed

differences (Rhodes, 1999; Sherin, 2011). Hispanics, African-Americans, and Native Americans may experience an increased risk for developing PTSD possibly due to increased trauma in their lives (U.S. Department of Veterans Affairs, 2015).

It is not known why some trauma victims develop PTSD (approximately between 5 and 30%), while others that experience the same trauma appear to be resilient (Mahan, 2012). Some evidence suggests that different responses and different types of trauma between women and men may partially attribute to their differential PTSD prevalence rates (Rhodes, 1999; Sherin, 2011). Furthermore, genetic composition, social support networks, and early life experiences may also contribute to resilience, or an increased predisposition for developing PTSD (Mahan, 2012). Information regarding the prevalence of PTSD among adolescents is limited (Kilpatrick, 2003). Because PTSD frequently goes undiagnosed, clinicians need to be prepared to detect it (Ohayon, 2000).

#### **1.3.4. Treatment of Posttraumatic Stress Disorder**

Based on their prior experiences, each individual with PTSD filters stimuli through a unique framework (Bremner, 1993; Forman, 1990; Mahan, 2012). Consequently, there is great variability in the severity and expression of PTSD (Atwoli, 2015; Mahan, 2012). While most effective treatments generally include some exposure to fear (Bremner, 1993; Hembree, 2003; Jaycox, 1998, Sherin, 2011; Tan, 2011; van Etten, 1998), there is no treatment which can be considered universally effective (Bizub, 2003). Gaining an understanding of an individual's fear response can promote targeted treatment in some cases (Mahan, 2012). Thus, interventions addressing negative appraisals, expectations, and emotions have shown promise in reversing

patterns of learned fear (Friedman, 2011; Hafstad, 2014). However, such talk-therapies are not always effective, and additional forms of therapy are needed (Bizub, 2003; Creamer, 1999, Seal 2010).

Conventional therapies for PTSD often include some form of medical management in conjunction with psychological therapies. Psychological therapy can provide significant improvement, especially with completion of the treatment regimen. Such combined therapies have lower drop-out rates than pharmacotherapy alone (Bradley, 2005; Monson, 2006), where compliance in taking medication can be reduced by forgetfulness, or concerns about social stigmatization (Bizub, 2003; Gould, 2007; Spont, 2005). Medical management is based on correcting hyper-arousal of the hypothalamic-pituitary-adrenocortical axis (Friedman, 1991; Sherin, 2011). In some cases, medical therapy may alleviate symptoms and improve general functioning and cognition (Bremner, 2004). For example, medical management can activate molecular mediators of plasticity and can enhance the extinction of inappropriate fear-association responses (Mahan, 2012). However, unless the underlying pain and distress are addressed, medical management may only mask problems, leaving the opportunity for the problem to resurface (Friedman, 1991).

The most effective psychological therapies involve cognitive-behavioral and prolonged exposure techniques (Lefkowitz, 2005; Seal, 2010; Tan, 2011; van Etten, 1998). The primary goal is to integrate the thoughts, memories, affects, and bodily sensations, which patients would prefer to avoid (Pearlman, 1995). In cognitive-behavioral therapy (CBT) sessions, people try to identify and change dysfunctional thinking, behaviors, and emotional responses. These sessions try to help people become aware of their feelings in relation to their (problematic) behaviors and cognitions (Resick, 2002; Tan, 2011). Prolonged exposure (PE) is another form of psychological

therapy that generally includes practice with psycho-education, relaxation techniques, and guided exposure to both feared memories and real-life situations. PE techniques allow the individual to become habituated to fearful stimuli, so that they feel more relaxed, safe, and calm in daily life (Hembree, 2003; Jaycox, 1998; Resick, 2002; Tan, 2011).

Regardless of the treatment type, many people are often reluctant to seek treatment for PTSD, primarily due to fear of being stigmatized (Bizub, 2003; Gould, 2007; Seal, 2010; Small, 2011; Spont, 2005). Veterans may feel especially abandoned after seeking treatment, and would rather endure pain than be ostracized. Shame and humiliation regarding their symptoms is common (Creamer, 1999; Gould, 2007). Furthermore, the costs of treating PTSD, can be high. In the United States \$45-50 billion dollars is spent yearly on PTSD therapy (Tan, 2011).

#### **1.4. Autism Spectrum Disorders**

Autism spectrum disorders have a complex pathophysiology that is poorly understood. However, like PTSD, autism appears to be associated, at least in part, with hyper-arousal of the sympathetic nervous system (Axelrod, 2006; Cheshire, 2012; Jansen, 2006; Lonsdale, 2011; Toichi, 2003). Autism was first recognized in 1911 and until the 1960s was associated with schizophrenia (Dave, 2015). Autism spectrum disorders are relatively common, and their prevalence is increasing (CDC, 2016b; Christensen, 2016; Dave, 2015; Kim, 2011; Newschaffer, 2005; Rice, 2009). There is no one/specific genetic marker or environmental risk factor that exists for autism spectrum disorder, but it is likely that some combination of genetic and environmental factors play a role in the pathogenesis of autism. A number of genes are correlated with abnormal levels of specific neurotransmitters in autistic children (Butter, 2003; CDC, 2016b; Dave, 2014; Gabriels, 2012; Lonsdale, 2011; Newschaffer, 2005; Rice, 2009).

Autism disorders are characterized by impairments of socialization and communication. Affected individuals frequently display repetitive and stereotyped behaviors (American Psychiatric Association, 2000; American Psychiatric Association, 2013a; Autism Research Institute, 2012; Christensen, 2016; Dave, 2015; Gabriels, 2012; Lanning, 2014; Newschaffer, 2005; Rice, 2009). While intellectual impairments may be seen in autism spectrum disorder (Christensen, 2016), about 44% of children identified with an autism show average or above average intellectual ability (CDC, 2016a; Christensen, 2016). Autism spectrum disorders are viewed along a continuum ranging from mild to severe (American Psychiatric Association, 2000; American Psychiatric Association, 2013a; Autism Research Institute, 2012; Christensen, 2016; Dave, 2015; Gabriels, 2012; Lanning, 2014; Newschaffer, 2005; Rice, 2009).

As mentioned above, the hallmark characteristics of autism spectrum disorders are impaired social interactions. A person along the autism spectrum usually exhibits difficulties in interpreting social cues and in expressing appropriate behavioral responses, patterns which become visible very early in life (Anckarsater, 2006; American Psychiatric Association, 2000; American Psychiatric Association, 2013a; Lanning, 2014; Newschaffer, 2005; Rice, 2009). People with autism spectrum disorders may lack social reciprocity or empathy, preferring solitary activities. They frequently exhibit poor eye contact with an absence of smiling and social responsiveness, resulting in impaired socialization and lack of imaginative social play. Furthermore, they may display a delay in language development, or they may lack language altogether (American Psychiatric Association, 2000; Newschaffer, 2005; Rice, 2009). Repetitive movements, such as rocking, twirling, and self-abusive behaviors, are also common in people with autism spectrum disorders. They may also exhibit a preoccupation with objects or a strict

adherence to specific routines (American Psychiatric Association, 2000; Newschaffer, 2005; Rice, 2009). Outcomes tend to be better if identification is made earlier and treatments are implemented as soon as possible (CDC, 2016b; Christensen, 2016; Butter, 2003).

#### **1.4.1. Autonomic Dysfunction and Autism Spectrum Disorders**

Autism spectrum disorders are hallmarked by many problems in basic neurophysiological functions, including alertness and attention (Christensen, 2016; Toichi, 2003), in which abnormal cerebral activity appears to lead to impaired social interactions (Anckarsater, 2006). Autistic patients have increased vulnerability to stress and can exhibit hyper-reactions, like tantrums, stereotyped behavior, and even self-injurious behavior (Jansen, 2006). Some self-stimulating activities appear to be relaxing to the children when arousal levels become too high (Hirstein, 2001). Individuals with an autism spectrum disorder may also show hypo-reactions and appear unresponsive to their surroundings (Jansen, 2006; Toichi, 2003), or react strongly to minimal stimuli, while not showing a startle response to loud stimuli. Individuals with autism may show restlessness, punctuated by moments of immobility.

It has been suggested that a hyper-sympathetic state results in autonomic hyper-arousal in autism (Axelrod, 2006; Cheshire, 2012; Lonsdale, 2011; Toichi, 2003). Individuals with an autism spectrum disorder have impaired parasympathetic activity, resulting in unrestrained sympathetic activity, especially during mental tasks (Axelrod, 2006; Cheshire, 2012; Toichi, 2003). Paradoxically, it seems that individuals with autism may become more stressed at rest than when performing repetitive tasks (Toichi, 2003). Autonomic tests have demonstrated low baseline cardiac vagal tone and low cardiac baroreceptor activity, resulting in increased heart rate and blood pressure (Axelrod, 2006). With a sympathetic nervous system on maximum alert, autistic individuals may view everything as potentially threatening, but then behave in an attempt

to “shut down the system”. Conversely, if nothing is viewed as significant, those with autism may engage in extreme behaviors in order to produce a sense of significance (Hirstein, 2001). It is not clear if this state of hyper arousal is a primary dysfunction, or a secondary effect of a deeper neurodevelopmental disorder (Cheshire, 2012).

Recent studies have found correlations between autonomic functions and psychosocial behavior. Autonomic responsiveness reflected in heart rate, pupil size, salivary alpha-amylase, and electro-dermal responsiveness differ between normal individuals and those with an autism spectrum disorder (Cheshire, 2012), especially during tasks involving the visualization and perception of human faces (Anckarsater, 2006; Cheshire, 2012). Autism may also cause constipation or diarrhea, urinary retention, cold and clammy extremities, and sleep disturbances, symptoms which also points to underlying autonomic dysfunction (Axelrod, 2006).

Research has established autism as a social brain disorder with a high degree of heritability (Anckarsater, 2006). Individuals with autism have abnormalities in structures associated with autonomic control, such as the brainstem, amygdala, limbic system, cerebellum, and the prefrontal lobe (Anckarsater, 2006; Axelrod, 2006; Hirstein, 2001; Lonsdale, 2011). The amygdala, specifically, is thought to play an excitatory role in producing sympathetic responses, such as pupil dilation, sweating of the palms, and decreased gastric mobility (Hirstein, 2001). However, the amygdala links many systems involving perception, emotion, and thought. Consequently, damage localized to the amygdala can the disrupt flow of information throughout the brain (Hirstein, 2001). Furthermore, the limbic-autonomic network, involving the amygdala, is vital in higher cognition, attaching value to different perceptions, and helping to show the value of social interaction (Hirstein, 2001). It comes as no surprise, therefore, that damage to the amygdala has been associated with impairment in social cognition (Anckarsater, 2006).

Higher levels of adrenergic neurotransmitters (epinephrine and norepinephrine) may contribute to hyperactivity and anxiety in autistic individuals (Axelrod, 2006; Hirstein, 2001; Jansen, 2006). Adults with autism spectrum disorders have also been found to show decreased basal oxytocin levels (Axelrod, 2006; Jansen, 2006). Vasopressin levels have also been found to be higher in individuals with autism spectrum disorders, when compared to healthy controls. Oxytocin and vasopressin are both secreted from the posterior pituitary gland, which has a direct nervous connection to the hypothalamus. Both hormones help in adaptation to the social environment and regulation of the HPA axis during psychological stress. Generally, vasopressin helps to activate the HPA system, while oxytocin inhibits it. Disturbances in oxytocin and vasopressin levels have been correlated with psychiatric disorders that are characterized by social impairments, such as autism (Jansen, 2006).

#### **1.4.2. Diagnosis of Autism Spectrum Disorders**

The identification of an autism spectrum disorder must be made by a professional health provider (Dave, 2015; Newschaffer, 2005; Rice, 2009). There are certain diagnostic criteria that must be met. Criterion A through E and other specification are set forth in the DSM-V (American Psychiatric Association, 2013a; CDC, 2017).

Criterion A discusses persistent deficits in social communication and interactions across multiple contexts. Deficits are seen in areas of social-emotional reciprocity, non-verbal communicative behaviors, and deficits in developing and maintaining friendships. Criterion B outlines restricted and repetitive patterns of behaviors, interests, or activities. Patterns should manifest in at least two of the following areas: stereotyped or repetitive motor movements, use of objects, or speech (e.g. simple motor stereotypes, echolalia, idiosyncratic phrases); insistence on sameness, inflexible adherence to routines, or ritualized patterns or verbal or non-verbal behavior



(e.g. extreme distress at small changes, difficulties with transition); highly restricted, fixated interest that are abnormal in intensity or focus; or hyper- or hypo-reactivity to sensory aspects of the environment. Levels of severity should be specified for social communication impairments and restricted, repetitive patterns of behavior (American Psychiatric Association, 2013a; CDC, 2017). Furthermore, in addition to the aforementioned criteria, a third major criterion (Criterion C) stipulates that must be present in the early developmental period. Criterion D requires that symptoms should cause clinically significant impairments in everyday activities, such as social, occupational or other important areas of functioning (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Anckarsater, 2006; CDC, 2017; Wing, 2010). Finally, Criterion E stipulates that the disturbances to an individual's functioning should not be better explained by intellectual disability or global developmental delay. Although intellectual disability and an autism spectrum disorder can co-occur, social communication should be below expectations for the general developmental level for a comorbid diagnosis of an autism spectrum disorder and intellectual disability (American Psychiatric Association, 2013a; CDC 2017). It should be specified if there is an accompanying intellectual or language impairment, association with a known medical or genetic condition or environmental factor, or if there is an association with another neurodevelopmental, mental, or behavioral disorder. It should also be specified if there is catatonia (American Psychiatric Association, 2013a; CDC 2017). It should be noted that the symptoms and severity of autism spectrum disorders vary widely between individuals. This may cause many cases to go unrecognized and undiagnosed, especially in very mild cases or if the expression is masked by other, more debilitating symptoms (American Psychiatric Association, 2000; Autism Research Institute, 2012; Dave, 2015; Newschaffer, 2005; Rice, 2009). The stigma associated with autism spectrum disorders has decreased in recent years,

which has helped to reduce some under-reported cases (Dave, 2015). Some observable characteristics of an autism spectrum disorder are also shared with other mental disorders, such as mental retardation and attention deficit disorder, which may add some additional challenges in the diagnosis of an autism spectrum disorder. For this reason, “developmental delay” is often seen as a precursor to an autism diagnosis because early characteristics may not be clear enough for a more specific autism spectrum diagnosis (Dave, 2015).

The new criteria in the DSM-V is more thorough and strict compared to the previously used DSM-IV-TR. For example, more symptoms are needed to meet the criteria of fixated interests and repetitive behaviors. The impact of the new changes will be profound, but they were done to create more precise guidelines for diagnosing autism spectrum disorders based on the understanding that symptoms run along a continuum (Autism Research Institute, 2012). Furthermore, the three core diagnostic criteria categories of autism in the DSM-IV-TR (language challenges, social deficits, and stereotyped or repetitive behaviors) have been reduced to two in the DSM-V (communication and social deficits, and fixed or repetitive behaviors) (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Autism Research Institute, 2012; Wing, 2010). There is an inherent overlap between communication and social deficits. Thus, specific terminology that previously made a distinction between social-related elements and social communication impairments were eliminated to combine this symptom category into one. Language challenges and delays were removed as diagnostic criteria because they tend to occur for a variety of reasons, many of which are not specifically related to the autism spectrum. Additionally, language challenges are also not consistent across the autism spectrum. Yet another shift in the definition of autism is a note that some deficits in social interactions may not be directly apparent until some social expectations exceed the limitations of

an individual. Individuals, especially those that exhibit mild presentations of autism, may be able to function normally within society and with other people up until a point when the social requirements or expectations exceed their capabilities. At that point, their specific symptoms of autism will become more apparent (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Anckarsater, 2006; Wing, 2010).

A diagnosis of an autism spectrum disorder at age 2 can be reliable, valid, and stable, but most children are not diagnosed until after age 4. Movements off the spectrum may reflect true improvement due to maturation, intervention, or an over-diagnosis at or before age 2 (CDC, 2016a; Kleinman, 2008). Studies have noted that parents of children with an autism spectrum disorder tend to notice developmental problems before the child turns 1 year, in addition to concerns about vision and hearing being reported before 1 year, while concerns about social, communication, and fine motor skills were apparent around 6 months of age (Bolton, 2012; CDC, 2016a).

Similar to many other mental health disorders, the definition of autism has experienced some major changes. The various versions of the Diagnostic and Statistical Manual of Mental Disorders have outlined standardized criteria for a specific diagnosis, which is often used/cited by insurance companies in health claims. Any mental health diagnosis was previously made according to the DSM-IV-TR criteria. However, the DSM-V was published in May, 2013 and has made its circulation and impact on the literature and population (Autism Research Institute, 2012). It is unclear how insurance companies and services will handle these changes as people that were previously diagnosed with an autism spectrum disorder under the DSM-IV-TR (2000) may be re-classified (American Psychiatric Association, 2013b; Autism Research Institute, 2012; Dave, 2015). The new diagnostic criteria for autism spectrum disorders under the DSM-V will

have profound changes. It is still being heavily debated who the new criteria will include or exclude and if these changes will be for the better (American Psychiatric Association, 2013b; Autism Research Institute, 2012). New classifications can be confusing and difficult to adjust to as parents and children may already strongly identify with their previous diagnosis. The new changes can be particularly concerning to those who are higher functioning and may no longer meet the stricter diagnostic criteria, as they may find difficulties receiving relevant services (Autism Research Institute, 2012). Individuals with a well-established DSM-IV-TR diagnosis of autistic disorder, Asperger's Disorder, or pervasive developmental disorder not otherwise specified were given a diagnosis of autism spectrum disorder under the DSM-V. Other individuals who have marked deficits, but whose symptoms do not otherwise meet the criteria for autism spectrum disorder are usually evaluated for social (pragmatic) communication disorder (CDC, 2017).

The DSM-IV identified a set of Pervasive Developmental Disorders that are now considered "autism spectrum disorders." These included Autistic Disorder, Asperger's Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (Autism Research Institute, 2012; Christensen, 2016). The new edition of the DSM does not include a separate diagnosis for Asperger's Disorder, which is one of the most significant changes made in the DSM-V (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Autism Research Institute, 2012; Christensen, 2016; Wing, 2010). Other sub-parts of the autism diagnosis have also been shuffled into one autism diagnosis, instead of five (Autistic Disorder or classic Autism, Asperger's Disorder, Pervasive Developmental Disorder – Not Otherwise Specified, Rett's Syndrome, and Childhood Disintegrative Disorder) (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Dave, 2015; Wing, 2010). Rett's

Syndrome will assume its own diagnosis in the DSM-V, separate from autism. This re-categorization is extremely significant and may one of the more profound changes to autism (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Wing, 2010). The DSM-V committee made this decision because they felt that the new definition/description of autism is better reflective that autism occurs on a spectrum, rather than separate diagnoses. Notations of symptom presentation and severity will be made, but no longer reflect different diagnoses (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Autism Research Institute, 2012; Wing, 2010).

It has been said that the re-organization of the diagnosis for the DSM –V, under the umbrella term of “Autism Spectrum Disorder,” stemmed from a difficulty to reliably diagnose separate sub-disorders. Refining a diagnosis based on severity has shown to be much more precise and reliable than separate, sub-disorders (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Autism Research Institute, 2012; Wing, 2010).

Overall, the definition of autism is changing in many ways. However, the core characteristics still remain. Persistent deficits in social interactions across contexts, social-emotional reciprocity, non-verbal communicative behaviors, and deficits in developing and maintaining friendships are all characteristics that are still included in the DSM-V definition of autism. Restricted and repetitive patterns of behaviors, interests, or activities will still be included in the DSM-V definition of autism, in addition to the third major criteria that symptoms much persist in early childhood. Symptoms should also still limit or impair everyday activity (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Anckarsater, 2006; Wing, 2010). The new criteria in the DSM-V is more thorough and strict compared to the previously used DSM-IV-TR. For example, more symptoms are needed to meet

the criteria of fixated interests and repetitive behaviors. The impact of the new changes will be profound, but they were done to create more precise guidelines for diagnosing autism spectrum disorders based on the understanding that symptoms run along a continuum (Autism Research Institute, 2012).

### **1.4.3. Prevalence Rates of Autism Spectrum Disorders**

Autism spectrum disorders display high prevalence in the US. Using the diagnostic criteria of DSM-IV, 1 in 88 children have been found to exhibit an autism spectrum disorder (American Psychiatric Association, 2000; Kim, 2011; Rice, 2009). More recent studies using DSM-V criteria report a higher prevalence of autism spectrum disorders of approximately 1 in 68 children (Autism Research Institute, 2012; CDC, 2016a; Christensen, 2016). Similarly, studies in Asia, Europe, and North America reported prevalence between 1 and 2% (CDC, 2016a). Examining autism by states in the US, New Jersey had the highest prevalence (24.6 children per 1,000), followed by Maryland (18.2 children per 1,000), Utah (17.3 children per 1,000), and North Carolina (16.9 children per 1,000). Areas where educational and health records were both reviewed showed a higher estimated autism prevalence than in areas where only health records were reviewed (Christensen, 2016). As of April, 2018, the Centers for Disease Control and Prevention is reporting a national increase in prevalence to 1 in 59 children. Estimates continue to vary widely depending on monitoring sites -with significantly higher estimates at sites where researchers had full access to school records (Autism Speaks, 2018a).

Autism spectrum disorders tend to be more prevalent in males versus females (CDC, 2016a; Christensen, 2016; Kim, 2011; Rice, 2009). Data from 2016 surveys suggest that the prevalence rate for male children was about 1 in 42 children (23.5 per 1,000), while approximately 1 in 189 for female children (5.3 per 1,000) (CDC, 2016a; Christensen, 2016).

According to 2016 research, estimates ranged for boys from 13.9 per 1,000 in Maryland to 39.1 per 1,000 in New Jersey and from 2.2 per 1,000 in Maryland for girls to 9.3 per 1,000 in New Jersey. Overall, the prevalence ratio for boys compared to girls was 4.5:1 (Christensen, 2016). The same meta-analysis estimated that the prevalence among non-Hispanic white children to be 15.5 per 1,000, which is higher than among non-Hispanic black children (13.3 per 1,000), Asian/Pacific Islander children (11.3 per 1,000), and Hispanic children (10.1 per 1,000) (Christensen, 2016). According to April, 2018 data from the CDC, boys are still more likely to be diagnosed than girls, but the gender gap appears to be decreasing. The ethnic gap also appears to be decreasing, possibly due to awareness and screening in minority communities (Autism Speaks, 2018a).

Autism spectrum disorders are linked to various other diseases. For example, approximately 10% of children diagnosed with an autism spectrum disorder are also identified as having Down syndrome, fragile X syndrome, tuberous sclerosis, or another genetic abnormality (CDC, 2016a; CDC, 2016b; Cohen, 2005; Levy, 2010). Autism spectrum disorders also commonly occur with other developmental, psychiatric, neurologic, chromosomal, and genetic diagnoses. Co-occurrence of one or more non-autism medical diagnoses with autism is 83%, while the co-occurrence of one or more psychiatric diagnosis is 10% (CDC, 2016a; Levy, 2010). Families with one autistic child have a 2-18% likelihood of having a second child that has autism (CDC, 2016a; Ozonoff, 2011). Similarly, children with a sibling that has an autism spectrum disorder are at a higher risk for developing autism (CDC, 2016b). If one identical twin has an autism spectrum disorder there is a 36-95% chance that the other twin will be affected, whereas in non-identical twins, if one twin has an autism spectrum disorder there is a 0-31% chance that the other twin will be affected (CDC, 2016a; Hallmayer, 2011). In addition, children born to

older parents are more likely to have autism (CDC, 2016a; CDC, 2016b; Durkin, 2008). Some children that are born prematurely, or with a low birth weight, are at greater risk for developing an autism spectrum disorder (CDC, 2016a; Schendel, 2008) and it has been suggested there may be a critical period for developing an autism spectrum disorder before, during, or immediately after birth (CDC, 2016b). Vaccines have not been shown to be associated with the development of an autism spectrum disorder, despite concerns of the general public to the contrary (CDC, 2016b).

Current statistics show that autism is second only to mental retardation (MR) as the most commonly diagnosed developmental disability (Dave, 2015). Indeed, surveys suggest that the prevalence of autism spectrum disorders in the United States is increasing (CDC, 2016b; Christensen, 2016; Dave, 2015; Kim, 2011; Newschaffer, 2005; Rice, 2009). It is not known if this is due an increase in awareness, broader diagnostic criteria, or a true increase in prevalence (CDC, 2016b; Dave, 2015; Kim, 2011; Newschaffer, 2005; Rice, 2009). Nor is it known if autism spectrum disorders are increasing independently of other mental disorders or replacing them. However, there is data to suggest autism may be supplanting some mental retardation diagnoses (Dave, 2015).

Despite increased prevalence, autism continues to go undiagnosed. This suggests that more comprehensive screening programs may yield more accurate prevalence estimates (Hess, 2008; Kim, 2011). Many hope that the new definition of autism in the DSM-V will address the need for improved autism diagnosis. However, issues such as social imagination, diagnosis in infancy and adulthood, misdiagnosis in females and exclusion of some individuals are causes for concern (Wing, 2010). There tends to be conflicting views regarding whether autism diagnostic criteria in DSM-IV and DSM-V lead to over or under estimates of prevalence (Autism Research



Institute, 2012; Dave, 2015; Wing, 2010). Recent 2018 reports are indicating that the new diagnostic criteria for autism made only a slight difference in prevalence estimates (Autism Speaks, 2018a). Nevertheless, many reports confirm that the prevalence of autism spectrum disorders is on the rise (CDC, 2016b; Christensen, 2016; Dave, 2015; Kim, 2011; Newschaffer, 2005; Rice, 2009).

#### **1.4.4. Treatment of Autism Spectrum Disorders**

The most effective treatment outcomes for autism spectrum disorders are usually seen with early interventions tailored to meet individual needs (Christensen, 2016; Butter, 2003). Because autism spectrum disorders originate from interaction between genetics and the environment, the clinical presentation can vary immensely (American Psychiatric Association, 2000; American Psychiatric Association, 2013a; Autism Research Institute, 2012; Butter, 2003; Christensen, 2016; Dave, 2015; Gabriels, 2012; Lanning, 2014; Newschaffer, 2005; Rice, 2009). Thus, a given treatment plan will not be equally effective for all individuals (Butter, 2003; Lanning, 2014; Lentini, 2015). Holding Therapy, Art Therapy, Integrated Movement Therapy, Relational Development Interventions, and Pet/Animal Therapies have had mixed results (Butter, 2003; Hess, 2008). Consequently, there is no universally accepted treatment for autism spectrum disorders, despite much anecdotal evidence (Butter, 2003). Research has suggested that animal-assisted interventions may produce sensory-related relaxation experiences which help children become better able to manage stressful events, as well as engage in prosocial behaviors (Gabriels, 2015). Other studies have shown evidence for reductions in stress hormones (like cortisol) in children with an autism spectrum diagnosis following an interaction with a service dog (Gabriels, 2015; Viau, 2010). There has been some evidence that children with an autism spectrum disorder that participated in an equine-assisted activity or therapy have shown marked

improvements in physical, emotional, and social functioning over those that participated in a non-equine program (Lanning, 2014). Particularly, research has suggested that equine-assisted therapies and activities help improve affective understanding/perspective taking, initiating interactions, and maintaining interactions in children with an autism spectrum disorder (Bass, 2009; Gabriels, 2012; Ghorban, 2013). This lends support to the utilization of equine-assisted activities and therapies in the treatment of children with an autism spectrum disorder (Bachi, 2012; Bass, 2009; Gabriels, 2012; Ghorban, 2013; Lanning, 2014).

Some common treatment plans include skill-based and behavioral treatments aimed at teaching specific skills and trying to aid in the development of social and language skills. Autistic clinical signs may remain in spite of treatment, but behavioral intervention can sometimes help a person function socially. While counseling sessions may help a family handle the challenges of raising an autistic child, medications may help reduce specific autism-related symptoms such as anxiety, depression, or obsessive-compulsive behaviors. Most of these medications also tend to decrease levels of impulsivity and hyperactivity (Butter, 2003; Hess, 2008). Most treatment interventions usually fall within the following six areas: sensory integration and sensory-based interventions; relationship-based, interactive interventions; developmental skill-based programs; social cognitive skills training; parent-directed or parent-mediated approaches; and intensive behavioral interventions (Lanning, 2014). Research has found that the care and management of the challenging behaviors associated with autism have contributed to higher rates of stress amongst caregivers when compared to other special needs populations (Gabriels, 2015). The cost for caring for individuals with an autism spectrum disorder can also be a burden (Dave, 2015; Lanning, 2014). Estimates have shown that the annual costs to raise a child with an autism spectrum disorder are 85-550% higher than for

raising a normal child (Dave, 2015). Costs include direct and indirect costs such as medical care, special education, behavioral interventions, and lost parental productivity (Buescher, 2014; CDC, 2016a). Medical expenses for children with an autism spectrum disorder are 4.1 to 6.2 times great than those children without an autism spectrum disorder (CDC, 2016a). Total costs for children with an autism spectrum disorder in the United States is estimated to be \$11.5 billion to \$60.9 billion per year (Buescher, 2014; CDC, 2016a; Dave, 2015). In a lifetime this could exceed \$4.7million per individual (Dave, 2015). The increase in prevalence and the increased cost of care has encouraged many researchers to examine new therapies for autism spectrum disorders (Dave, 2015). In some cases, families may use Medicaid funds for a child with an autism spectrum disorder.

### **1.5. General Principles for the Treatment of Autonomic Dysfunctions**

Treatments for autonomic dysfunctions are intended to maintain or improve strength, functioning, and mobility, as well as slowing the progression of disease. Thus, while not curative, treatments can assist the patient to live more comfortably (Millhouse-Flourie, 2004). Treatments should be individualized to suit the needs of each patient (Benarroch, 2007; Millhouse-Flourie, 2004; Pauw, 2000). Occupational, speech, and respiratory therapies, and animal and equine-assisted therapies can be beneficial and may be offered in combination with other therapies (Millhouse-Flourie, 2004). The needs of a patient should be evaluated through observations, interviews, and additional cognitive and neuro motor tests as appropriate (Benarroch, 2007; Millhouse-Flourie, 2004; Wallden, 2012). Treatment regimens are intended to restore balance between the sympathetic and parasympathetic nervous systems (Benarroch, 2007; Wallden, 2012). The health care team may include a neurologist, dietitian, physical therapist, urologist or gastroenterologist (Benarroch, 2007) with oversight provided by a

qualified physician (Millhouse-Flourie, 2004). Therapies frequently involve modifying the diet, including vitamin supplementation, enrolling in programs offering specific activities, and pharmacologic correction of autonomic imbalances related to the cardiovascular, digestive, immune or reproductive system (Benarroch, 2007; Millhouse-Flourie, 2004).

Physical therapy is used in the treatment of some autonomic disorders through improving range of motion, injury prevention, and pain management (Millhouse-Flourie, 2004; Rosenwinkel, 2001). Therapeutic exercises can maintain muscle strength and delay deterioration (Hall, 2012; Hoffman, 2005; Millhouse-Flourie, 2004; Taylor, 2007) while they can improve balance, coordination, posture, motor function, and respiration (Aetna, Inc., 2016; Hall, 2012; Jansen, 2011; Millhouse-Flourie, 2004; Taylor, 2007). Exercise also assists cardiovascular health, weight loss, and the slowing of osteoporosis and deconditioning (Freeman, 2006; Hall, 2012; Hoffman, 2005; Hsu, 2015; Millhouse-Flourie, 2004). Physical therapies and exercise programs should be developed and supervised by a physical and/or physiotherapist (Jansen, 2011; Millhouse-Flourie, 2004; Taylor, 2007). Specialty areas of physical therapy include cardiovascular and pulmonary disorders, neurological disorders, geriatrics, pediatrics, orthopedics, sports medicine, women's health, and palliative care. Each specialty genre often requires special certification in order to practice (Jensen, 2000; Millhouse-Flourie, 2004). Different modalities of physical therapy include aerobic training, aquatics, and therapeutic horseback riding (Hall, 2012; Millhouse-Flourie, 2004).

Occupational therapies are similar to physical therapies, but focus on upper extremities, cognitive abilities, and fine motor skills. Occupational therapies are used to help enhance specific abilities so that a person may perform the necessary activities of daily life (Millhouse-Flourie, 2004). Treatments are customized with activities, exercises, and games for maximizing

independence relevant to the life-style, environment, and developmental stage of the participant (Benarroch, 2007; Millhouse-Flourie, 2004). Occupational therapies also require therapists to be trained and licensed properly before practicing (Millhouse-Flourie, 2004).

Speech problems can be congenital or acquired, and often are a result of developmental abnormalities, weakened neuro-musculature, or brain injury (Millhouse-Flourie, 2004; Newschaffer, 2005; Rice, 2009). Breathing support is frequently necessary due to respiratory dysfunction (Millhouse-Flourie, 2004). Speech, language, and communication problems are common in some disorders associated with autonomic dysfunction, such as autism spectrum disorders (American Psychiatric Association, 2000; Axelrod, 2006; Millhouse-Flourie, 2004; Newschaffer, 2005; Rice, 2009). Sign language can be beneficial alternative if hand muscles function properly. Ventilators, breathing therapies, and communication devices can be used to help strengthen breathing (Millhouse-Flourie, 2004).

A common thread amongst most therapies used in the treatment of autonomic disorders is exercise (Benarroch, 2007; Millhouse-Flourie, 2004). Exercise therapies are particularly beneficial because they engage both the sympathetic and parasympathetic systems and can help to restore balance between these systems (Freeman, 2006; Wallden, 2012). Exercise therapies are often utilized with other treatments, including physical, emotional, cognitive, and behavioral therapies (Benarroch, 2007; Millhouse-Flourie, 2004). A combination of exercise and physical, occupational, speech, and respiratory therapies, can be extremely beneficial in the treatment of autonomic disorders and dysfunctions (Benarroch, 2007; Millhouse-Flourie, 2004).

### **1.5.1. Exercise Training as Therapy**

Exercise training used in therapy is a treatment method that has been shown to help restore healthy autonomic dynamics and timing in individuals with an autonomic dysfunction/imbalance (Hsu, 2015; Freeman, 2006; Millhouse-Flourie, 2004; Rosenwinkel, 2001). Exercise training in a therapeutic setting can alter the balance between the sympathetic and parasympathetic nervous systems (Freeman, 2006; Hsu, 2015; Wallden, 2012). There is a complex interplay between the autonomic nervous system and the cardiovascular system during exercise (Freeman, 2006). Heart rate response to exercise and the recovery from exercise depends on the dynamic interplay between the sympathetic and parasympathetic nervous system (Freeman, 2006; Hsu, 2015).

Exercise invokes the sympathetic nervous system through increased heart rate, blood flow, and mobilization of muscles (Hsu, 2015; Wallden, 2012). Regular, dynamic exercise can help enhance vagal tone and lower resting heart rates. Higher vagal tone and lower resting heart rates are also associated with lower mortality. Aging, weight, cardiac size, maximum respiratory exchange ratio, deconditioning, altitude, and the avoidance of gravitational stress (such as during bed rest) can impair vagal tone and elevate resting heart rates (Freeman, 2006). Chronic activation of the sympathetic nervous system and/or the limitation of the parasympathetic vagal tone can increase the risk of cardiovascular occurrences. The risk of potentially fatal cardiovascular events can be reduced by the increased parasympathetic tone that occurs during regular and dynamic exercise (Freeman, 2006). The parasympathetic nervous is invoked during breathing, stretching, and recovery, improving conditioning throughout body (Wallden, 2012).

The balancing of different focused exercises between the sympathetic and parasympathetic nervous systems assists in the rehabilitation and conditioning of the participant (Freeman, 2012; Hsu, 2015; Wallden, 2012).

Wallden (2012) described how “working out” engages the sympathetic nervous system and increase heart rate, blood flow, and engages muscles and joints. Wallden (2012) also described how engaging the parasympathetic nervous system is critically important in therapy and aids in rest, digest, and repair. They described “working in” during exercise as engaging the parasympathetic system. “Working in” during parasympathetic exercises focuses on breathing and stretching, while also focusing on the timing of breathing during stretches/exercise and listening to the internal state of the body. Parasympathetic stimulation is a powerful way to relax and gain a feel for the body’s inner workings (Wallden, 2012). Benefits of “working in” during parasympathetic exercises include enhanced fluid dynamics. Rhythmically contracting muscles in a slow, effortless manner can aide in the dispersing of waste metabolites that collect in muscles and associated connective tissues and joints. Furthermore, parasympathetic activities can aid in neurological reprogramming and encourage better communication within neurological pathways that target different muscle groups. Parasympathetic activities also help with mechano-receptive stimulation and can help block pain messages while also improving full-body awareness. Overall, parasympathetic activities can improve general/base conditioning within the entire body. Specific activities can target appropriate muscle groups and increase work tolerance, even before more challenging work outs are utilized (Wallden, 2012). The balancing of different focused exercises is a great benefit of exercise training in therapy and in the rehabilitation or conditioning of the participant (Freeman, 2006; Wallden, 2012).

Exercise training in a therapeutic setting, including equine-assisted activities, can have this balancing effect, while simultaneously engaging cognition and emotional processing (Bachi, 2012; Bizub, 2003; PATH Intl., 2011; Porter-Wenzlaff, 2007). Exercise training in therapy also generally includes the utilization of voluntary muscle contractions and/or body movements (Hall, 2012; Hoffman, 2005; Taylor, 2007). The ultimate goal of the physical activity is to relieve symptoms, and/or improving, retaining, or slowing the deterioration of a participant's health (Hall, 2012; Hoffman, 2005; Millhouse-Flourie, 2004; Taylor, 2007).

Exercise training in a therapeutic setting has many different dimensions. It can be used to release contracted muscles and tendons, mobilize joints, improve strength, circulation, respiratory capacity, exercise performance and endurance, and coordination and balance, reduce rigidity, and promote relaxation (Hall, 2012; Jansen, 2011; Millhouse-Flourie, 2004; Taylor, 2007). Research in exercise training has showed significant improvements in clinically relevant outcome parameters, including exercise capacity and quality of life (Hsu, 2015; van Tol, 2006). Exercise training typically includes some combination of flexibility and strength training/building muscle (especially in weakened muscles/areas and including core strengthening and stabilization), range of motion and joint flexibility exercises (passive, active, assisted, and active), proprioceptive exercise, functional activities, and aerobic, cardiovascular, and respiratory training activities (Hall, 2012; Jansen, 2011; Millhouse-Flourie, 2004; Taylor, 2007). Strength training exercises often target the trunk muscles, including abdominal (abdominis and obliques), back, and pelvic musculature, and aims to improve balance, stability, and posture. This specific type of training has been found to be particularly beneficial for people with certain upper and lower limb and spinal conditions (Hall, 2012). Proprioceptive and neuromotor exercise training includes activities that strengthen balance, coordination, gait, and agility, and aims to restore



timing patterns of muscular activation. This specific type of training has been found to be beneficial for people with osteoarthritis, diabetes mellitus, rheumatological diseases, and for problems associated with aging (Hall, 2012; Hoffman, 2005). Each dimension of exercise training has several different methods of obtaining the desired outcomes. A few examples of some forms of exercises that have been used in therapy are plyometrics, occupational and sport-specific training, aquatic exercise, stretching, yoga, Pilates, and Tai chi (Hall, 2012). There is no evidence that any one type of exercise is vastly more beneficial than another. However, the success of an exercise program is dependent upon how well it suits the needs of the participant (Taylor, 2007).

Exercise training in therapy encompasses treatment, rehabilitation, and the prevention of pathological conditions (Hall, 2012; Hoffman, 2005). There is also a great deal of evidence in the literature that supports the notion that exercise training in therapy can provide much needed relief and be beneficial to individuals across a broad range of diseases, disorders, and/or impairments (Jansen, 2011; Millhouse-Flourie, 2004; Taylor, 2007). Specialty genres of exercise and other physical therapies touch in areas such as the rehabilitation and management of issues concerning cardiovascular and pulmonary disorders, neurological disorders, geriatrics, pediatrics, orthopedics, sports medicine, women's health, and palliative care (Jensen, 2000; Millhouse-Flourie, 2004). Furthermore, limited to moderate evidence has shown it to be effective in peripheral neuropathy, Parkinson's disease, hypertension, Down syndrome, and HIV. Strong effects have been observed in multiple sclerosis, osteoarthritis, sub-acute and chronic lower back pain, chronic heart failure, coronary heart disease, chronic obstructive pulmonary disease, intermittent claudication, and after lumbar surgery (Taylor, 2007). Exercise training programs have been noted to have positive effects on cardiac autonomic balance and heart rate

response (Freeman, 2006; Hsu, 2015). Additionally, exercise, in general, has many benefits and improves all-cause mortality, prevents cardiovascular disease, regulates blood pressure and lipid management, helps in weight control, amongst many other benefits. However, in order to be successful, exercise training in therapy requires the active participation of an individual, including the completion of any at-home exercise programs (Freeman, 2006; Hall, 2012; Hoffman, 2005; Millhouse-Flourie, 2004). Effects are more difficult to assess if they are confounded by things such as substance abuse and smoking. Smoking is strongly correlated with exercise performance (Freeman, 2006).

When exercise is used in therapy, it should always be prescribed by a physical and/or physiotherapist (Jansen, 2011; Millhouse-Flourie, 2004; Taylor, 2007). It should also be used as a supplemental therapy in addition to clinical therapy. It is an alternative and favorable treatment approach to existing therapies, particularly for the prevention and treatment of certain disorders and autonomic imbalances (Hsu, 2015). Programs should be chosen appropriately for a particular diagnosis and a program should be tailored to fit the specific needs of an individual (Hall, 2012; Hoffman, 2005; Lentini, 2015; Millhouse-Flourie, 2004; Taylor, 2007; Wallden, 2012). Programs should be designed to directly target any impairments that have caused activity limitations and/or pain (Jansen, 2011; Millhouse-Flourie, 2004; Taylor, 2007). Targeted and individualized exercise programs in therapy are usually more beneficial than standardized programs, as with any therapeutic technique (Millhouse-Flourie, 2004; Taylor, 2007). Exacerbation of current musculoskeletal or health problems, such as cardiovascular, pulmonary, or other/systemic disease processes, should be limited. Precautions should always be taken, and

the frequency, duration, and specifics of an exercise should always be appropriate (Hall, 2012; Millhouse-Flourie, 2004). In order to be successful, exercise therapies require active participation from the participant in a way that they can safely manage (Jansen, 2011; Millhouse-Flourie, 2004; Taylor, 2007).

Exercise training in therapy can help to restore healthy autonomic dynamics in individuals with an autonomic dysfunction (Hsu, 2015; Millhouse-Flourie, 2004; Rosenwinkel, 2001). Therapeutic exercises in physical therapy can address/maintain muscle strength and delay deterioration that may have been caused by autonomic dysfunctions and their related disorders (Millhouse-Flourie, 2004; Rosenwinkel, 2001). Therapeutic exercises can also be beneficial for the restoration of strength, range of motion, balance, coordination, posture, motor function, and respiration, in which imbalances can all be caused by autonomic dysfunctions (Hall, 2012; Hsu, 2015; Jansen, 2011; Millhouse-Flourie, 2004; Taylor, 2007; Rosenwinkel, 2001). Exercise is also beneficial to cardiovascular health, weight control, and in the slowing of osteoporosis and other deconditioning that can exacerbate disease processes/deteriorations, such as those associated with autonomic dysfunction (Hall, 2012; Hoffman, 2005; Millhouse-Flourie, 2004; Rosenwinkel, 2001). Exactly how exercise training improves autonomic function is not fully understood. It can increase cardiac vagal tone. Nitric oxide (NO) bioavailability also increases with exercise training. NO affects cardiac vagal tone and sympathetic influence (Hsu, 2015). Exercise training also lowers angiotensin II levels, which inhibit cardiac vagal activity (Freeman, 2006; Hsu, 2015). Furthermore, exercise training has anti-inflammatory effects, which can improve autonomic function (Hsu, 2015). More research is needed in this area.

#### **1.5.1.1. Equine Activities as an Exercise Treatment for Autonomic Dysfunction**

Equine-assisted activities and therapies are a multidimensional form of therapy using the relationship between human and animal to improve physical, emotional, and cognitive impairments (All, 1999; Benda, 2000; Farias-Tomaszewski, 2001; Lentini, 2015; Millhouse-Flourie, 2004; Vidrine, 2002). Interactions with companion animals, like horses, can lower blood pressure, quiet the autonomic nervous system, calm cardiovascular activity, elicit responses in oxytocin, vasopressin, and cortisol, and also promote physiological relaxation (Yorke, 2013). Interactions with horses can also decrease anxiety, blood pressure, and heart rate (Farias-Tomaszewski, 2001), while supplying connection for someone who has felt disconnected, abandoned, or unwanted (Ewing, 2007). Horses can provide a safe place for a person to develop social relationships and practice how to interact other individuals (Bass, 2009; Lanning, 2014).

Equine-assisted activities and therapies are a form of exercise training that can address physical and psychological impairments (All, 1999; Bachi, 2012; Benda, 2000; Farias-Tomaszewski, 2001; Lentini, 2015; Millhouse-Flourie, 2004; Vidrine, 2002). Diverse treatment options are available to meet the requirements of a diverse set of populations (Lentini, 2015). Equine assisted activities and therapies thus complement treatment programs for many autonomic dysfunctions (Bliss 1997; Millhouse-Flourie, 2004). Equine activities and therapies can also be effective for suicide prevention, ADHD, anxiety, PTSD, history of abuse, and other behavioral problems (Lentini, 2015).

Horse activities can involve many forms of coordinated physical and mental effort (Bachi, 2012; Bizub, 2003; Millhouse-Flourie, 2004; Nimer, 2007; PATH Intl., 2011; Porter-Wenzlaff, 2007), helping in the improvement of physical, emotional, and cognitive impairments (All, 1999; Benda, 2000; Farias-Tomaszewski, 2001; Lanning, 2014; Millhouse-Flourie, 2004; Vidrine, 2002).

Equine - assisted therapy utilizes the rhythmic motion of the horse's body to engage the parasympathetic and sympathetic nervous systems, improving balance, coordination, posture, etc., while developing social skills (Bass, 2009; Borzo, 2000; Hall, 2012; Farias-Tomaszewski, 2001; Millhouse-Flourie, 2004; Vidrine, 2002). Thus, horses can engage the mind and body together (Bizub, 2003; Millhouse-Flourie, 2004; PATH Intl., 2011; Porter-Wenzlaff, 2007), and facilitate an alliance between a therapist and a patient (Lefkowitz, 2005; Missel, 2001; Roberto, 2002; Yorke, 2008). It is therefore possible that equine-assisted activities and therapies are an effective therapy for autism spectrum disorders and PTSD (Bass, 2009; Gabriels, 2012; Lanning, 2014; Lentini, 2015).

#### **1.5.1.2. Therapeutic Background of Animal-Assisted Therapies**

The modern concept of animal-assisted therapies was first developed in the 1960s, when it was asserted that a connection to animals can have a positive effect on humans (Bachi, 2012). This stems from the recognition of human-pet bonding as noted by Dr. Boris Levinson in 1961 (Velde, 2005). Dr. Levinson was working with a withdrawn and mentally impaired young boy. Dr. Levinson made a profound discovery when he briefly left his dog alone with the boy. When he returned, he found the boy interacting with the dog. Dr. Levinson found that the presence of a dog during therapy sessions had a positive impact on his patients. He would later use the expression "pet therapy" in reference to the beneficial effects that the dogs had on the mentally

impaired children in a therapeutic setting (Levinson, 1962; Levinson, 1964). Levinson had stated that a ‘man’s universal experience with animals indicates an innate tendency to associate with them and the natural world’ (Brickel, 1981; Levinson, 1972). Although he initially emphasized the benefits of using pets with children, he did not ignore the potential of using pets with adults and geriatric population. Levinson described how pets contribute to the healthy development of children and adults (Brickel, 1981; Levinson, 1962; Levinson 1964; Levinson, 1969).

Perhaps due to our shared history of contact, humans have a high awareness of animals. People also tend to feel calmer with animals, possibly because we assess safety of surroundings based on calmness exhibited by animals in close proximity (Lefkowitz, 2005). Touching an animal has been associated with decreases in blood pressure, heart rate, stress, anxiety, anger, and depression, and increases in cardiovascular health and psychological well-being (Berget, 2007; Brodie, 1999; Connor, 2000; Lefkowitz, 2005; Millhouse-Flourie, 2004; Parshall, 2003; Sable, 2012; Sockalingam, 2008). Contact with an animal also releases endorphins, natural pain suppressors, and oxytocin, which elicits feelings of pleasure (Millhouse-Flourie, 2004; Sable, 2012). Oxytocin also strengthens the immune system, lowers the production of stress hormones, and reduces feelings of fear and danger (Sable, 2012).

Because humans are social creatures, they have a desire to belong and to be accepted by a group (Gruenewald, 2004). Social support has been shown to help an individual cope with the normal stressors of life, which helps promote mental well-being (Millhouse-Flourie, 2004; Parshall, 2003; Small, 2011). Animals can provide such stress-reduction and various physiological, emotional, and cognitive, and benefits (Gruenewald, 2004; McConnell, 2002; Millhouse-Flourie, 2004; Roberto, 2002; Sable, 2012).

An individual with minimal social skills can have rewarding interactions with animals which can make them feel needed (Brodie, 1999; Connor, 2000; Lefkowitz, 2005; Millhouse-Flourie, 2004; Roberto, 2002; Sable, 2012; Sockalingam, 2008). Because humans form judgments of each other, many find that interacting with animals is less stressful than fellow humans (Brodie, 1999; Lefkowitz, 2005; Millhouse-Flourie, 2004; Roberto, 2002; Sockalingam, 2008). Pet owners, especially elderly pet owners, report less psychological distress and fewer visits to the doctor (Sable, 2012).

People easily develop attachments to animals because they exhibit many childlike behaviors (Bachi, 2012; Brodie, 1999; Nimer, 2007; Sable, 2012). These relationships fulfill emotional needs in a manner similar to relationships between people and children (Brodie, 1999; Lefkowitz, 2005; Millhouse-Flourie, 2004; Sable, 2012; Vidrine, 2002; Yorke, 2008). Such interspecies relationships can be highly enjoyable (Millhouse-Flourie, 2004; Roberto, 2002). Animal assisted activities and therapies use these interspecies relationships to help improve an individual's physical, emotional, and cognitive health, breaking patterns of loneliness, and providing social contact, play, and laughter (Brodie, 1999; Lefkowitz, 2005; Millhouse-Flourie, 2004; Sable, 2012). Social engagement with animals can then be transferred into engagement with other people (Bachi, 2012; Roberto, 2002; Millhouse-Flourie, 2004; Stanley-Hermanns, 2002).

Through fulfilling an essential need for social contact, relationships with animals can provide a sense of well-being and self-worth. Being part of a social network with mutual responsibilities (Brodie, 1999; Lefkowitz, 2005; Millhouse-Flourie, 2004) improves self-esteem and confidence (Missel, 2001; Roberto, 2002; Sockalingam, 2008). Furthermore, caring for animals, can help people view themselves as nurturing, caring, and capable. In particular, being

able to work with challenging animals builds notions of confidence and control (Lefkowitz, 2005; Roberto, 2002). Overall, animals increase awareness, psychosocial functioning, and general life satisfaction (Brodie, 1999; Lentini, 2015; Millhouse-Flourie, 2004; Sable, 2012).

The calming and soothing effects that animals provide suggest that they help restore physical and emotional equilibrium (Bachi, 2012; Sable, 2012). Even people that merely receive visits from volunteers with animals report a positive change in mood (Lutwack-Bloom, 2005; Millhouse-Flourie, 2004; Sockalingam, 2008). Moreover, when animals are used therapeutically, people show improved cardiovascular health and psychological well-being with decreases in blood pressure, anxiety, anger, and depression, and increases in (Berget, 2007; Brodie, 1999; Connor, 2000; Lefkowitz, 2005; Millhouse-Flourie, 2004; Parshall, 2003; Sable, 2012; Sockalingam, 2008). These responses have also been linked to decreases in medication use, violence, suicide attempts, and other destructive behaviors (Connor, 2000; McConnell, 2002).

Animal-assisted activities and therapies can help individuals connect with a therapist (Lefkowitz, 2005; Millhouse-Flourie, 2004; Sockalingam, 2008). Animals act as a catalyst between and client and a therapist, which can promote therapeutic change and healing (Brandt, 2013). Animals tend to engage individuals that are withdrawn and isolated, possibly because those individuals are viewed as less likely to respond aggressively (Lefkowitz, 2005; Sockalingam, 2008). Because the person can then focus on the animal, instead of themselves or the therapist, they may feel less pain, discomfort, and inhibition (Brodie, 1999; Connor, 2000; Millhouse-Flourie, 2004; Roberto, 2002). Therapeutic interventions that incorporate an animal tend to exhibit an increased treatment adherence, particularly with clients who previously demonstrated inconsistent attendance or low motivation (Brandt, 2013). Therapy sessions that



are conducted with animals may be enjoyable and more tolerable than sessions with only a therapist (Lefkowitz, 2005; Macauley, 2006; Millhouse-Flourie, 2004; Parshall, 2003). Animal-assisted activities and therapies also provide an engaging learning environment, helping the patient learn how to properly care for another living being through topics such as feeding, play, work, and dying (Roberto, 2002).

Animal-assisted activities and therapies are alternative forms of therapies that have been growing in popularity in recent years (Lentini, 2015; Millhouse-Flourie, 2004; Sable, 2012; Sockalingam, 2008; Stanley-Hermanns, 2002). However, when animal therapies are used, they are generally not seen as stand-alone treatments, but are rather complement existing treatment protocols (Aetna, Inc., 2016; Millhouse-Flourie, 2004; Nilson, 2004; Nimer, 2007). They can help one relate to others, regulate emotions, and cope with stress (Sable, 2012). Social work professionals and psychologists should be made aware about the significance of the human-animal bond in a therapeutic setting (Sable, 2012).

Animal-assisted activities (AAA) and animal-assisted therapies (AAT) are the two primary ways in which animals are used in therapeutic settings (Connor, 2000; Millhouse-Flourie, 2004; Stanley-Hermanns, 2002). AAA sessions are generally conducted by volunteers using an animal that is typically the personal pet of the volunteer. In AAA sessions there are no specific goals to achieve from the interventions. They are conducted to reduce loneliness and enhance a person's psychological well-being and quality of life, and frequently involve group settings (Connor, 2000; Millhouse-Flourie, 2004; Stanley-Hermanns, 2002). In contrast, AAT sessions are more formalized than AAA sessions (Millhouse-Flourie, 2004), occur during regularly scheduled therapeutic interventions, and tend to be in a one-on-one setting.

Often times, pet therapy, pet-facilitated therapy, pet-assisted therapy, animal-facilitated therapy, and animal visitation, amongst other terms, are commonly used to refer to both AAA and AAT (Bachi, 2012; Connor, 2000; Stanley-Hermanns, 2002). Both methods occur in a variety of settings, including hospitals, nursing homes, convalescent homes, rehabilitation facilities, oncology units, acute and critical care units, psychiatric facilities, psychotherapy sessions, and prisons (Connor, 2000; Millhouse-Flourie, 2004; Stanley-Hermanns, 2002).

However, there are basic differences between AAA and AAT, especially with regards to how the animals are used and the goals of the therapeutic intervention, with AAA being the simpler of the two. While AAA sessions are of short duration, frequently occurring in informal groups, AAT sessions address specific goals for improving the cognition and physical functioning of a given patient (Connor, 2000; Brandt, 2013; Millhouse-Flourie, 2004; Nimer, 2007; Sockalingam, 2008; Stanley-Hermanns, 2002). AAT sessions generally take on a systematic approach that moves in a step-by-step fashion conducted by a certified practitioner (Connor, 2000; Nimer, 2007; Sockalingam, 2008; Stanley-Hermanns, 2002). The animals used in AAT sessions are specially trained, selected, and certified through obedience and behavioral conditioning, and temperament evaluations (Connor, 2000; Brandt, 2013; Millhouse-Flourie, 2004; Nimer, 2007; Sockalingam, 2008; Stanley-Hermanns, 2002).

Many different types of animals have been used in therapeutic settings. The most common animal that has been used in therapy sessions is, of course, the dog (Connor, 2000; Millhouse-Flourie, 2004; Brandt, 2013; Sockalingam, 2008; Stanley-Hermanns, 2002). When animals are used in a therapeutic setting, they are employed in a way that achieves specific therapeutic goals. For example, if enhanced motor function and strength are specific goals of therapy, a person may be asked to walk or throw a ball with a dog, or even simply pet a dog. If

achieving cognitive goals from a therapeutic intervention is desired, a person may be asked to put a collar on a dog and attach a leash prior to walking. Furthermore, if speech goals are desired, a person may be asked to give oral commands and praise to an animal or asked to recall information verbally (i.e. name, age, breed) (Millhouse-Flourie, 2004). Animals can also be used as full-time service animals, whereby they are individually trained to work or perform tasks for the benefit of a person with a disability. These tasks usually involve guiding, altering, responding, providing muscle work (e.g. pulling wheelchair, or providing balance and support. When animals are used in ATT or as service animals, they must be carefully trained, selected, and certified in order to ensure the safety of the participants (Connor, 2000; Millhouse-Flourie, 2004; Nimer, 2007; Sockalingam, 2008; Stanley-Hermanns, 2002). If an animal cannot become certified, possibly because they did not complete training, they can still be helpful companions to those with disabilities. (Bachi, 2012; Brodie, 1999; Connor, 2000; Gruenewald, 2004; McConnell, 2002; Millhouse-Flourie, 2004; Sable, 2012; Stanley-Hermanns, 2002; Roberto, 2002).

Humans have had a long, evolutionary history with dogs, and canine behavior is easily predicted and modified by humans (Connor, 2000; Sockalingam, 2008; Stanley-Hermanns, 2002; Roberto, 2002). Cats, rabbits, birds, fish, rodents, and reptiles have also been used in therapy sessions, but their behaviors may be a less predictable and/or controllable (Roberto, 2002). Domestic livestock and even dolphins have been used in therapeutic settings (Macauley, 2006; Bachi, 2012).

Each species carries its own distinct limitations. For example, cats tend to be highly allergenic, birds frequently carry zoonotic disease, and reptiles inspire fear in many people (Connor, 2000; Stanley-Hermanns, 2002). There is a shortage of data regarding the use of domestic livestock in therapeutic settings, in part because of the greater risks associated with interacting with larger animals (Berget, 2008; Bachi, 2012; Yorke, 2008).

Although horses have been used extensively in therapy, there is also a shortage of information regarding the efficacy of specifically equine assisted activities and psychotherapy. Working with horses is expensive, potentially dangerous, and requires special training, making these kinds of studies difficult (Bachi, 2012). This lack of adequate data is partly why equine activities, and animal activities in general, are not universally accepted (Kaiser, 2004; Sable, 2012; Vidrine, 2002). In spite of abundant anecdotal and qualitative data, a more evidence-based approach is necessary to establish the efficacy of equine therapies (Aetna, Inc., 2009; Aetna, Inc., 2016; Bachi, 2012; Brandt, 2013; Kendall, 2015; Lentini, 2015; Millhouse-Flourie, 2004; Pauw, 2000; Sable, 2012; Vidrine, 2002; Yorke, 2013). In particular, the tools and techniques of conducting studies in riding stables and barns needs further development, with adequate controlling for bias and confounding variables.

#### **1.5.1.3. The Full Spectrum of Equine-Assisted Therapies**

Equine assisted activities and therapy are believed to exert a beneficial effect by teaching the patient how to manage a dangerous situation through communication and partnership. Horses are large and unpredictable, their size eliciting respect and fear, possibly paralleling the parent-infant relationship (Brandt, 2013; Christian, 2005; Schultz, 2007; Vidrine, 2002). The size of a

horse can help a person focus on their surroundings and establish boundaries of personal space (Christian, 2005; Ewing, 2007; Porter-Wenzlaff, 2007; Vidrine, 2002). Productive confrontation of this fear is thought to teach valuable skills (Lentini, 2015).

Many find that facing the challenge of working with horses boosts confidence, cognition and empathy. Horse care, management, riding, and grooming seem to improve memory, responsibility, and confidence (Christian, 2005; Vidrine, 2002), while developing focus (Bass, 2009; Lanning, 2014). Performing these tasks develops body-awareness, socialization, empathy, and a proper use of power and control (Ewing, 2007). Working with horses appears to provide the same physiological benefits as working with other animals, such as decreased stress, blood pressure, and heart rate (Farias-Tomaszewski, 2001).

The bond that develops between a horse and a human can help develop multiple skills that are often lacking in individuals with behavioral or mental health disorders (Brandt, 2013). Horses and humans form strong, productive relationships. Indeed, relationships with a horse are similar to those with other people, with feelings of mutual trust, affection, responsibility, and compassion (Brandt, 2013; Ewing, 2007). Similar to other animals, horses are viewed as giving unconditional, positive regard and non-judgmental acceptance (Brandt, 2013; Brodie, 1999; Connor, 2000; Kaiser, 2004; Lefkowitz, 2005; Millhouse-Flourie, 2004; Roberto, 2002). Consequently, it can be easier to open up to a horse than to a human, especially for someone who feels apprehensive or disconnected from society (Cantin, 2017; Lefkowitz, 2005; Vidrine, 2002). Horses are also generally viewed as unashamed “hairy beasts” which nevertheless form bonds unique among human-animal relationships (Lefkowitz, 2005; Vidrine, 2002). By fulfilling socialization and acceptance needs, a relationship with a horse may decrease loneliness, depression, hostility, and aggression (Benda, 2000; Bizub, 2003; Ewing, 2007; Farias-

Tomaszewski, 2001; Lanning, 2014; Millhouse-Flourie, 2004; Rothe, 2005; Vidrine, 2002).

Furthermore, success in building a relationship with a horse increases a person's confidence and feelings of acceptance. These skills can then show how to build relationships (Burgon, 2003; Lefkowitz, 2005; Porter-Wenzlaff, 2007), and help forge a working alliance between the therapist and the patient (Lefkowitz, 2005; Missel, 2001; Roberto, 2002; Yorke, 2008).

In equine-assisted activities and therapies, individuals can be more willing to open up to the therapist, thereby fostering the alliance that is essential for a positive outcome (Lefkowitz, 2005; Yorke, 2008). People feel more safe, relaxed, and calm while interacting with or petting a relaxed animal (Brodie, 1999; Connor, 2000; Millhouse-Flourie, 2004; Roberto, 2002; Sable, 2012) and need not be aware that a therapy session is occurring in order to receive its benefits (Macauley, 2004). In addition, a calm horse, because of its size, may make a therapist seem less threatening. Equine therapy can also facilitate communication with the therapist without eye-contact, if the horse is placed between the patient and the therapist (Ewing, 2007; Klontz, 2007; Vidrine, 2002). Thus, the animal helps focus the mind of the patient on something outside of themselves (Brodie, 1999; Connor, 2000; Millhouse-Flourie, 2004; Roberto, 2002) and can make them more willing to open up to the therapist (Brandt, 2013; Lefkowitz, 2005; Missel, 2001; Roberto, 2002). Equine interactions are further facilitated by the intrinsic bond that many feel for horses (Bachi, 2012; Lefkowitz, 2005; Missel, 2001; Roberto, 2002). Horses can thus interact with a patient in ways that a therapist cannot.

In addition, horse riding adds a unique dimension to equine therapies and activities (Brandt, 2013; Millhouse-Flourie, 2004; Porter-Wenzlaff, 2007; Vidrine, 2002; Yorke, 2008). Riding a horse requires mutual trust and awareness while making use of verbal and non-verbal communication (Brandt, 2004; Brandt, 2013; Vidrine, 2002; Yorke, 2008). In addition, the close

physical contact builds body identity and self-control (Vidrine, 2002; Yorke 2008). Such integration of mind and body can then be incorporated into equine therapy sessions (Bachi, 2012; Bizub, 2003; Millhouse-Flourie, 2004; PATH Intl., 2011; Porter-Wenzlaff, 2007). Recovery from a disorder with multidimensional effects, like autonomic dysfunction, can be hastened by such integration (Bizub, 2003; Millhouse-Flourie, 2004; Porter-Wenzlaff, 2007).

Because horses are prey animals, they can reveal subtle features of the environment as well as a patient's behavior. The natural history of horses has caused them to be hyper-vigilant in order to detect predators (Brandt, 2013; Klontz, 2007; Porter-Wenzlaff, 2007; Vidrine, 2002). They have a highly developed "fight-flight" response, often showing exaggerated startle responses similar to individuals with PTSD. Horses will generally show an innate impulse to escape when they feel frightened or threatened. This underlying impulse to flee and the constant state of hyper-arousal, invoke many of the same emotions that patients may feel (Klontz, 2007; Porter-Wenzlaff, 2007; Vidrine, 2002).

Horses are extremely sensitive to changes in the behavior of their herd mates, which alerts them to potential threats. This sensitivity extends into their relationships with humans, in which a horse's response reflects what a person is feeling about their situation and the environment (Porter-Wenzlaff, 2007). Horses are said to provide an unbiased mirror of a person's physical and emotional states during interspecies interactions (Brandt, 2013; Klontz, 2007; Porter-Wenzlaff, 2007; Rothe, 2005; Schultz, 2007; Vidrine, 2002). Because much of horse-human communication is non-verbal (Brandt, 2013; Dalenberg, 2000; Rothschild, 2004; Sable, 2012), horses can detect subtle cues in body language and are highly sensitive to human

reactions (Ghorban, 2013). In working with horses, humans develop a heightened awareness about non-verbal language expressed through movement, posture, etc., and can develop a keen awareness of the signals they transmit to horses (Brandt, 2004).

In addition to being sensitive, horses are also highly expressive. Indeed, humans and horses communicate with one another through symbolic expressions of the body and through vocalization. The theory of symbolic interaction describes the body as a means of expression in human-horse relationships. Interactions become relationships when both parties can communicate feelings and desires (Brandt, 2004). Horses indeed appear to express a wide range of emotions. For example, the ears of a horse can convey whether or not a horse is relaxed, curious, scared, angry, or listening. Tension in the body can signal fear and anxiety, while a swishing tail can indicate agitation or physical discomfort. Humans who work closely with horses need to recognize the emotions that horses are expressing (Brandt, 2004). Conversely, horses are excellent at reading human body language, and will constantly assess if they can trust people near them. Thus, people, in turn, need to be mindful of what their body language is signaling to a horse when working with one.

If a person is behaving nervously, aggressively, or curiosity, a horse may reflect those emotions and display those same behaviors. Thus, working with horses can help people begin to recognize themselves (Brandt, 2013; Porter-Wenzlaff, 2007). However, dissociative or inconsistent behavior can be confusing to a horse, which makes a horse feel threatened and scared. Such responses may be invoked in therapeutic settings, and can help people become more aware of their behaviors, helping them build a sense of self-awareness and conscientiousness (Brandt, 2013; Vidrine, 2002). Through their interactions with horses, people can also learn to be present in the moment, and learn to be honest, direct, and congruent in their



communication. Horses will not respond positively unless a person is perceived as trustworthy, i.e. one whose behavioral signals match subsequent actions (Bachi, 2012). Miscommunication and mixed messages will only confuse horses and potentially scare them into responding dangerously. Developing a sense of physical awareness is critical in communicating with horses, and in maintaining the safety of both parties (Brandt, 2004; Yorke, 2008). When a person learns how to modify their own behavior, it will help them work with a horse, and ultimately with other people (Porter-Wenzlaff, 2007).

Work with horses in a therapeutic session requires a degree of balance in the partnership (Porter-Wenzlaff, 2007). As much as possible, the communication requires give and take, with neither party dictating to each other (Brandt, 2004). Because horses need to trust the people with whom they work, horses reward and respond favorably to authentic communication where behavioral cues faithfully predict subsequent actions (Lentini, 2015). Similarly, if a patient proceeds honestly in a relaxed manner, the horses will be more likely to do so. Many people with autonomic dysfunctions have difficulties with speech and language, and may rely on non-verbal communication (Axelrod, 2006; Millhouse-Flourie, 2004; Newschaffer, 2005; Rice, 2009). Many survivors of trauma and individuals with autism spectrum disorders may have an enhanced dependence on non-verbal communication, and can strengthen these skills by achieving an even-handed relationship with a horse (Anckarsater, 2006; Vidrine, 2002). Thus, horse and patient can interact in ways to which each can relate (Klontz, 2007; Porter-Wenzlaff, 2007; Rothe, 2005; Schultz, 2007; Vidrine, 2002).

A heavy power imbalance between horse and patient may not be helpful. If the person has too much control, the horse may respond aggressively. If the horse has too much power, it may take advantage of the situation and could literally walk over the patient. Thus, a patient must

learn to develop with the horse a balanced relationship which can be transformed into a working alliance (Porter-Wenzlaff, 2007; Yorke, 2008). In this work, patients can learn both how to take more control, but also how to give-up control. This experience can then assist the patient in social relationships. Patients will, in turn, will become more confident, capable, and caring (Ewing, 2007; Lefkowitz, 2005; Vidrine, 2002).

Equine-assisted activities and therapies (EAAT ) is a collective term describing two areas of equine-assisted interventions: equine-assisted activities (EAA) and equine-assisted therapies (EAT) (Gabriels, 2012). When the term EAA is used, it refers to horseback riding, vaulting, carriage driving, and non-riding activities with a horse such as grooming etc. In contrast, EAT is used specifically for equine assisted psychotherapy and hippotherapy (Lanning, 2014). Hippotherapy is a physical, occupational, or speech therapy treatment strategy that employs the physical movement of the horse to aid in the treatment of an individual with neurological, physical, or other disabilities (Aetna, Inc., 2016; Bachi, 2012; Lanning, 2014). Most research in the field of EAAT focuses on its physical applications, with more limited research regarding its mental, emotional, and social components (Bachi, 2012; Bizub, 2003; Burgon, 2003; Kaiser, 2004).

In EAT a certified or licensed therapist is included who may not be a horse professional (Christian, 2005; Klontz, 2007; Millhouse-Flourie, 2004; Schultz, 2007). In addition, an equine professional must be present for all equine sessions. Sometimes the general therapist can double as the horse professional if they have the proper credentials. Some organizations require the horse professional to be certified as such (Aetna, Inc., 2016; Bachi, 2012; All, 1999; Christian, 2005; Gabriels, 2012; Klontz, 2007; Millhouse-Flourie, 2004; Schultz, 2007). A certified horse professional can help utilize the movement of the horse for the utmost benefit of the client

(Gabriels, 2012). The certified professional must be qualified to teach riding skills related to the pursuit of educational, therapeutic, sport, and leisure goals (Gabriels, 2012; Yorke, 2008).

Assistants are usually positioned with one on each side to help reposition and stabilize the rider. More able-bodied riders may be able to ride more independently, while more severely disabled riders may require a back/accompanying rider (Aetna, Inc., 2016). Equine-assisted therapy may not be appropriate for some individuals because of safety concerns (Bachi, 2012). Severely intellectually disabled or violent children may not benefit from equine-assisted therapy (Ewing, 2007; Lentini, 2015).

Because the safety of the participants, including the horses, is of utmost concern, carefully selected and trained horses are required for equine therapy sessions (All, 1999; Christian, 2005; Klontz, 2007; Schultz, 2007). Above all, horses should be comfortable working with people. The horses are allowed to respond to how a person is treating them, even if it is somewhat aggressively, to help build social skills and empathy. In responding, the horses should not over-react or become unmanageable (Christian, 2005). The equine professional should intervene in a situation that could harm a participant or a co-therapist.

Equine assisted psychotherapy interventions are aimed at addressing issues of self-esteem, anxiety, depression, etc (Bachi, 2012; Brandt, 2013; Cantin, 2017; Lentini, 2015; Yorke, 2008). Objectives include developing life skills involving communication, assertiveness, problem solving, etc (Bachi, 2012; Lentini, 2015; Rothe, 2005; Yorke, 2008). These sessions involve feeding, grooming, ground-handling, and light work including interactive play. Riding may be included. Grooming and ground activities, such as lunging, are more often included in equine-psychotherapy sessions than in hippotherapy sessions, which are generally based on riding) (Ewing, 2007; Lentini, 2015; Rothe, 2005). Abundant anecdotal and qualitative evidence

suggests that equine-assisted activities and therapies improve quality of life (Bachi, 2012; Lanning, 2014; Lentini, 2015; Millhouse-Flourie, 2004; Rothe, 2005). Postulated reasons for these effects include active involvement, visible modeling, immediacy of responses, bonding, skill practice, metaphor, encouragement and success (Lentini, 2015).

Hippotherapy, the physical side of EAT, is aimed at improving the physical, occupational, or speech function through the dynamic and rhythmic physical movements of the horse (Aetna, Inc., 2016; Bachi, 2012; Millhouse-Flourie, 2004; Vidrine, 2002). The therapeutic interventions are conducted on a horse or a riding machine that mimics horse's motion (Bass, 2009; Farias-Tomaszewski, 2001, Vidrine, 2002). The movement of a horse can improve strength, posture, balance, coordination, range of motion, motor development, and mobility (Aetna, Inc., 2016; Bachi, 2012; Bass, 2009; Farias-Tomaszewski, 2001, Vidrine, 2002). Ground work with horses can also be used therapeutically. Grooming and routine care of horses can improve range of motion and flexibility (Borzo, 2002; Lentini, 2015). Horses can also be used for support and to assist with balance from the ground (Lentini, 2015).

Riding a horse provides a unique opportunity for neuromuscular stimulation (Benda, 2000; Borzo, 2002; Millhouse-Flourie, 2004). The smooth and rhythmic motion of the horse's body mimics aspects of walking by mobilizing the pelvis, lumbar spine, and hip joints, thus helping to rebuild the muscles, balance, and strength for ambulation (Borzo, 2002; Millhouse-Flourie, 2004). In addition, deep muscles that are not accessible in conventional physical therapies are also stretched and strengthened. The shifting of gravity enhances the righting and balance and improves trunk stability, posture, and strength (Millhouse-Flourie, 2004). Various exercises, such as mounting and dismounting, stretching, rotating, sitting the trot, riding without stirrups, etc., achieve physical and occupational benefits (Lincoln, 2010). The therapist can also

place the rider in various positions on the horse for balance and stretching exercises (Aetna, Inc., 2016; Lentini, 2015). Closing the eyes can be used to increase body awareness as part of relaxation exercises (Lentini, 2015). In equine-assisted therapies, exercises on and off the horse can focus on speech, behavior, sensory modulation, and social-emotional responsiveness skills. Specific therapeutic strategies vary per individual (Gabriels, 2012).

The rural setting where equine assisted therapy takes place provides a multisensory, enriching environment that can stimulate learning, enthusiasm, motivation, and social engagement (Bass, 2009; Lentini, 2015; Yorke, 2013). First, the natural, open-air environment of a horseback riding facility can provide a beneficial, physical activity that boosts confidence (Benda, 2000; Millhouse-Flourie, 2004). In addition, patients may enjoy outdoor sessions more than indoor talk-therapy sessions, and be more willing to participate and return (Brandt, 2013; Lefkowitz, 2005; Lentini, 2015). Bio-ecological theory follows the belief that there is a reciprocal, evolving interaction between an individual and their environment that contributes to that individual's ongoing development and contributes to their optimum health (Yorke, 2013).

Additionally, therapy sessions that are conducted with horses are also usually more enjoyable than conventional therapy (Lefkowitz, 2005; Lentini, 2015; Macauley, 2006; Millhouse-Flourie, 2004; Parshall, 2003), leading to improved motivation and enthusiasm (Bass, 2009; Lentini, 2015; Millhouse-Flourie, 2004). It is believed that horses lower defense systems, challenge old behaviors, and help develop insight and perspectives in ways that conventional therapies do not (Cantin, 2017). A horse facility, often offering routine lessons, also normalizes equine therapy activities, making them more acceptable or motivating to participants (Bachi, 2012; Bizub, 2003; Cantin, 2017). Equine-assisted activities and therapies can be great sources of enjoyment, self-confidence, and normalcy for participants (Lemke, 2014).

Some express skepticism regarding the use of horses in a therapeutic setting, due to the lack of quantitative evidence, confusion about terminology, and the size of horses (Aetna, Inc., 2016; Bachi, 2012; Lentini, 2015; Millhouse-Flourie, 2004).

However, it has long been documented that there are many benefits to equine assisted therapies/activities and therapeutic riding. Since the seventeenth century, horses have been used to help with neurological disorders and low morale. They have also been used to help with orthopedic dysfunctions, such as scoliosis (Lanning, 2014; Willis, 1997). Equine-assisted activities and therapies have also aided in the treatment of many different physical, behavioral, and mental health disorders (Brandt, 2013; Cantin, 2017, Millhouse-Flourie, 2004). These have included, but are not limited to, developmental disorders, neuromuscular disabilities, cerebral palsy, Down syndrome, developmental delays, traumatic brain injuries, and other disorders related to autonomic dysfunctions (Millhouse-Flourie, 2004).

Research has supported the positive influences of equine-assisted activities and therapies in many behavioral categories and areas of general functioning, including improvements in the Children's Global Assessment of Functioning scores. Equine-assisted activities and therapies have been used in the treatment approach for a variety of behavioral, mental, and physical health issues (Bachi, 2012; Cantin, 2017; Lanning, 2014; Schultz, 2007). In mental health settings, there is a great deal of qualitative and anecdotal evidence suggesting the benefits of animal-assisted therapies and equine-assisted activities and therapies, particularly in the rehabilitation of those suffering from emotional, as well as physical, impairments (Aetna, Inc., 2016; Bachi, 2012; Kaiser, 2004; Vidrine, 2002; Yorke, 2013). Recently, more claims in the literature are supporting the anecdotal evidence that animal-assisted therapies can be beneficial to many different people (Parshall, 2003). The same is true of equine-assisted therapies in mental health

settings as well. In modern literature, there is a lack of quantitative evidence, despite the strong and plentiful subjective anecdotal evidence, regarding the effectiveness of horses, and other farm animals, in therapeutic activities. Nevertheless, it is still widely believed that horses can be particularly excellent co-therapists (Aetna, Inc., 2016; Bachi, 2012; Berget, 2008; Ewing, 2007; Nilson, 2004; Pauw, 2000).

Numerous organizations certify practitioners in Equine Assisted Activities and Therapy. Each organization has its own method of certification and theoretical background. The Equine Assisted Growth and Learning Association (EAGALA) and the Professional Association of Therapeutic Horsemanship International (PATH-International), formerly the North American Riding for the Handicapped Association (NARHA), are two major organizations of equine therapies which certify practitioners (Brandt, 2013; Lentini, 2015; Porter-Wenzlaff, 2007). The OK Corral, and EPONA, facilitated equine experiential learning (FEEL), trauma-focused equine-assisted psychotherapy (TF-EAP), human-equine alliances for learning (HEAL), Gestalt equine therapy (GET), the HorseCourse, and The Equine Experiential Education Association (E3A) are other prominent organizations which certify practitioners in equine assisted activities and therapies. The Certification Board for Equine Interaction Professionals (CBEIP) and the Equine Guided Education Association (EGEA) also provide credentialing, membership, and standards of competency (Lentini, 2015). However, there is no educational requirement or license needed to conduct equine therapy and some people say that they practice equine therapy without any training or certification at all (Lentini, 2015).

PATH is a non-profit, international, credentialing organization. PATH prefers the term “equine-facilitated psychotherapy” and it emphasizes the role of the horse within the therapeutic process, acknowledging equine-facilitated psychotherapy as the foremost psychotherapy.

Mounted and unmounted equine activities are incorporated into therapy sessions that are conducted by qualified mental health and equine professionals (or a mental health professional trained and certified to work with horses in a therapeutic setting) (Brandt, 2013; PATH, 2018). PATH accredits centers and certifies instructors and equine specialists, as well as offers a variety of educational resources and a yearly international conference (PATH, 2018).

### **1.6. Ethical Principles in Equine-Assisted Therapies**

When using horses in therapy, psychologists need to follow ethical principles. According to the American Psychological Association's Ethical Code of Conduct (2002), psychologists shall not practice, provide services, teach, or conduct research with populations outside their boundaries of competence. These boundaries are determined by education, training, supervised experience, consultation, study, or professional experience (American Psychological Association, 2002; PATH Intl., 2011). The skills, education, expertise, and experience of a psychologist should be accurately represented in order to competently serve the client (PATH Intl., 2011).

Equine activities therefore need to be taught by knowledgeable and skilled instructors. There are different requirements and ethical codes within each type of EAT. Generally, a licensed, credentialed mental health professional works with an appropriately credentialed equine professional. Practitioners should obtain the necessary training and certification if they intend to practice equine assisted therapy. They should also reveal any significant limitation in their experience or skill, allowing the patient to make an informed decision (PATH Intl., 2011; Small, 2011). There are various ways to develop and maintain the required competence to



conduct EAT (PATH Intl., 2011). This includes literature review, continuing education seminars, etc. (American Psychological Association, 2002; PATH Intl., 2011). It would be considered inexcusable to provide an alternative form of care without adequate competence (American Psychological Association, 2002).

Psychologists must obtain informed consent from their client prior to commencing EAT. The client needs to be aware of the goals, expectations, risks, and confidentiality safeguards, especially since EAT is an alternative form of therapy. They should understand the environment in which therapeutic sessions will take place, such as if it is outside during inclement weather or in an unheated barn. Informed consent is especially important when other parties that are participating or playing a role in delivering the therapy may have access to confidential information (Giorgini, 2015). All reputable Equine-assisted therapy organizations, such as PATH and EAGALA, have their own strictly enforced codes of conduct to ensure safety, confidentiality, and professionalism (Bachi, 2012). These will also cover appropriate delegation of authority by the psychologist to other professionals (American Psychological Association, 2002; PATH Intl., 2011). Often insurance companies will not provide full financial coverage. Services and personnel should be represented accurately prior to initiation of treatment (PATH Intl., 2011).

Safety of the client is of utmost importance (American Psychological Association, 2002; PATH Intl., 2011). Psychologists and clients need to be aware, prior to commencing therapy, of possible safety concerns in working with horses and take proper precautions to protect all involved. In particular, clients need to be aware of and understand the sensitive nature of

physical touch and use it with caution. For example, touch may be necessary when helping a client mount or dismount a horse, or to secure balance once mounted. Touch should be used appropriately and only performed with permission of the client or guardian (PATH Intl., 2011).

In a therapeutic setting, horse use is governed by strict codes of practice, horses being selected, cared for, and maintained to the highest possible standards. Horses may be owned, leased, or borrowed. When an animal is used in therapy, psychologists need to make sure that they abide by federal, state, and local laws, regulations, and professional standards in how they acquire, care for, use, and discharge the animal after use (American Psychological Association, 2002; PATH Intl., 2011). The equine professional must supervise all procedures involving horses and must train others appropriately. Care should be taken to design therapies according to the temperament, needs and physical limitations of the available horses. Therapeutic procedures should provide the minimum of discomfort and stress, the horses being rewarded for their efforts by being made comfortable, secure and safe at all times.

Appropriate levels of comfort, health, and humane treatment of the animals must be provided, including adequate socialization, play, turnout, and time off (American Psychological Association, 2002; PATH Intl., 2011). In addition, the retirement needs of the horses must be respected (PATH Intl., 2011). Preventative medicine, veterinary care, including euthanasia if necessary, must conform to the APA Ethical Code of Conduct and its subsection for the human care and use of animals in research (American Psychological Association, 2002). It is the duty of the therapy-provider to negotiate and clarify fee structures and payment policies prior to the initiation of services.

## **1.7. Posttraumatic Stress Disorder and Equine-Assisted Therapies**

Equine-assisted activities, like other animal therapies, shows promise as a treatment for those suffering from PTSD (Brandt, 2013; Cantin, 2017; Lefkowitz, 2005). Mental illness is viewed more positively through contact with other people with mental illnesses, and equine activities are well suited to groups of veterans sharing experiences and challenges (Gould, 2007). Because equine-assisted therapy sessions are conducted at stables (Bachi, 2012; Bizub, 2003; Cantin, 2017), these new outdoor surroundings can make the sessions more enjoyable than conventional talk therapies indoors (Lefkowitz, 2005). Routine activities and lessons taking place at the same facility as EAT can normalize the therapy activity, often making it more acceptable in the minds of the participants (Bizub, 2003; Lefkowitz, 2005).

Interestingly, the state of hyper-vigilance exhibited by horses, with their heightened startle response, is similar to that experienced by patients with PTSD. Horses will generally show an innate impulse to escape when they feel frightened or threatened. These underlying impulses to flee, coupled with the constant state of hyper-arousal, are similar to feelings of sensitivity and vulnerability to which many trauma survivors can relate (Klontz, 2007; Porter-Wenzlaff, 2007; Vidrine, 2002). It is believed that horses can unlock fears, stimulate powerful thoughts and feelings, and give a sense of acceptance, while shifting feelings of detachment and numbing (Cantin, 2017).

Many trauma survivors can also directly relate to the enhanced dependence on non-verbal communication that horses exhibit (Vidrine, 2002). From their own experiences they keenly observe body signals and can quickly determine the attentiveness and emotional status of those

around them (Dalenberg, 2000; Rothschild, 2004). For example, through the subconscious movement of the listener's body, trauma survivors can tell when a listener has become overly stressed from hearing their experiences (Pearlman, 1995; Rothschild, 2004).

However, such refusal by a listening partner can reinforce the feeling that their experiences are abnormal and unbearable (Pearlman, 1995). This might reinforce that they are incompetent because they are unable to adequately handle stress in their life (Foa, 1992). Consequently, this state of hyper-arousal, and fear of communication, can lead to increased isolation, with many survivors choosing not to discuss stressful issues for fear of losing friends (Dalenberg, 2000; Rothschild, 2004). However, EAT can address this situation through the horse helping to forge a relationship between the survivor and therapist. Skills learned in developing these relationships can help forge relationships with others, and achieve social acceptance (Burgon, 2003; Porter-Wenzlaff, 2007).

As described in section 1.3.4, conventional therapies for PTSD often include some form of medical management in conjunction with psychological therapies (Bradley, 2005; Monson, 2006). The most effective psychological therapies involve cognitive-behavioral and prolonged exposure techniques (Lefkowitz, 2005; Seal, 2010; Tan, 2011; van Etten, 1998). Equine assisted activities and therapies are well suited to treat the many forms of PTSD, due to the many activities they offer (Millhouse-Flourie, 2004). There are many possible kinds of traumatic experiences that an individual may encounter, and each individual may respond differently to each of them. (Kessler, 1995; Mahan, 2012; Stein, 1997). Horses can offer a variety of mounted and un-mounted activities to target specific dysfunctions (Lincoln, 2010; Porter-Wenzlaff, 2007; Vidrine, 2002; Yorke, 2008). Targeted and individualized programs in therapy tend to be more beneficial than standardized programs (Millhouse-Flourie, 2004; Taylor, 2007).

## **1.8. Autism Spectrum Disorders and Equine-Assisted Therapies**

Equine-assisted activities and therapies may prove to be an extremely beneficial alternative form of therapy for autism spectrum disorders (Bachi, 2012; Bass, 2009; Brandt, 2013; Gabriels, 2012; Lanning, 2014; Lentini, 2015). It is believed that equine-assisted activities and therapies can improve quality of life and yield positive behavioral changes in children with an autism spectrum disorder (Lanning, 2014; Lentini, 2015). There has also been some evidence that children with an autism spectrum disorder that participated in an equine-assisted activity or therapy have shown marked improvements in physical, emotional, and social functioning, while those that participated in a non-equine program improved to a lesser extent. This finding has lent support to the utilization of equine-assisted activities and therapies in the treatment of children with an autism spectrum disorder (Bachi, 2012; Lanning, 2014). In children with autism spectrum disorder, social interactions, externalization of problems, avoidant behaviors, and parent-child interactions have appeared to improve following equine interventions (Lentini, 2015).

Individuals with autism spectrum disorders appear able to relate to the non-verbal communication that horses provide (Anckarsater, 2006; Vidrine, 2002). Thus, horses can interact in a way that an autistic individual may be able to understand (Klontz, 2007; Porter-Wenzlaff, 2007; Rothe, 2005; Schultz, 2007; Vidrine, 2002). Because horses use a wide variety of non-verbal communication methods, they can greatly help a child on the autism spectrum to learn and practice communication and social skills in a safe, non-judgmental environment (Bass, 2009). Furthermore, a person with an autism spectrum disorder may also lack emotional reciprocity and prefer solitary activities (American Psychiatric Association, 2000; Newschaffer, 2005; Rice, 2009). Horses may be able to open up new lines of communication with such individuals. Some

have found that autistic children have improved their use of language and became more socially interactive when an animal was incorporated into their therapy (Bachi, 2012; Ghorban, 2013). This could be from learning to verbally control and direct a horse or from learning to follow a trainer's commands while riding (Ghorban, 2013). Additionally, a person with autism can learn how to regulate their emotions and behaviors through those working with a horse (Gabriels, 2012; Lanning, 2014; Vidrine, 2002).

Autism spectrum disorders are also characterized by a variety of motor skill impairments (American Psychiatric Association, 2000; Bass, 2009). Restricted and repetitive patterns actions are characteristic symptoms of autism, and may impair everyday activity (American Psychiatric Association, 2013a; American Psychiatric Association, 2013b; Anckarsater, 2006; Wing, 2010). Equine therapies can provide an opportunity for structured physical activities to counteract repetitive behaviors (American Psychiatric Association, 2000; Bass, 2009).

People with autism spectrum disorders also typically exhibit low sensory and affective arousal levels. Equine-assisted activities offer a multisensory environment with distinct sounds, smells, sights, and touch (Bass, 2009; Millhouse-Flourie, 2004; Redefor, 1989). Horses can be demanding, persistent, and can motivate a person to act (Bass, 2009). Similarly, the outdoor environment of equine-assisted activities and therapies provides an abundance of a sensory stimulation (Ghorban, 2013; Lefkowitz, 2005). This powerful environment can help increase motivation, enthusiasm, and social engagement in children with autism spectrum disorders (Bachi, 2012; Bass, 2009; Ghorban, 2013; Lanning, 2014; Lentini, 2015).

Autism spectrum disorder, similar to PTSD, varies from individual to individual (Butter, 2003; Lanning, 2014). Luckily, equine-assisted activities and therapies are multi-dimensional and complement other therapies (Lanning, 2014; Millhouse-Flourie, 2004) and can be

individualized to target specific dysfunctions (Lincoln, 2010). Horses can be used to engage physical, emotional, cognitive, social, and behavioral issues according to the needs of the child (All, 1999; Benda, 2000; Farias-Tomaszewski, 2001; Ghorban, 2013; Lanning, 2014; Lentini, 2015; Millhouse-Flourie, 2004; Vidrine, 2002). Thus, equine-assisted activities and therapies appear to have great potential for treatment of individuals with autism spectrum disorders (Bachi, 2012; Bass, 2009; Gabriels, 2012; Ghorban, 2013; Lanning, 2014).

### **1.9. Equine-Assisted Therapies and Insurance Coverage**

Quantitative data regarding the effectiveness of equine-assisted activities and/or therapies is critically lacking. Most of the data is qualitative and anecdotal (Aetna, Inc., 2016; Bachi, 2012; Bass, 2009; Farias-Tomaszewski, 2001; Kendall, 2015; Pauw, 2000; Vidrine, 2002; Yorke, 2013). This has led many, especially the health insurance industry, to question whether or not equine therapies are actually effective (Aetna, Inc., 2009; Aetna, Inc., 2016). Nevertheless, health insurance companies are beginning to recognize equine therapies as a form of therapy. These companies may pay for the services provided by a mental health professional, depending upon the diagnosis. Often coverage will be incomplete (Bachi, 2012).

Despite a great deal of anecdotal evidence that supports reductions in symptoms and improved psychological well-being following EAT (Bass, 2009; Farias-Tomaszewski, 2001; Gabriels, 2012; Kendall, 2015; Lentini, 2015; Vidrine, 2002), much of the current literature does not provide enough solid evidence to definitively establish that equine-assisted interventions are effective (Kendall, 2015). Still, participants, parents of the participants, therapists, and even some experimenters have witnessed improvements (Aetna, Inc., 2016; Vidrine, 2002; Pauw, 2000; Yorke, 2008). There is a need for quantitative data that demonstrates the effectiveness of equine-assisted activities and therapies, especially for disorders like PTSD and autism spectrum

disorders (Aetna, Inc., 2016; Bass, 2009; Gabriels, 2012; Lanning, 2014; Lentini, 2015).

Anecdotal evidence alone is usually not sufficient to justify insurance reimbursement and severely reduces access to therapy (Aetna, Inc., 2009; Aetna, Inc., 2016; Anthem, Inc., 2009).

A major hurdle is that insurance companies consider equine-assisted activities and therapies, including hippotherapy, as experimental. These companies note that there is insufficient data in peer-reviewed medical literature to support the effectiveness of equine-assisted therapies (Aetna, Inc., 2016). Specific diseases identified in Aetna Incorporated's 2016 insurance policy as lacking sufficient data to justify coverage of equine-assisted therapies include post-traumatic stress disorder and autism spectrum disorders. Coverage of a therapy or treatment usually requires quantitative evidence from peer-reviewed literature that has been confirmed in multiple studies (Aetna, Inc., 2009; Aetna, Inc., 2016; Anthem, Inc., 2009).

More information regarding insurance coverage and equine-assisted therapies can be found in Hofmann (2010): *An Experimental Design for Insurance Approved Equine-Assisted Therapies for Veterans with Post-Traumatic Stress Disorder*.

### **1.9.1. Research Limitations and Challenges**

Equine-assisted activities and therapies are widely used, but more data comparing the efficacy of equine-assisted activities and therapies versus other clinical treatments is needed (Aetna, Inc., 2016). Inconsistent results across various studies and the documented feelings of staff, participants, and families further complicate this matter (Bachi, 2012). Small sample sizes, lack of proper control groups, and inconsistent methodologies are some of the key problems that research in this field faces (Aetna, Inc., 2009; Aetna, Inc., 2016; Bachi, 2012; Brandt, 2013; Cantin, 2017). Studies concerning equine-assisted activities therapies with replication, adequate comparisons, and longitudinal components are sparse. Long-terms effects of equine-assisted



activities and therapies are largely unknown (Brandt, 2013; Ewing, 2007). Establishing methodologically rigorous studies has been difficult because research has often stemmed from the equine community, rather than an academic or clinical mental health community (Brandt, 2013). Improvements in methodologies could help provide solid evidence to show that equine-assisted activities and therapies are effective (Bachi, 2012; Lentini, 2015). These needed improvements would facilitate increased coverage by insurance companies (Aetna, Inc., 2016).

There is a lack of consensus regarding the appropriate methods for an equine therapy intervention and/or evaluation, (Bachi, 2012; Brandt, 2013; Lentini, 2015). For example, it is unclear if more and longer therapeutic interventions yield better results, which subgroups would be best served, and which specific forms of equine therapies would be most beneficial to the identified subgroups (Aetna, 2009; Lentini, 2015). Researchers need to be more specific in their treatment protocols, with regards to types, intensity, duration, and definitions (Bachi, 2012; Lentini, 2015; Pauw, 2000; Wilson, 2003). Terminology also needs to be more consistent with clearly defined methodologies. This will help make generalizations, replications, and comparisons easier (Aetna, Inc., 2009; Wilson, 2003). Clear outlines and methodologies are essential for the comparison of studies and for future replication (Aetna, Inc., 2016; Pauw, 2000). A great deal of the available literature is scattered and repetitive and does not build or expand upon existing publications (Brandt, 2013).

More objective data will move the field towards the statistical validation of equine-assisted therapies (Lentini, 2015). Physiological measures, such as biofeedback, neurofeedback, cortisol samples, blood samples, heart rate variability, skin conductance level, brain wave activity, and/or neurotransmitter uptake can provide statistically analyzable data (Lentini, 2015).

Another suggestion would be the employment of a methodology that is more reflective of the “real world.” Recently researchers have been advocating for a more “real world” approach in their projects (Möller, 2011). Properly collected survey data can yield data that is more reflective of the “real world,” and thus more representative of its sample and more generalizable to the general population (Kelley, 2003).

A regularly referenced criticism of all human-animal interactions/therapies is that they lack control groups (Aetna, Inc., 2016; Bachi, 2012; Pauw, 2000). This is partially due to animal-assisted activities and therapies are rarely being a stand-alone therapeutic technique (Aetna, Inc., 2016; Millhouse-Flourie, 2004; Nilson, 2004; Nimer, 2007). It becomes difficult to reliably separate confounding variables introduced by other therapies which can obscure the effects of the equine interventions (Aetna, Inc., 2009; Brandt, 2013; Pauw, 2000). It has also been called into question whether human relationships and the stimulating outdoor environment in EAT account for the observed improvements more than the horse (Pauw, 2000). Isolating treatment effects and identifying the roles of specific confounding variables, such as the environment and co-occurring treatments, is time consuming and expensive and has not been thoroughly explored (Brandt, 2013).

Randomized controls and selection of subjects is preferred, but not always feasible. (Lentini, 2015; Wilson, 2003). There is merit to the utilization of nonrandomized approaches with systematic reviews (Paulus, 2014). Larger sample sizes will help to balance some issues with randomization. It becomes extremely difficult to draw any sort of valid conclusions from studies with small sample sizes (Aetna, Inc., 2009; Aetna, Inc., 2016; Anthem, Inc., 2009; Bachi, 2012; Lentini, 2015; Pauw, 2000; Wilson, 2003).

Longitudinal comparisons with comparisons to a wait-list could be a way to show the effectiveness of equine therapies. However, most of the current literature lacks proper, rigorous follow-up measures that could demonstrate any long-term effects of the human-horse connection (Aetna, Inc., 2009; Aetna, Inc., 2016; Lentini, 2015; Wilson, 2003). Most current studies utilize present review and waitlist controls, but are not randomized and have subjective outcome measures. Standardized measures with a sample population greater than 10 have shown more meaningful results (Lentini, 2015)

## **CHAPTER 2**

### **EARLY PROJECT DEVELOPMENT AND PRELIMINARY STUDIES**

The overall goal of this study was to assess the efficacy of equine assisted psychotherapy (EAP) in a clinical setting. During the planning phase it was initially decided to study EAP's effect on a population of veterans undergoing treatment for PTSD. Due to logistical difficulties, described below, this approach shifted to the study of EAP's effect on children with autism spectrum disorders. In either case, the overall hypotheses were similar.

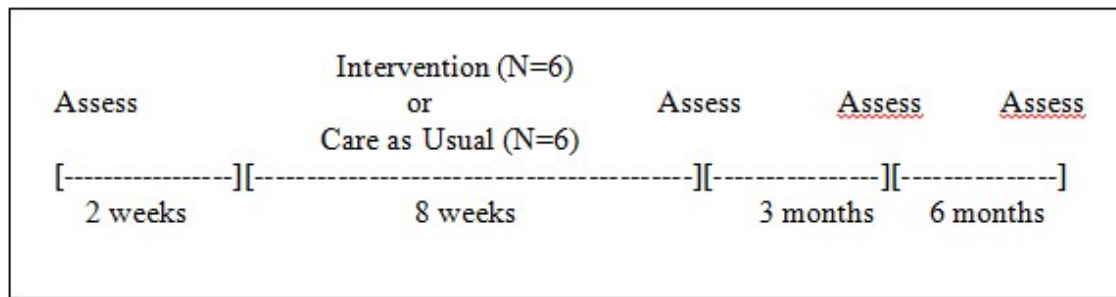
#### **2.1. Hypotheses of the study**

It was hypothesized that equine-assisted psychotherapy is an effective form of therapy for people suffering anxiety related disorders, including PTSD and autism spectrum disorders. Specifically, it was hypothesized that EAP would improve social and communication skills. It was intended to test these hypotheses using quantitative methods.

#### **2.2. Initial Experimental Design – Treatment of PTSD in Veterans**

The original design of this study involved assessment of an equine intervention in veterans receiving treatment for PTSD. Subjects were to be recruited at the Togus Veterans Administration Medical Center mental health clinics, community-based outpatient clinics (CBOCs), veterans' centers, and veterans' associations in Maine. Participants, once selected, were to be assigned to one of two groups: (1) care as usual or (2) a therapeutic equine-activity group (Hofmann, 2010; Petzel, 2009). The study was to take place over a year with one pre-intervention and three post-intervention patient assessments, with an equine intervention of 8-week duration (Hofmann, 2010; Petzel, 2009). The proposed timeline is outlined in Figure 2.1.

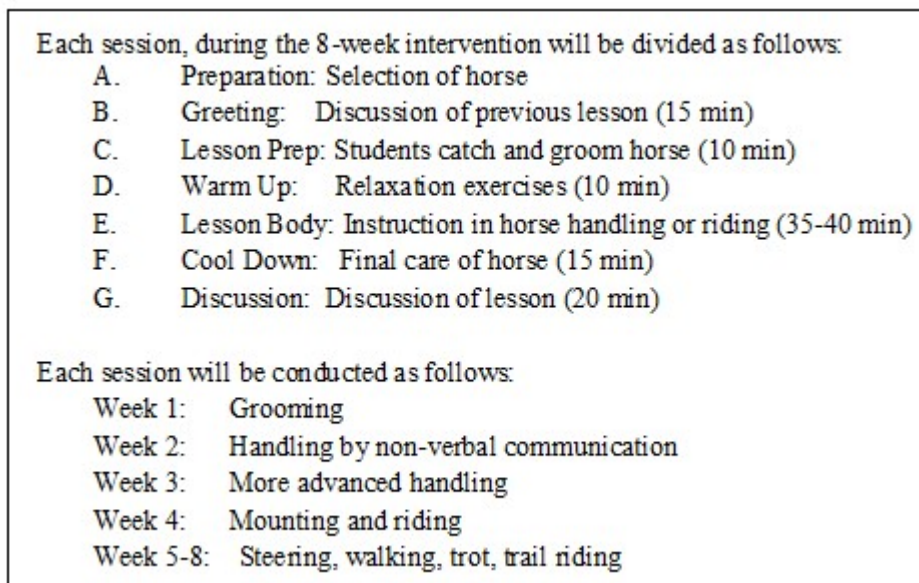
Figure 2.1. Timeline of the first proposed experimental design.



(Hofmann, 2010; Petzel, 2009)

Each week within the intervention period was to have one equine session at a previously selected Maine riding center. Each week was to have different goals, as outlined by the experimenters and equine-instructor, building upon each previous lesson (Hofmann, 2010; Petzel, 2009). The format for the 8-week intervention period is outlined in Figure 2.2.

Figure 2.2. Proposed intervention schedule of the first experimental design.



(Hofmann, 2010; Petzel, 2009)

The initial assessments were to include psychiatric interviews and biological evaluations of cortisol and single nucleotide polymorphisms linked to autism. The equine sessions would be conducted at a farm, under the instruction of a PATH certified riding instructor. Follow-up assessments would take place after the equine intervention, and at 3-months and 6-months following the intervention period. Follow-up assessments would also include a psychiatric interview and biological evaluations. Appropriate assistants would be used when necessary (Hofmann, 2010; Petzel, 2009).

This study design addressed many of the experimental problems stated by insurance companies (Hofmann, 2010; Petzel, 2009). However, the Togus Veteran's Administration Hospital with which the researchers at the University of Maine were to partner became unable to join in collaboration. Consequently, a different experimental approach was developed.

### **2.3. Second Experimental Design – Assessment of Autism using the Autism Spectrum Quotient**

Although the study design described above focused on the effects of equine assisted psychotherapy and PTSD, autism spectrum disorders are becoming increasingly prevalent, with many people searching for alternative treatments for autism. Therefore, when it became impossible to examine the effects of equine assisted psychotherapy in a population of veterans, the focus of the study shifted to the effects of equine assisted psychotherapy on autism spectrum disorders in children.

A preliminary trial was therefore conducted at a Therapeutic Riding Facility (Riding to the Top, Windham, ME) which provided equine assisted activities and psychotherapy for children with a variety of disorders, including autism spectrum disorders. No existing protocols at the farm were altered, the farm having questionnaires already in place. A short questionnaire

regarding prior riding experience was added, which was completed by parents whose children were enrolled at the facility. The participating farm typically ran 5-6 sessions a year. Most of the people enrolled were under 18, and most had autism spectrum disorders. It was decided to use a questionnaire validated in the literature, with questions regarding social skills, attention switching, attention to detail, communication, and imagination. All physiological measures were removed from this design of the project.

The Autism Spectrum Quotient (AQ)-Children's Version, designed by Bonnie Auyeung and Simon Baron-Cohen (Auyeung, 2008; Baron-Cohen, 2006; Woodbury-Smith, 2005) was the questionnaire used by the researchers in this experimental design. The AQ questionnaire was used solely by the researchers – and was not a questionnaire routinely used 'Riding to the Top.' The AQ questionnaire is a parent-report questionnaire intended to quantitatively measure traits associated with the autism spectrum. Adapted from the AQ-Adult Version, scores for individuals with an autism spectrum condition have been shown to be significantly higher than those sampled from the general population. There is also an adolescent version of the questionnaire. The AQ-Adult and AQ-Adolescent questionnaires are divided into five different domains of autistic traits: social skills, attention to detail, attention switching, communication, and imagination. Each domain is assessed by 10 questions with a Likert scale response (definitely agree, slightly agree, slightly disagree, and definitely disagree). These questionnaires have demonstrated good internal consistency. The same format has been incorporated into the children's version of the questionnaire (Auyeung, 2008).

In the development of the AQ-Children's Version, the questionnaire has been tested in a sample of the general population as well as in children with autism spectrum disorders, and has been validated for the detection of autistic characteristics (Auyeung, 2008). Analyses showed

that using a cut-off score of 76 for autism-characteristics has a sensitivity of 95% and specificity of 95% in the AQ-Children's Version. Studies also show high levels of internal consistency (Auyeung, 2008). The questionnaire can also be useful in the detection of autistic characteristics at younger ages and allows age comparisons using the other, age-specific, questionnaires (Auyeung, 2008).

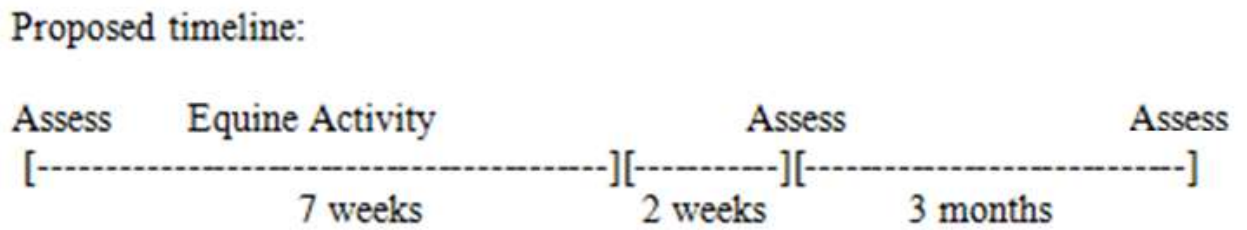
The AQ-Children's Version is a 50-pt questionnaire completed by parents. There are 10 questions per 5 domains. Questions are given in a 4-pt Likert scale where 0 represents "definitely agree," 1 represents "slightly agree," 2 for "slightly disagree," and 3 for "definitely disagree." In order to avoid response bias, questions were worded to produce approximately equal agree/disagree responses. The range of scores in the AQ-Children's Version is 0-150. The total AQ score represents the sum of all scores (Auyeung, 2008).

As part of this preliminary study design, additional questions were used to determine some general horse experience/riding information about the child. Most of the families in the preliminary study had children that had been riding for at least one year to four years. To be enrolled children needed to be 4-11 years old and have a professional diagnosis of high functioning autism and Asperger Syndrome based on the AQ-child questionnaire. The age of the child therefore was required information, along with a physical mailing address, in order to be able to send a follow-up questionnaire. Names were not required.

No protocols were altered at the therapeutic riding center. The initial assessment was given at the beginning of the intervention which lasted 7 weeks and included one lesson per week. Follow up assessment was conducted two weeks after the conclusion of the intervention and once more after an additional 3 months. The data from different participants at the same facility were compared. The timeline for the design of this study is outlined in Figure 2.3.



Figure 2.3. Timeline of second proposed experimental design



During the course of visiting the farm and collecting data for this design, only 20 questionnaires were distributed to parents with children that met the criteria for the study. While 15 people completed initial questionnaires, only three completed all the follow ups. These follow-ups were always mailed with previously-addressed and stamped envelopes for return, with multiple reminders for each follow-up being sent.

Results of the 3 patients are shown in Table 2.1. A score of 76 on the AQ-Child is the cut-off for autism (Auyeung, 2008). All three of the subjects whose parents filled out questionnaires were diagnosed with Pervasive Developmental Disorder – Not Otherwise Specified with the DSM-IV.

Table 2.1. Preliminary data from the second proposed experimental design.			
Time	Participant 1	Participant 2	Participant 3
Pre-intervention	77	75	77
2 weeks post intervention	74	78	81
15 weeks post intervention	80	72	88

No statistical analysis was conducted due to low sample size. However, in reviewing the results it was noted that the AQ-child questionnaire, which is designed for the diagnosis of autism, might not be suitable for this kind of study. Equine assisted psychotherapy would not be expected to cure autism, i.e. reverse the diagnosis, but might be expected to alleviate clinical signs such as those related to socialization and anxiety. It was therefore decided, in the following study, to use questionnaires which more specifically addressed communication, socialization, and anxiety.

## **CHAPTER 3**

### **EVALUATION OF SOCIALIZATION AND ANXIETY IN CHILDREN ON MULTIPLE FARMS RECEIVING EQUINE-ASSISTED PSYCHOTHERAPY**

It was decided to test the efficacy of Equine Assisted Psychotherapy employing a consistent methodology on multiple facilities, in order to improve sample size and power of studies in this field. While there are published meta-analyses that compare studies, including studies conducted at separate farms (Cantin, 2011; Stergiou, 2017; Wang 2014), it is rare for one study to extend across multiple facilities. Because there is great variation in therapeutic practices between facilities, studies involving multiple farms may have difficulty in achieving statistical power. This variation might be reduced if facilities use the same questionnaires and procedures.

An important goal of this project, therefore, was to utilize quantitative data. Most studies in the field of equine-assisted activities and therapies research employ qualitative and anecdotal evidence (Bachi, 2012; Bass, 2009; Burgon, 2003; Farias-Tomaszewski, 2001; Hofmann, 2010; Lanning, 2014; Vidrine, 2002). While qualitative data has some merit, insurance companies make decisions based on quantitative evidence from peer-reviewed medical literature (Aetna, Inc., 2009; Anthem, Inc., 2009; Hofmann, 2010). To achieve an element of quantitative analysis without physiological sampling, the present study employed standardized and validated questionnaires that employed quantitative scoring. Although previous project designs had included quantitative assessment of hormones (e.g. salivary cortisol), such analyses were dropped in the present study due to logistics and the potentially negative effect on the children of sample collection. Physiological sampling such as heart rate monitoring, or salivary cortisol, would be useful in future studies (Hofmann, 2010; Yorke, 2013).

In the present study, two numeric questionnaires were employed to test the hypothesis that Equine Assisted Psychotherapy is of benefit to children with autism spectrum disorders. First, the CARS 2 was selected to specifically address socialization and communication skills. Second, the Children's Sleep Habits Questionnaire was included to evaluate the physiological benefits/stress reducing aspects of equine-assisted activities and therapies. Because sleep might be disturbed if anxiety is high, it was felt that sleep patterns may provide an assessment of stress, anxiety, and the HPA axis.

### **3.1 Materials and Methods**

Due to the difficulty in obtaining 3-months follow-up assessments, only pre and immediately post intervention assessments were performed. It was also noted that the previously employed AQ-Child questionnaire had focused on many characteristics that would always be present in participants with an autism diagnosis. Consequently, the CARS-2 Questionnaire for Parents and Caregivers, and an abbreviated version of the Children's Sleep Habits Questionnaire, were employed in this study. These questionnaires were specifically selected to assess improvement in social communication skills (CARS-2), and to assess changes in the hypothalamic-pituitary-adrenal (HPA) axis through sleep behavior.

The CARS-2 questionnaire has 36 scaled-response questions, as well as some open-ended questions. The CARS-2 questionnaire focuses on communication, emotion, motion, play, and senses of the body, and routines. The scale extends from "not a problem/does very well"; "mild to moderate problem/sometimes a problem"; "severe problem/often or always a problem"; "not a problem now, but was in the past"; to "don't know." These were scored as 1, 2, 3, 4, and 5 respectively.

The Children's Sleep Habits Questionnaire, written by Dr. Judith Owens, (used with permission), is a 22-question scaled-response survey for parents regarding the sleep patterns of their child. The scale extends from "7/Always," "5-6/Usually," "2-4/Sometimes," "1/Rarely," "0/Never".

Additional questions, not covered by the CARS-2 or Children's Sleep Habits Questionnaire, were asked to obtain demographic information, such as age, diagnosis, and riding/horse experience. They also included subjective questions to reveal feelings about previous therapy, the expected benefit of the upcoming therapy, whether the equine therapy helped the child, and if the child enjoyed the treatment. These subjective questions involved 4 scaled questions specifically addressing expectations and perceived effect of the intervention. The wording of the answer choices was made similar in the pre and post-assessment questions to simplify analysis. These questions were:

*How would you rate your child's therapeutic experience thus far?* (pre-assessment)

*How beneficial do you think your child's therapeutic riding experience will be?* (pre-assessment)

These questions were scored on a 4-point Likert scale as follows:

1. Not helpful
2. Slightly helpful
3. Very helpful
4. Extremely helpful

The follow-up questionnaire asked the following questions, whose wordings was slightly different, but nevertheless comparable to the other questions:

*How beneficial do you think your child's therapeutic riding experience was?* (post-assessment)

*How much did your child enjoy the experience?* (post assessment)

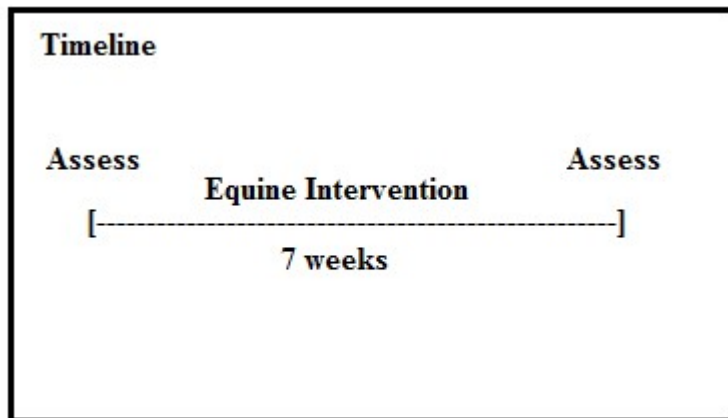
These questions were also scored on a 4-point Likert scale:

1. No enjoyment
2. Enjoyed slightly
3. Enjoyed very much
4. Enjoyed extremely

The researchers also provided a questionnaire for the executive director of each farm to determine if there were any differences between facilities (Facility Questionnaire). All questionnaires are provided in the Appendices.

The questionnaire packet was provided in person by the principle investigator (PI) at an initial meeting, or mailed if a participant or PI could not schedule a meeting. Participants could take the questionnaire packet home with a stamped-addressed envelope. Initial questionnaires requested a mailing address so that the follow-up portion of the questionnaire could be mailed back. The same questionnaire was mailed as a follow-up assessment after a 7-week period of riding. The timeline of the study is outlined in Figure 3.1.

Figure 3.1. Timeline of the experimental design



In order to be included in this study, participating farms, as well as instructors, had to be certified with PATH International (PATH Intl.), a federally registered, non-profit organization that promotes and conducts equine-assisted activities and therapies. During the 7-weeks in between questionnaires, the goals of each rider were integrated into specific horsemanship and riding activities. Most of the enrolled children participated in mounted activities with horses, where the movements of the horse were used to help address physical/motor-skill limitations. In all lessons, educational and developmental goals, specific to each rider, were incorporated with farm and riding experiences. The activities with the horses focused on the development of life skills such as memory, trust, respect, and communication.

### **3.1.1. Data collection**

Contact information for potential farms was obtained from the PATH Intl. website and directory for certified centers within the United States. Facilities were contacted if they were at a university (regardless of location), if they were in the Mid-Atlantic region, or if they were referred to by another facility director.

The executive directors at each farm sent an email to all parents whose children would be participating in an upcoming riding session to inform them of the study and to invite them to participate. Families were required to have freely given their contact information to the executive director of the riding facilities. The principle investigator did not contact families without permission, although some families contacted the researcher directly. Although the study was intended to focus on children with autism spectrum disorders, anyone who wanted to fill out a questionnaire could participate. Participation was voluntary and the study had no impact on services provided to the riders.

The PI visited each responding farm at least once to discuss the project with prospective participant. At these visits, 5-10 families were met and given an initial questionnaire if they accepted the participation requirements. Families could fill out the questionnaire and give it back in person immediately or mail it back at a later date with a stamped return-envelope. Due to traveling distance only one in-person visit per farm was feasible, thus some families would have been missed if they only attended one riding session per week. 15 additional questionnaires were left at each farm to be distributed to additional families that wished to participate.

The study was reviewed after a year and a half. As a result of the review a \$25 Amazon gift card was offered as an incentive to participants to complete initial and follow-up questionnaires.

### **3.1.2. Data Analysis**

The CARS-2 questionnaire had 36 scaled questions and the Children's Sleep Habits Questionnaire had 22 scaled questions. Within each questionnaire, participants could select a number on a scale relating to the severity of particular issues/behaviors in question. Initial and final questionnaires were compared within individuals to determine percent improvement,



percent with no change, and percent decline, both per individual and per question in each questionnaire. The percent improvement was also determined in individuals with a diagnosis of autism spectrum disorders, and in those with little experience of horse riding or equine assisted psychotherapy.

The CARS-2 responses were transformed to provide a range from best to worst. Scores 1, 2 and 3 (“not a problem/does very well”; “mild to moderate problem/sometimes a problem”; “severe problem/often or always a problem”) conformed to a scale from best to worse and were left unchanged. A score of 4 (“not a problem now, but was in the past”), which nevertheless represented a desired outcome, was converted to a 1, because it could not be reliably distinguished from a 1 without further investigation. A score of 5 (“don’t know”) was analyzed as missing data and not used.

The sleep habits questionnaire extended along a linear scale ranging from “0/Never” to “7/Always”. However, in spite of having 7 points, the scale had only five categories (“0/Never,” “1/Rarely,” “2-4/Sometimes,” “5-6/Usually,” and “7/Always”). For this reason, it was scored as 1 to 5 in calculations. Questions were scored with a “B” (Better) for improvement or “W” (Worse) for worsening. Although a linear scale in which lower values were desirable in most questions, in some questions the higher score represented a preferred outcome. Specifically, in Questions 1, 2, 3, 10, and 19, higher scores were desirable and scored with a “G” (Good) for improvement or an “L” (Less) for worsening while all other questions, in which lower values were preferred. These distinctions were retained in the data tables so one would know when the interpretation of scale was reversed. If no response was given in one or both questionnaires, then a score of “no change” or “0” was given for that participant for that question.

In cases where two responses were given for the same question, the numbers (after being transformed) were averaged. Analyses were conducted with the help of an additional, blinded, scorer to prevent bias. For each question with pre and post responses, the difference between pre and post was recorded as being the “Same,” “Better,” or “Worse”.

For the four subjective questions asked, the following datasets were created from the responses, based on whether or not participants completed the study.

From participants **who completed the study**:

Responses to each question in sequence of ascending participant identification number were stored as numeric vectors designated  $a$  through  $d$  as follows:

$a$  = Responses to: *How would you rate your child's therapeutic experience thus far?*

$b$  = Responses to: *How beneficial do you think your child's therapeutic riding experience will be?*

$c$  = Responses to: *How much did your child enjoy the experience?*

$d$  = Responses to: *How beneficial do you think your child's therapeutic riding experience was?*

From participants **who did not complete study** (i.e. did not complete follow up questionnaire):

Responses were stored as numeric vectors designated  $e$  and  $f$  as follows

$e$  = Responses to: *How would you rate your therapeutic experience thus far?*

$f$  = Responses to: *How beneficial do you think your child's therapeutic riding experience will be?*

From **all participants**:

Additional vectors representing all participants were created by joining vectors  $a$  to  $e$ , and vectors  $b$  to  $f$  and were designated  $a,e$  and  $b,f$  as follows:

$a,e$  = Combined responses to: *How would you rate your therapeutic experience thus far?*

$b,f$  = Combined responses to: *How beneficial do you think your child's therapeutic riding experience will be?*

Based on this dataset, the following estimates were then made of feelings about previous therapy, the expected benefit of the upcoming therapy, whether the equine therapy helped the child, and if the child enjoyed the treatment.

### ***1. Feelings about previous therapy***

- Estimated as mean of vector  $a$  for participants who completed the study and vector  $e$  for those who did not.

- Difference between those completing both questionnaires *versus* those who complete just the initial estimated as (mean of  $a$  - mean of  $e$ ).

### ***2. Expected benefit of upcoming therapy***

- Estimated as mean of vector  $b$  for participants who completed the study and vector  $f$  for those who did not.

- Difference between those completing both questionnaires *versus* those who complete just one estimated as (mean of  $b$  - mean of  $f$ )

- Difference between how much benefit is expected *versus* previous therapy estimated as means of  $(b - a)$ ,  $(f - e)$ ; and  $(b,f) - (a,e)$

**3. Feelings about whether the therapy helped the child** – estimated as a mean of  $d$

- Difference between benefit of equine therapy *versus* previous therapy estimated as mean of  $d - a$ .

- Difference between benefit of equine therapy *versus* expectations estimated as mean of  $d - b$ .

- Difference between benefit of equine therapy *versus* child's enjoyment estimated as mean of  $d - c$

**4. Child's enjoyment of received experience** - estimated as a mean of  $c$

-Difference between child's enjoyment *versus* feelings about previous therapy estimated as mean of  $c - a$ .

- Difference between child's enjoyment *versus* expected benefit of therapy estimated as a mean of  $c - b$ .

The aforementioned approach is summarized in the results section in Figure 3.3. All comparisons which involved paired data *within* participants were evaluated using a paired t test. In the case of the comparison *between* participants who did and did not complete the study (mean of  $a$  - mean of  $e$ ) and (mean of  $b$  - mean of  $f$ ) the data were not paired and therefore an unpaired t test was performed.

## **3.2 Results**

### **3.2.1 Response rate**

A total of 140 farms from 15 states were invited to participate this study. The locations of these farms were: Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Pennsylvania, Ohio, New York, New Jersey, Maryland, Delaware, Texas, North Dakota, Alaska, and Wisconsin.

Of the farms contacted, 53 responded. Most farms expressed interest and support for this type of research, but several declined participation. Reasons for not participating included: a newly certified center and with no current lessons; an active program, but of insufficient size to participate; already or recently conducting research at the facility; only offering mental health services for adults; riders did not match the targeted population; privacy policy specifying no involvement of families in research projects; lack of interest expressed by families; and scheduling conflicts.

Overall, 16 farms participated in the study by filling out a Facility Questionnaire and received an in - person visit from the PI. These farms were in Maine, Pennsylvania, New York, New Jersey, and Maryland. Of these 16 farms, 11 had participants that filled out at least an initial questionnaire. Of these, only 8 farms had participants that completed follow-up questionnaires. Obtaining responses from farms was challenging, in spite of frequent requests by email or phone from the PI.

Overall, 43 initial questionnaires were returned. Of these, 16 had an associated follow-up questionnaire, meeting the complete criteria for the project. Raw data on each of these 43 subjects can be viewed in the Appendix of this document.

The children/riders were already entered in a therapeutic riding intervention program at their individual riding facilities. Some children were new to equine therapies, while some children had been around horses for months to years. Some farms were larger than others, however the demographics of the farm populations could not be determined due to privacy restrictions.

Existing protocols at the riding facilities were not altered, save for the parents filling out the required questionnaires. The children were not interviewed, although their riding sessions

were sometimes observed. No adverse events or unanticipated problems, involving risks to subjects or others, occurred during the study. There were no complaints received about the design of the research that was conducted. Voluntary withdrawals (failure to complete a follow up questionnaire) were expected due to the follow-up design of the study.

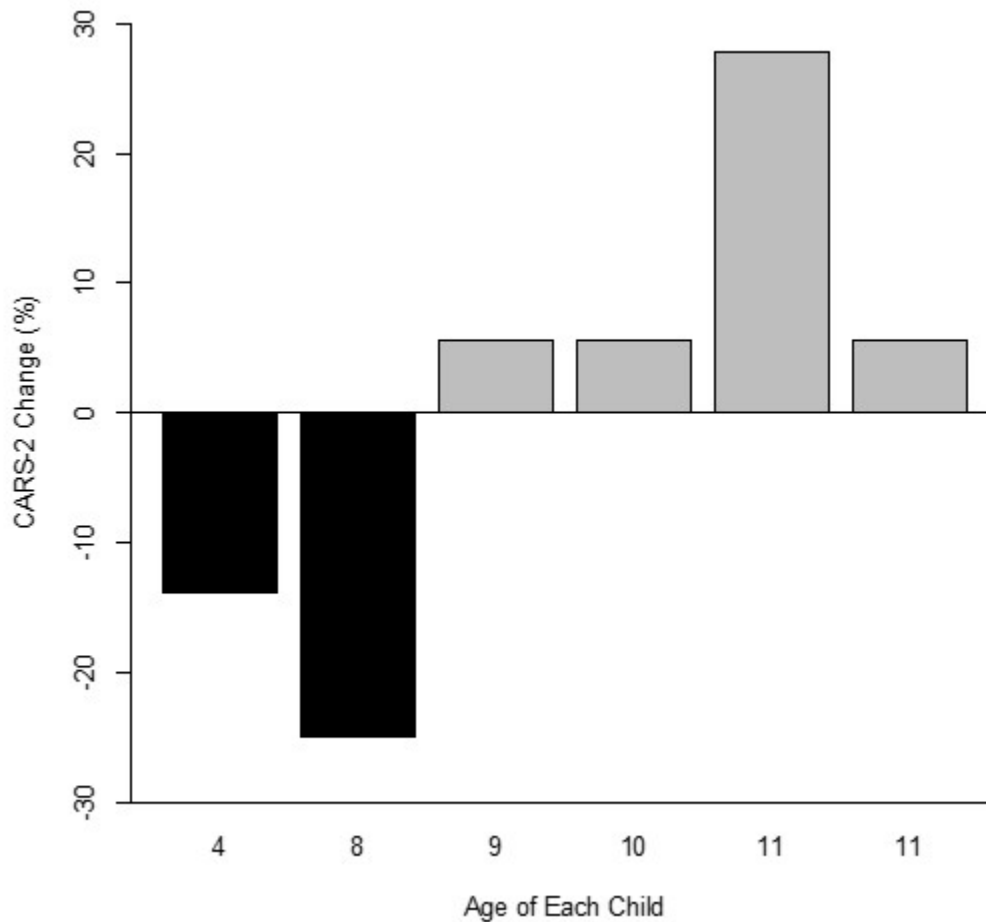
### **3.2.2. CARS-2 Responses**

Key demographic data and summary of responses to the CARS-2 and Children's Sleep Habits questionnaire are shown in Table 3.1. When inspected according to age, gender, prior experience, farm, or diagnosis no strong trends in the data could be discerned with respect to these variables for the data set. However, when restricted to the 6 patients with an autism diagnosis (including one child with Asperger's syndrome), a possible age effect was noticed in that improvements were only seen in children 9 years of age or greater. Although 3 individuals from farm 7 showed improvements in the CARS-2 reports, this was not sufficient to make statistically valid conclusions (Figure 3.2).

Table 3.1. Demographic information and percent change in CARS-2 and Children's Sleep Habits Questionnaires for participants who completed the study							
ID	Farm	Gender	Age Years	Duration of prior equine therapy	Change CARS-2	Change Sleep-Habits	Diagnosis
02	2	M	4	1 month	-13.9 %	13.6%	Autism, Global Delay
03	2	M	18	7 years	5.6%	0.0%	Physically/Cognitively delayed (severe)
06	3	M	15	6 years	-12.9%	9.1%	Developmental disorder, Tourette's syndrome
07	3	M	9		6.5%	-18.2%	Autism
10	4	M	8*	13 months	-14.3%	15.0%	ADHD, Learning disability
14	5	F	6	2 years	8.6%	4.5%	Anxiety
20	6	F	29	N/A	-23.5%	-4.5%	Chromosomal abnormality 2q37
24	6	M	11	4 years	27.8%	-22.7%	Autism, PDD-NOS
26	7	M	11	N/A	5.7%	0.0%	Asperger, developmental coordination disorder
27	7	F	10	1 year	7.1%	-31.8%	Kabuki syndrome
28	7	F	9	2 years	-5.6%	-22.7%	ADHD/ODD
30	7	M	10	5 years	5.6%	4.5%	High functioning autism
33	8	M	15	4-5 years	-15.4%	-13.6%	Cerebral dysgenesis
34	8	M	8		-25%	13.6%	Autism
35	8	M	12		-27.8%	13.6%	Interstitial deletion 22
40	9	M	8	3 years	-8.3%	0.0%	Static motor encephalopathy,

\* = Twin

Figure 3.2. Change in CARS-2 in children ages 4 to 11 with an autism spectrum disorder or Asperger's Syndrome.



Shown here in Figure 3.2, black boxes indicate a negative change and grey boxes a positive change.

Out of the 16 participants that completed an initial and follow-up questionnaire, 12/16 selected “4’s” (“*not a problem now, but was in the past*”) on the CARS-2 (Table 3.2). These were transformed to a score of 1 for analysis. Also, 5/16 selected “5’s” (“*don’t know*”) which was counted as missing data (Table 3.3). One participant (# 14) recorded double scores which were averaged for subsequent analysis (Table 3.2).



Table 3.2. Instances of a “4” in participants who completed pre and post CARS-2 questionnaires.

Participant	Question		Scores <sup>a</sup>		Change
	1-40 <sup>b</sup>	S:Q <sup>c</sup>	Initial	Follow-up	
06	23	S3:4	4	2	Worse
07	3	S1:3	3	4	Better
	14	S2:4	3	4	Better
	17	S2:7	3	4	Better
10	1	S1:1	4	1	Same
	2	S1:2	4	3	Worse
	6	S1:6	1	4	Same
	13	S2:3	4	2	Worse
	24	S4:1	2	4	Better
14	9	S1:9	2	2, 4	Better
	10	S1:10	3	2, 4	Better
	17	S2:7	4	1,4	Same
	18	S2:8	4	1	Same
20	6	S1:6	4	1	Same
	10	S1:10	4	2	Worse
	24	S4:1	4	3	Worse
	30	S5:3	4	2	Worse
24	3	S1:3	4	2	Worse
	20	S3:1	4	1	Same
	24	S4:1	4	2	Worse
	33	S6:1	4	2	Worse
	34	S6:2	4	1	Same
	36	S6:4	4	1	Same
26	25	S4:2	4	1	Same
28	3	S1:3	4	1	Same
	5	S1:5	4	1	Same
	7	S1:7	4	2	Worse
	20	S3:1	4	1	Same
	24	S4:1	4	2	Worse
30	35	S6:3	1	4	Same
34	6	S1:6	1	4	Same
35	1	S1:1	4	1	Same
	2	S1:2	4	2	Worse
40	5	S1:5	4	1	Same

A coding of “4” indicates “not a problem now, but was in the past.” Change (better, same, or worse) determined after transforming “4” to “1”.

<sup>a</sup>1=Not a problem, does very well; 2=Mild to moderate problem; 3=Severe problem, or often/always a problem; 4=Not a problem now, but was in the past; 5=Don’t know

<sup>b</sup> Questions numbered consecutively from 1 to 40

<sup>c</sup> Questions as they appeared on questionnaire (by section, and question within section)

Table 3.3. Instances of a “5” in participants who completed pre and post CARS-2 questionnaires.					
Participant	Question		Scores <sup>a</sup>		Change
	1-40 <sup>b</sup>	S:Q <sup>c</sup>	Initial	Follow Up	
14	27	S4:4	1	5	NA
20	26	S4:3	1	5	NA
26	27	S4:4	5	1	NA
27	19	S2:9	5	3	NA
	26	S4:3	5	5	NA
	27	S4:4	5	5	NA
33	8	S1:8	N/A	5	NA
	25	S4:2	3	5	NA
	26	S4:3	5	5	NA
	27	S4:4	5	5	NA
	29	S5:2	5	5	NA
	30	S5:3	3	5	NA

A coding of “5” correlates with: “don’t know.” NA indicates that no assessment of change was performed or noted by participants.

<sup>a</sup>1=Not a problem, does very well; 2=Mild to moderate problem; 3=Severe problem, or often/always a problem; 4=Not a problem now, but was in the past; 5=Don’t know

<sup>b</sup> All questions numbered consecutively from 1 to 40

<sup>c</sup> Questions identified as on questionnaire (by section, and question within section).

Table 3.4 shows the results of the CARS-2 questionnaire for subjects that completed an initial and follow-up questionnaire. The table displays all outcomes (better, worse, or same) for each question which each participant answered, however responses to opened-ended questions are not shown. Of 16 participants, 8 answered all 36 questions. All participants completed at least 26 paired initial and follow-up questions on the questionnaires.

Table 3.4. Results of CARS-2 in all participants who completed pre and post questionnaires.

		Participant															
Question		02	03	06	07	10	14	20	24	26	27	28	30	33	34	35	40
S1:1	1	S	S	S	W	S	S	S	S	W	S	S	S	S	S	S	B
S1:2	2	B	W	S	W	W	S	S	S	S	W	S	S	S	S	W	S
S1:3	3	S	S	S	B	S	S	S	W	S	W	S	S	S	S	S	S
S1:4	4	S	S	S	S	S	B	S	S	S	B	S	S	W	S	W	W
S1:5	5	S	B	S	S	S	S	S	B	S	S	S	W	S	S	S	S
S1:6	6	S	S			S	S	S	S	W		S	S		S	W	S
S1:7	7	W	S			S	S	W	B	B		W	S		S	W	B
S1:8	8	S	B				S	S	B	S		S	S		S	S	S
S1:9	9	S	B			S	B	S	S	S		S	S		S	S	S
S1:10	10	S	S			S	B	W	B	S		W	S		S	S	S
S2:1	11	S	S	S	B	S	S	W	S	S	W	B	S	W	S	S	B
S2:2	12	W	S	S	S	S	S	S	B	S	W	B	S	W	S	S	S
S2:3	13	S	S	S	S	W	S	S	B	S	W	S	S	S	S	S	S
S2:4	14	S	S	S	B	B	S	S	B	B	W	B	S	S	S	S	S
S2:5	15	S	W	S	S	W	S	S	S	B	S	S	S	S	S	W	S
S2:6	16	S	S	W	S	S	W	W	S	S	W	S	S	S	W	W	W
S2:7	17	S	S	S	B	S	S	S	W	B	S	B	S	S	S	W	W
S2:8	18	S	S	S	W	S	S	S	S	S	S	B	S	S	S	W	B
S2:9	19	S	S	S	B	W	S	S	B	S		S	S	S	W	W	S
S3:1	20	W	B	S	W	S	S	S	S	S	S	S	S	S	S	B	S
S3:2	21	S	B	S	S	S	S	S	S	W	S	S	S	S	S	S	S
S3:3	22	S	S	W	S	S	S	S	S	S	B	S	S	S	W	S	S
S3:4	23	S	S	W	S	W	S		B	S	S	S	S	S	W	S	W
S4:1	24	S	S	S	W	B	S	W	W	S	B	W	S	S	S	S	S
S4:2	25	S	S	S	S	S	B	W	B	S	S	S	S		S	S	S
S4:3	26	S	S	S	S	S	S		B	S		S	S		W	W	S
S4:4	27	S	W	S	S	S		S	B			S	S		W	S	S
S5:1	28	W	S	S	W	S	S	S	S	S	S	B	B	S	S	W	W
S5:2	29	W	S	W	S	W	B	S	S	S	B	S	B		S	W	S
S5:3	30	S	S	B	S	S	W	W	S	S	B	S	S		S	S	W
S5:4	31	W	S	W	B	S	S	W	S	S	B	S	S	S	W	B	W
S5:5	32	W	B	S	B	W	S	S	B	B	B	W	S	W	W	S	S
S6:1	33	S	S	S	S	S	S	S	W	S	B	S	B	B	W	B	S
S6:2	34	B	S	S	S	S	S	S	S	S	S	S	B	S	S	W	S
S6:3	35	S	S	S	B	S	S	S	B	S	S	S	S	W	S	S	S
S6:4	36	S	W	S	S	S	S	S	S	S	B	S	W	S	S	S	S

Changes between initial and follow-up questionnaires are indicated by a Dark gray box (“B”) indicating Better; Light grey box (“W”) indicating Worse; and a White box (“S”) indicating “Same”. Black coloration indicates a missing data point, including instances of a “5”.

Results of Table 3.4, are summarized in Table 3.5. Overall, 9 out of 16 participants recorded a worsening of behavior, with an average change of -4.94%, indicating a slight worsening of behaviors.

Table 3.5. Summary of CARS-2 results shown in Table 3.4.																
	Participant															
	02	03	06	07	10	14	20	24	26	27	28	30	33	34	35	40
#Q	36	36	31	31	35	35	34	36	35	28	36	36	26	36	36	36
#B	2	6	1	8	2	5	0	14	5	9	6	4	1	0	3	4
#W	7	4	5	6	7	2	8	4	3	7	4	2	5	9	13	7
Diff	-5	2	-4	2	-5	3	-8	10	2	2	-2	2	-4	-9	-10	-3
%C	-13.9	5.6	-12.9	6.5	-14.3	8.6	-23.5	27.8	5.7	7.1	-5.6	5.6	-15.4	-25	-27.8	-8.3

Positive change indicates improvement, while negative change indicates worsening. Mean percent change is -4.94%.

#Q = number of times question was answered with scores of 1, 2, 3 or 4.

#B = number of times a subject improved

#W = number of times a subject worsened

Diff = arithmetic difference between #B and #W

%C = overall percent change as a factor of #Q ((Diff/#Q) X 100 %).

Of the 16 participants who completed initial and follow up questionnaires, 7 (participants 03, 07, 14, 24, 26, 27, and 30) observed overall improvements in their children, whereas 9 (participants 02, 06, 10, 20, 28, 33, 34, 35 and 40) observed overall worsening (Table 3.3 and 3.4). Improvements were seen in 2/4 females and 5/12 males. The individuals that showed the highest degree of negative change were subjects 20 (-23.5%), 34 (-25%), and subject 35 (-27.8%). These subjects did not share a diagnosis, although two came from farm 8. The individual with the highest degree of positive change, 24 (27.8%), shared a farm with subject 20 (farm 6). Subjects 24 and 34 both reported “autism” as at least one of their diagnoses. No difference between initial and follow-up responses could be concluded, though the trend in the data indicated a slight worsening following equine assisted psychotherapy.

Table 3.6 shows the individual CARS-2 results for the subset of riders with autism spectrum disorder or Asperger's syndrome that completed initial and follow-up questionnaires. Summarized data are presented in Table 3.7. The average percent change overall is a positive 1.117%. Although this is a positive change, this is not sufficient to draw any conclusions.

Table 3.6. Results of CARS-2 in participants with an autism spectrum diagnosis.

		Participant					
Question		02	07	24	26	30	34
S1:1	1	S	W	S	W	S	S
S1:2	2	B	W	S	S	S	S
S1:3	3	S	B	W	S	S	S
S1:4	4	S	S	S	S	S	S
S1:5	5	S	S	B	S	W	S
S1:6	6	S		S	W	S	S
S1:7	7	W		B	B	S	S
S1:8	8	S		B	S	S	S
S1:9	9	S		S	S	S	S
S1:10	10	S		B	S	S	S
S2:1	11	S	B	S	S	S	S
S2:2	12	W	S	B	S	S	S
S2:3	13	S	S	B	S	S	S
S2:4	14	S	B	B	B	S	S
S2:5	15	S	S	S	B	S	S
S2:6	16	S	S	S	S	S	W
S2:7	17	S	B	W	B	S	S
S2:8	18	S	W	S	S	S	S
S2:9	19	S	B	B	S	S	W
S3:1	20	W	W	S	S	S	S
S3:2	21	S	S	S	W	S	S
S3:3	22	S	S	S	S	S	W
S3:4	23	S	S	B	S	S	W
S4:1	24	S	W	W	S	S	S
S4:2	25	S	S	B	S	S	S
S4:3	26	S	S	B	S	S	W
S4:4	27	S	S	B		S	W
S5:1	28	W	W	S	S	B	S
S5:2	29	W	S	S	S	B	S
S5:3	30	S	S	S	S	S	S
S5:4	31	W	B	S	S	S	W
S5:5	32	W	B	B	B	S	W
S6:1	33	S	S	W	S	B	W
S6:2	34	B	S	S	S	B	S
S6:3	35	S	B	B	S	S	S
S6:4	36	S	S	S	S	W	S

Changes between initial and follow-up questionnaires are indicated by a dark gray box (B) indicating Better; light gray box (W) indicating Worse; and a white box (S) indicating Same. Black coloration indicates a missing data point, including instances of a 5.

Table 3.7. Summary of CARS-2 results in participants with an autism spectrum diagnosis shown in Table 3.6.

	Participant					
	02	07	24	26	30	34
#Q	36	31	36	35	36	36
#B	2	8	14	5	4	0
#W	7	6	4	3	2	9
Diff	-5	2	10	2	2	-9
%C	-13.9	6.5	27.8	5.7	5.6	-25

The mean percent change is +1.117%.

#Q = number of questions answered with scores 1, 2, 3, or 4.

#B = number of times a subject improved

#W = number of times a subject worsened

Diff = arithmetic difference between #B and #W

%C = overall percent change as a factor of #Q ((Diff/#Q) X 100 %).

In addition to the qualitative change recorded as overall Better, Same, or Worse, the quantitative change was calculated as the change in the total score-value of each individual (Table 3.8), and each question (Table 3.9) for CARS-2. Overall, the results do not indicate a high level of change. Most commonly, no change occurred between the initial and follow-up response. When a change did occur, it was most often a 1. A change of 2 (the highest degree recorded), rarely occurred.

Table 3.8. Score changes between initial and follow-up CARS-2 questionnaires for each participant

	Participants															
	02	03	06	07	10	14	20	24	26	27	28	30	33	34	35	40
SC	-6	3	-4	3	-5.5	4	-9	11	2	3	1.5	2	-6	-9	-10	-2
#Q	36	36	31	31	35	35	34	36	35	28	36	36	26	36	36	36
ASC	-0.17	0.08	-0.13	0.10	-0.16	0.11	-0.26	0.31	0.06	0.11	0.04	0.06	-0.23	-0.25	-0.28	-0.06

SC = Score value change for each individual

#Q = number of question answered with scores 1, 2, 3, or 4 (re-coded as a 1).

ASC = Average Score Change (SC / #Q)

Table 3.9 summarize responses to specific questions within the CARS-2 questionnaire by showing the average change in score-value for each question averaged over all the participants.

Table 3.9: Average score change per question in the CARS-2 questionnaire to show the average change for each question answered.					
Question			SC	#Q	ASC
S1:1	1	Imitates sounds, words, and movements of others.	-2	16	-0.125
S1:2	2	Responds to facial expressions, gestures, and different tones of voice used by others.	-6	16	-0.375
S1:3	3	Responds to his or her name being called by turning and making eye contact with the person calling his or her name.	0	16	0.0
S1:4	4	Directs facial expressions to others to show the emotions he or she is feeling.	-1	16	-0.063
S1:5	5	Uses a variety of gestures (pointing, nodding the head, showing the size of something) that are coordinated with words or used to explain things when he or she doesn't have words to do so.	1	16	0.063
S1:6	6	Uses made-up words or repeats specific words or phrases.	-2	12	-0.167
S1:7	7	Has an unusual tone, rhythm, loudness, or rate of speech.	-0.5	12	-0.042
S1:8	8	Speech is overly formal; for example, uses vocabulary that seems more sophisticated than usual for a person of his or her age or for the situation.	3	11	0.273
S1:9	9	Carries on a conversation with another person that flows back and forth, at a level you would expect for someone of his or her age.	1.5	12	0.125
S1:10	10	Can talk with another person about that person's interests.	0.5	12	0.042
S2:1	11	Makes eye contact when speaking or listening to another person.	-0.5	16	-0.031
S2:2	12	Points to and shares things of interest with others.	-1	16	-0.063
S2:3	13	Follows another person's gaze or points toward an object that is out of reach.	-1	16	-0.063
S2:4	14	Is responsive to social initiations from others.	5	16	0.313
S2:5	15	Initiates social interactions with adults and peers (not just to get a basic need met).	-2	16	-0.125
S2:6	16	Sustains an interaction with others in an easy, flowing, back-and-forth manner.	-7	16	-0.438
S2:7	17	Makes and maintains friendships with peers of same developmental level.	0.5	16	0.031
S2:8	18	Shows a range of emotional expressions that match the situation (for example, smiles, frowns, conveys different emotions through eyes and facial expressions, etc.).	0	16	0.0
S2:9	19	Understands and responds to how another person may be thinking or feeling (for example, tries to comfort someone in distress, does something because he or she thinks the other person will like it).	-0.5	15	-0.033
S3:1	20	Has unusual ways of moving fingers, hands, arms, legs; or spins or rocks body.	0	16	0.0
S3:2	21	Does things that might result in self-injury, like scratching, head banging, or picking at his or her skin, etc.	0	16	0.0
S3:3	22	Is clumsy, stumbles, or has an awkward walk or run.	-1	16	-0.063
S3:4	23	For school-aged children or adults: Has difficulty tying shoes or difficulty with handwriting or other tasks that require fine motor coordination.	-2.5	15	-0.167
S4:1	24	Uses only parts of toys instead of whole toys or plays with objects (e.g. opens and closes toy barn doors, spins wheels on cars, wobbles or spins household objects).	-3	16	-0.188
S4:2	25	Plays with the same things in the same way over and over.	2	15	0.133
S4:3	26	Uses toys or other materials to represent something they are not (e.g., uses a banana as a phone or microphone).	-2	13	-0.154
S4:4	27	Engages in make-believe play, taking on a role (not based on scripts from movies or TV shows).	-1	12	-0.083
S5:1	28	May show anxiety or worry in facial expression or body movement, or by becoming overly impatient.	-2.5	16	-0.156
S5:2	29	May show worry about the same thing over and over.	-1	15	-0.067



Table 3.9 continued

S5:3	30	Copes with changes in routine or the environment (for example, moving furniture).	-0.5	15	-0.033
S5:4	31	Has specific routines or specific ways things must be done by self or others.	-0.5	16	-0.031
S5:5	32	Has special interests or topics (for example, dinosaurs, trains, clocks, weather, or license plates, etc.).	-1	16	-0.063
S6:1	33	Tends to look at objects from unusual angles or out of the corner of his or her eyes.	2	16	0.125
S6:2	34	Is overly interested in light from mirrors or light reflecting off objects.	1	16	0.063
S6:3	35	Is overly sensitive to some sounds, smells, or textures; seeks some out, actively avoids others.	0	16	0.0
S6:4	36	Has an unusual response to touch; may overreact to touch or pain or may not respond to things that others would find uncomfortable or painful.	0	16	0.0

SC = Score change for each individual question

#Q = number of questions answered with scores 1, 2, 3, or 4 (re-coded as a 1)

ASC = Average Score Change (SC / #Q)

In addition, Table 3.10 shows the number of times a “Same,” “Better,” or “Worse” occurred per question set, in individuals that completed an initial and follow-up questionnaire.

Table 3.10. Number of times and percentage of no change, improvement, or worsening (same, better, worse) for each question of the CARS-2 for which initial and follow-up responses were recorded.							
CARS-2 Question		Number of times question answered:	Number of times scored: SAME	Number of times scored: BETTER	Number of times scored: WORSE	Percent Better	Percent Worse
S1:1	1	16	13	1	2	6.3%	12.5%
S1:2	2	16	10	1	5	6.3%	18.8%
S1:3	3	16	13	1	2	6.3%	12.5%
S1:4	4	16	11	2	3	12.5%	18.8%
S1:5	5	16	13	2	1	12.5%	6.3%
S1:6	6	12	10	0	2	0.0%	16.7%
S1:7	7	12	5	3	4	25.0%	33.3%
S1:8	8	11	9	2	0	18.2%	0.0%
S1:9	9	12	10	2	0	16.7%	0.0%
S1:10	10	12	8	2	2	16.7%	16.7%
S2:1	11	16	8	3	3	18.8%	18.8%
S2:2	12	16	11	2	3	12.5%	18.8%
S2:3	13	16	13	1	2	6.3%	12.5%
S2:4	14	16	10	5	1	31.3%	6.3%
S2:5	15	16	12	1	3	6.3%	18.8%
S2:6	16	16	9	0	7	0.0%	43.8%
S2:7	17	16	10	3	3	18.8%	18.8%

Table 3.10 continued

S2:8	18	16	12	2	2	12.5%	12.5%
S2:9	19	15	10	2	3	13.3%	20.0%
S3:1	20	16	12	2	2	12.5%	12.5%
S3:2	21	16	14	1	1	6.3%	6.3%
S3:3	22	16	13	1	2	6.3%	12.5%
S3:4	23	15	10	1	4	6.7%	26.7%
S4:1	24	16	10	2	4	12.5%	25.0%
S4:2	25	15	12	2	1	13.3%	6.7%
S4:3	26	13	10	1	2	7.7%	15.4%
S4:4	27	12	9	1	2	8.3%	16.7%
S5:1	28	16	10	2	4	12.5%	25.0%
S5:2	29	15	8	3	4	20.0%	26.7%
S5:3	30	15	10	2	3	13.3%	20.0%
S5:4	31	16	8	3	5	18.8%	31.3%
S5:5	32	16	6	5	5	31.3%	31.3%
S6:1	33	16	10	4	2	25.0%	12.5%
S6:2	34	16	13	2	1	12.5%	6.3%
S6:3	35	16	13	2	1	12.5%	6.3%
S6:4	36	16	13	1	2	6.3%	12.5%

% Better = (Number of times scored better/Number of times question answered) X 100

% Worse = (Number of times scored worse/Number of times question answered) X 100

Overall, a strong trend to improvement or worsening was not seen (Table 3.10). The most positive changes were seen in Question 14 (31.3%: *Is responsive to social initiations from others*) and Question 32 (31.3%: *Has special interests or topics (for example, dinosaurs, trains, clocks, weather, or license plates)*). The most negative changes were seen in Questions 7 (33.3%: *Has an unusual tone, rhythm, loudness, or rate of speech*), Question 16 (43.8%: *Sustains an interaction with others in an easy, flowing, back-and-forth manner*), Question 31 (31.3%: *Has specific routines or specific ways things must be done by self or others*).

### 3.2.3 Children's Sleep Habits Questionnaire Responses

Table 3.11, shows the individual results and Table 3.12 summarizes the data from the Children's Sleep Habits Questionnaire. All except 2 of the participants answered all 22 questions. Participant 10 answered 20 omitting 5 and 20), and Participant 40 answered 13 (omitting 1-9). Overall, there is an average change of -2.48% (Table 3.12), indicating a slight worsening of behaviors, but insufficient for statistical significance.

Table 3.11. Individual results of the Children's Sleep Habits Questionnaire.																
Questions	Participants															
	02	03	06	07	10	14	20	24	26	27	28	30	33	34	35	40
1	S	S	S	S	S	L	S	S	S	S	L	S	S	S	S	
2	S	S	S	S	G	S	S	L	L	S	L	S	L	S	S	
3	S	S	S	S	S	S	S	S	G	L	G	S	S	S	S	
4	W	S	S	S	S	S	S	S	B	S	B	S	S	S	W	
5	S	S	B	W		S	S	S	S	S	S	S	S	S	W	
6	B	W	S	S	W	S	S	W	B	S	S	B	S	B	S	
7	B	S	S	S	S	S	S	W	B	S	W	S	S	S	W	
8	S	S	B	S	S	S	W	S	W	S	W	S	S	S	S	
9	S	S	S	S	S	S	S	S	S	S	S	S	S	B	S	
10	S	S	S	L	L	L	S	S	S	S	S	S	L	S	S	S
11	S	S	B	S	B	B	S	B	S	W	S	S	S	S	B	S
12	S	S	S	S	W	S	S	S	S	S	W	S	S	S	B	S
13	B	S	S	W	S	S	S	S	S	S	W	S	W	B	B	S
14	B	S	S	S	B	S	S	S	S	S	B	S	S	S	S	S
15	S	S	S	S	B	S	B	S	W	W	W	S	S	S	B	S
16	S	S	S	S	S	S	S	S	B	S	S	S	W	S	S	S
17	S	W	S	S	B	B	W	W	S	W	S	S	B	S	B	S
18	S	B	S	S	S	B	W	W	S	W	S	S	S	S	S	B
19	S	S	S	S	G	G	S	L	S	S	S	S	L	L	G	S
20	S	S	S	W		S	B	S	W	S	S	S	B	B	W	W
21	S	S	W	S	S	W	S	S	W	W	S	S	S	S	S	S
22	S	B	S	S	S	S	S	S	S	W	W	S	S	S	B	S

Dark gray box (with B or G) indicates improvement. A light grey box (with W or L) indicates worsening. An S indicates that scores were the Same. Blackened boxes indicate missing data. Questions 1, 2, 3, 10, 19 are coded with G or L to indicate a reversed scale (see section 3.1.3 Data Analysis for further explanation).

Table 3.12. Summary of the Children's Sleep Habits Questionnaire results shown in Table 3.11.

	Participants															
	02	03	06	07	10	14	20	24	26	27	28	30	33	34	35	40
#Q	22	22	22	22	20	22	22	22	22	22	22	22	22	22	22	13
#B	4	2	3	0	6	4	2	1	5	0	3	1	2	4	7	1
#W	1	2	1	4	3	3	3	6	5	7	8	0	5	1	4	1
Diff	3	0	2	-4	3	1	-1	-5	0	-7	-5	1	-3	3	3	0
%C	13.6	0.0	9.1	-18.2	15.0	4.5	-4.5	-22.7	0.0	-31.8	-22.7	4.5	-13.6	13.6	13.6	0.0

Positive percent change (%C) indicates improvement, negative percent change indicates worsening. Mean percent change is -2.48%.

#Q = number of times question was answered with scores of 1, 2, 3, 4, or 5.

#B = number of times a subject improved

#W = number of times a subject worsened

Diff = arithmetic difference between #B and #W

%C = overall percent change as a factor of #Q ( $\text{Diff}/\#Q \times 100\%$ ).

Subjects 02, 06, 10, 14, 30, 34, and 35 observed overall improvements in their children between the initial and follow-up questionnaires (7/16). Of these, improvements were seen in 6/12 males and 1/4 females. In 8/16 participants, the change in sleep habits was in the opposite direction to change in CARS-2 results (Table 3.4). There was insufficient information to reveal a correlation with either farm or age. The individuals that showed the most degree of improvement were subjects 02, 10, 34, and 35. These subjects were from different farms (2, 4, and 8 respectively) and had different diagnoses (Autism and Global Delay, ADHD and Learning Disability, Autism, and Interstitial Deletion 22 respectively).

Subjects 07, 20, 24, 27, 28, and 33 scored worsening conditions in their children between the initial and follow-up questionnaires according to the Children's Sleep Habits portion. The individuals that showed the highest degree of negative change were subjects 27 (-31.8%) and subjects 24 and 28 (-22.7%). These subjects were from farms 6 and 7, subjects 27 and 28 being from the same farm and both female. All three subjects had different diagnoses.

Table 3.13 shows the individual results for each question of the Children's Sleep Habits questionnaire for riders with an autism spectrum diagnosis. The data is summarized in Table 3.14. The average percent change overall is -1.53 %. Although negative, the change is insufficient to draw a valid conclusion about a positive or negative effect on sleep habits in autistic children.

Table 3.13. Results of the Children's Sleep Habits Questionnaire in participants with an autism spectrum diagnosis.						
Question	Participant					
	02	07	24	26	30	34
1	S	S	S	S	S	S
2	S	S	L	L	S	S
3	S	S	S	G	S	S
4	W	S	S	B	S	S
5	S	W	S	S	S	S
6	B	S	W	B	B	B
7	B	S	W	B	S	S
8	S	S	S	W	S	S
9	S	S	S	S	S	B
10	S	L	S	S	S	S
11	S	S	B	S	S	S
12	S	S	S	S	S	S
13	B	W	S	S	S	B
14	B	S	S	S	S	S
15	S	S	S	W	S	S
16	S	S	S	B	S	S
17	S	S	W	S	S	S
18	S	S	W	S	S	S
19	S	S	L	S	S	L
20	S	W	S	W	S	B
21	S	S	S	W	S	S
22	S	S	S	S	S	S

Changes between initial and follow-up questionnaires are indicated by a dark gray box (B) indicating Better; light gray box (W) indicating Worse; and a white box (S) indicating Same.

Table 3.14. Summary of the Children’s Sleep Habits Questionnaire results in participants with autism spectrum diagnosis shown in Table 3.13.

	Participant					
	02	07	24	26	30	34
#Q	22	22	22	22	22	22
#B	4	0	1	5	1	4
#W	1	4	6	5	0	1
Diff	3	-4	-5	0	1	3
%C	13.6	-18.2	-22.7	0.0	4.5	13.6

The mean percent change is -1.53%.

#Q = number of questions answered with scores

#B = number of times a subject improved

#W = number of times a subject worsened

Diff = arithmetic difference between #B and #W

%C = overall percent change as a factor of #Q ((Diff/#Q) X 100 %).

In addition to the qualitative change recorded as Better, Same, or Worse, the quantitative change was calculated as the change in the total score of each individual (Table 3.15) for the Children’s Sleep Habits Questionnaire. Overall, the results do not indicate a high level of change. Most commonly changes of 0 occurred, with the initial score matching the follow-up response. When a change occurred, it was most commonly a 1-point difference. Rarely there was a change of 2 points (in 8 cases) or 3 (in 4 cases). In only one instance a change of 4 occurred. This occurred in subject 10 on Question 12, *Child moves to someone else’s bed during the night (parent, sibling, etc.)*. The change went from “never” to and “always” on the follow-up, which, based on the scale of the question, would be a worsening of the behaviors.

Table 3.15. Score changes between initial and follow-up Children's Sleep Habits questionnaires for each participant																
	Participants															
	02	03	06	07	10	14	20	24	26	27	28	30	33	34	35	40
SC	3	-2	4	-5	2	1	-1	-4	0	-7	-2.5	1	-4	4	2	0
#Q	22	22	22	22	20	22	22	22	22	22	22	22	22	22	22	13
ASC	0.14	-0.09	0.18	-0.23	0.10	0.05	-0.05	-0.18	0	-0.32	-0.11	0.05	-0.18	0.18	0.09	0

SC = Score change for each individual

#Q = number of question answered with scores

ASC = Average Score Change (SC / #Q)

Table 3.16 summarizes responses to specific questions within the Childs Sleep Habits questionnaire by showing the average change in score for each question averaged over all the participants.

Table 3.16: Average score change per question in the Children’s Sleep Habits Questionnaire to show the average change for each question answered.

Question		SC	#Q	ASC
1	Child goes to bed at the same time at night.	-2	15	-0.13
2	Child falls asleep within 20 minutes after going to bed.	-0.5	15	-0.03
3	Child falls asleep alone in own bed.	2	15	0.13
4	Child falls asleep in parent’s or sibling’s bed.	2	15	0.13
5	Child falls asleep with rocking or rhythmic movements.	-1	14	-0.07
6	Child needs special object to fall asleep (doll, special blanket, stuffed animal, etc.).	0	15	0.0
7	Child needs parent in the room to fall asleep.	-2	15	-0.13
8	Child resists going to bed at bedtime.	-1	15	-0.06
9	Child is afraid of sleeping in the dark.	1	15	0.06
10	Child sleeps about the same amount each day.	-4	16	-0.25
11	Child is restless and moves a lot during sleep.	6	16	0.38
12	Child moves to someone else’s bed during the night (parent, sibling, etc.).	-4	16	-0.25
13	Child grinds teeth during sleep (your dentist may have told you this).	-3	16	-0.19
14	Child snores loudly.	1	16	0.06
15	Child awakens during the night and is sweating, screaming, and inconsolable.	0	16	0.0
16	Child naps during the day.	0	16	0.0
17	Child wakes up once during the night.	-2	16	-0.13
18	Child wakes up more than once during the night.	0	16	0.0
19	Child wake up by him/herself.	1	16	0.06
20	Child wakes up very early in the morning (or, earlier than necessary or desired).	-1	15	-0.07
21	Child seems tired during the daytime.	-4	16	-0.25
22	Child falls asleep while involved in activities.	0	16	0.0

SC = Score change for each individual question

#Q = number of question answered with scores

ASC = Average Score Change (SC / #Q)

In addition, Table 3.17 shows the number of times a “Same,” “Better/Greater,” or “Worse/Lesser” occurred per question set, only looking at the 16 individuals that completed an initial and follow-up questionnaire. The “Percent Better” and “Percent Worse” columns show the percentage of responses for each question that showed improvement or worsening.



Table 3.17. Number of times and percentage of no change, improvement, or worsening (same, better, worse) for each question of Children's Sleep Habits Questionnaire for which initial and follow-up responses were recorded.

Children's Sleep Habits Question	Number of times question answered:	Number of times scored: SAME	Number of times scored: BETTER/ GREATER	Number of times scored: WORSE/ LESS	Percent Better	Percent Worse
1	15	14	0	2	0.0%	13.3%
2	15	11	1	4	6.7%	26.7%
3	15	13	2	1	13.3%	6.7%
4	15	12	2	2	13.3%	13.3%
5	14	13	1	2	7.1%	14.3%
6	15	9	4	3	26.7%	20.0%
7	15	11	2	3	13.3%	20.0%
8	15	12	1	3	6.7%	20.0%
9	15	15	1	0	6.7%	0.0%
10	16	12	0	4	0.0%	25.0%
11	16	10	5	1	31.3%	6.3%
12	16	13	1	2	6.3%	12.5%
13	16	10	3	3	18.8%	18.8%
14	16	13	3	0	18.8%	0.0%
15	16	10	3	3	18.8%	18.8%
16	16	14	1	1	6.3%	6.3%
17	16	8	4	4	25.0%	25.0%
18	16	10	3	3	18.8%	18.8%
19	16	10	3	3	18.8%	18.8%
20	15	9	3	4	20.0%	26.7%
21	16	12	0	4	0.0%	25.0%
22	16	12	2	2	12.5%	12.5%

% Better = (Number of times scored better/Number of times question answered) X 100

% Worse = (Number of times scored worse/Number of times question answered) X 100

Overall, a strong trend to improvement or worsening was not seen (Table 3.17). The most positive changes were seen in Question 11(31.3%: *Child is restless and moves a lot during sleep*) and Question 6 (26.7%: *Child needs special object to fall asleep (doll, special blanket, stuffed animal, etc.)*). The most negative changes were seen in Question 2 (26.7%: *Child falls asleep within 20 minutes after going to bed*) and Question 20 (26.7%: *Child wakes up very early in the morning (or, earlier than necessary or desired)*).

Overall, 2/16 subjects (14 and 30) showed improvements on both CARS-2 and the Children's Sleep Habits questionnaire, and 3/16 subjects (20, 28 and 33) showed worsening on both questionnaires, with 9/16 subjects (02, 03, 06, 07, 10, 24, 26, 27, 34, 35, 40) showing conflicting results or a no change score.

#### **3.2.4. Responses to Subjective Questions.**

Responses of the four subjective questions from individuals are listed for those who did (Table 3.18) and did not (Table 3.19) complete the study. Comparisons between responses are summarized in Figure 3.3.

Table 3.18. Individual responses of participants who completed the study.

Participant	Question			
	Pre-Intervention		Post-Intervention	
	(a) Rate therapeutic experience so far	(b) Rate how beneficial you think it will be	(c) Rate how much child enjoyed experience	(d) Rate how beneficial experience was
02	4	4	3	3
03	3	3	4	3
06	2	2	3	3
07	3	3	4	4
10	4	4	3	4
14	2	2	3	3
20	3	3	4	4
24	3	3	3	3
26	4	4	4	4
27	4	3	4	3
28	4	3	4	4
30	4	4	3	3
33	4	4	3	3
34	2.5	3	3	3
35	4	4	4	4
40	4	4	4	4
	Mean = 3.41	Mean = 3.31	Mean = 3.50	Mean = 3.44

This table shows the results for those participants that completed the study (i.e. submitted pre - and post - intervention questionnaires). Letters in parentheses designate vectors referred to in text.

Columns (a) and (b)

- 1 = Not helpful
- 2 = Slightly helpful
- 3 = Very helpful
- 4 = Extremely helpful

Columns (c) and (d)

- 1 = No enjoyment
- 2 = Enjoyed slightly
- 3 = Enjoyed very much
- 4 = Enjoyed extremely

Table 3.19. Individual responses of participants who did not complete the study. i.e. only submitted a pre - intervention questionnaire. Letters in parentheses designate vectors referred to in text.		
	Question	
	Pre-Intervention	
Participant	(e) Rate therapeutic experience so far	(f) Rate how beneficial you think it will be
01	4	4
04	4	4
05	3	3
08	4	3
09	4	4
11	4	4
12	4	4
13	4	4
18	4	4
19	4	4
21	3	3
22	4	4
23	3	3
25	4	3
29	4	4
31	4	4
32	4	3
36	3	3
37	4	4
38	3	3
39	4	4
41	4	4
42	4	4
43	3	3
	Mean = 3.75	Mean = 3.65

This table shows the results for those participants who did not complete the study (i.e. only submitted a pre - intervention questionnaires). Letters in parentheses designate vectors referred to in text.

Columns (e) and (f)

1 = Not helpful

2 = Slightly helpful

3 = Very helpful

4 = Extremely helpful

**1. Feelings about previous therapy** - Of the 16 participants (Table 3.18) who completed the study, 9 (56 %) felt that prior therapy was "extremely" helpful, while 4 (25%) considered it "very" helpful, with a mean response of 3.41 (mean of vector  $a$ ). Of the 24 participants (Table 3.19) who did not complete the study, 18 (75 %) felt that prior therapy was "extremely" helpful, while 6 (25%) considered it "very" helpful, with a mean response of 3.75 (mean of vector  $e$ ). Participants who did not complete the study tended to rank previous therapy more highly than those who did complete the study ( $P = 0.058$ , mean of  $a$  - mean of  $e$ , Figure 3.3).

**2. Expected benefit of upcoming therapy** - Of the 16 participants (Table 3.18) who completed the study, 7 (44 %) felt that upcoming therapy would be "extremely" helpful, while the same number considered it "very" helpful, with a mean response of 3.31 (mean of vector  $b$ ). Of the 24 participants (Table 3.19) who did not complete the study, 15 (62.5 %) felt that upcoming therapy would be "extremely" helpful, while 9 (37.5%) considered it "very" helpful, with a mean response of 3.65 (mean of vector  $f$ ). Participants who did not complete the study tended to rank upcoming therapy more highly than those who did complete the study ( $P = 0.068$ , (mean of  $b$ ) - (mean of  $f$ ), Figure 3.3). In participants who completed the study there was a tendency to expect less benefit from the upcoming therapy than from previous therapy ( $P = 0.167$ ,  $b - a$ ). This was statistically significant in participants who did not complete the study ( $P = 0.042$ ,  $f - e$ ) and in all participants who completed the initial questionnaire ( $P = 0.024$ ,  $(b,f) - (a,e)$ ).

**3. Feelings about whether the therapy helped the child** - Of the 16 participants (Table 3.18) who completed the study, 7 (44 %) felt that the equine therapy received was "extremely" helpful, while 9 (54%) felt it "very" helpful, with a mean response of 3.44 (mean of vector *d*). However, the participants did not feel that the received therapy was superior to their previous therapy ( $P = 0.43$ ,  $d - a$ ). However, it appeared to be consistent with their expectations ( $P = 0.25$ ,  $d - b$ ). Similarly, the benefits were felt to be consistent with the child's enjoyment of the experience ( $P = 0.29$ ,  $d - c$ ).

**4. Child's enjoyment of received experience** - Of the 16 participants (Table 3.18) who completed the study, 8 (50 %) of the children enjoyed the therapy "extremely", while an equal number enjoyed it "very much", with a mean response of 3.5 (mean of vector *c*). There did not appear to be a significant difference between the child's enjoyment of the received therapy *versus* parents' feelings about benefits of the therapy received previously ( $P = 0.32$ ,  $c - a$ ), or *versus* parents' expectations of the equine therapy they received ( $P = 0.19$ ,  $c - b$ ).

Figure 3.3. Comparisons of responses by participants within and between questionnaires, and between those who did and did not complete the study.

		Participants							
		Completed Pre Only		Completed Pre and Post				All Participants	
		<i>e</i> Rate therapeutic experience so far	<i>f</i> Rate how beneficial you think it will be	<i>a</i> Rate therapeutic experience so far	<i>b</i> Rate how beneficial you think it will be	<i>c</i> Rate how much child enjoyed experience	<i>d</i> Rate how beneficial experience was	<i>a,e</i> Rate therapeutic experience so far	<i>b,f</i> Rate how beneficial you think it will be
Completed Pre Only	<i>e</i> Rate therapeutic experience so far		<i>f - e</i> D = - 0.125 P = 0.042 Paired	mean of <i>a</i> - mean of <i>e</i> D = - 0.344 P = 0.058 Not paired					
	<i>f</i> Rate how beneficial you think it will be				mean of <i>b</i> - mean of <i>f</i> D = -0.313 P = 0.068 Not paired				
Completed Pre and Post	<i>a</i> Rate therapeutic experience so far				<i>b - a</i> D = - 0.094 P = 0.167 Paired	<i>c - a</i> D = 0.094 P = 0.32 Paired	<i>d - a</i> D = 0.031 P = 0.43 Paired		
	<i>b</i> Rate how beneficial you think it will be					<i>c - b</i> D = 1.875 P = 0.19 Paired	<i>d - b</i> D = 0.125 P = 0.25 Paired		
	<i>c</i> Rate how much child enjoyed experience						<i>d - c</i> D = - 0.063 P = 0.29 Paired		
	<i>d</i> Rate how beneficial experience was								
All Participants	<i>a,e</i> Rate therapeutic experience so far								<i>(b,f) - (a,e)</i> D = - 0.113 P = 0.024 Paired
	<i>b,f</i> Rate how beneficial you think it will be								

D represents mean differences between responses. Analyses were by a paired t-test when data was paired within participants, and by a non-paired t test when data was compared between participants who did and did not complete the study. See Section 3.1.2 Data Analysis for further explanation.

### **3.2.5. Narrative Responses to Open Ended Questions**

On the initial questionnaire, participants were asked to open-endedly describe why they chose therapeutic riding for their child and also why they chose a particular facility. Answers varied, but generally parents had heard promising things about the benefits of therapeutic riding and/or were also looking to provide their child with a different form of therapy (that either did not feel like therapy or was more enjoyable, and/or provided their child with additional benefits that they may not have been receiving in their more traditional/other therapies).

Parents noted many different reasons why they had chosen therapeutic riding for their child. Some parents mentioned how their child loves animals/horses and took an interest/liking to the new activity of riding. These parents often mentioned that they had heard great things about therapeutic riding. Additional families elaborated that their child loves horses and riding, and therapeutic riding helped their child learn a new skill and build confidence. Other parents also mentioned how animals seem to calm their child down and how it seemed more enjoyable than other therapies. Some parents chose therapeutic riding for their child because they hoped that their child would enjoy riding and that it would calm their child, and they thought that their child would enjoy the responsibility of taking care of an animal. Another parent elaborated how they wanted a therapy for their child that didn't feel like therapy. Their child did not look forward to going to any of the other therapies and actually complained about going. However, their child never complained about going to horse therapy. One parent noted that due to some issues, the participant's child was not able to attend school and needed one-on-one tutoring. They had a lot of open time and wanted to fill the time with therapeutic and community activities rather than staying at home. Their child loves animals and they calm him when he touches them, so they thought grooming and riding would be something that he would enjoy. Overall,



enjoyment seemed to be a big factor in why therapeutic riding was chosen for the children riders, in addition to many other benefits. This indicates that people seem to be drawn to therapeutic riding activities because of the perceived benefits as well as due to how enjoyable it is for the participants.

Other families chose therapeutic riding for their child because they had received funding through a grant and some chose to try therapeutic riding because they felt that therapeutic riding addresses many things that cannot be duplicated in traditional therapy sessions. Many families hoped that riding would help their child's muscles and self-confidence. Another family added that they wanted their child to experience some social interaction. Furthermore, that family's child also has special physical needs and they believe that therapeutic riding would help with trunk strengthening, muscle tone, flexibility, and motor skill improvement and maintenance. Additional families also noted these reasons, as well as balance and core strengthening as why they were drawn to therapeutic riding. Another family wrote that they were drawn to therapeutic riding because they believed it would help strengthen their child's legs and back so that they could gain the strength to walk. Many parents noted that they wanted a therapy to help their child's trunk stability, spasticity, and/or muscle strength and flexibility for movement. Additionally, benefits to attention span and improvements to fine and gross motor skills were also mentioned as reasons parents cited for choosing therapeutic riding for their child. Other parents mentioned social and speech improvements as reasons for choosing therapeutic riding for their child as well. Many families were drawn to therapeutic riding because they wanted to give their child a variety of therapeutic services. Horseback riding involves both physical and mental/education benefits. One family noted how they were drawn to therapeutic riding because it combined physical therapy, occupational therapy, and exercise techniques. Therapeutic riding

also allows the rider to experience non-stop activity/exercise during the entire lesson, where they can also focus and learn to follow directions. Benefits to bonding and learning to paying attention were surprise benefits to some parents. These parents felt that the structure of the therapeutic riding lessons was appropriate and clear/rigid in what needed to be done to benefit the riders, but there were also unexpected benefits, like the horse/child partnership. Initially, some children were “scared to death of horses,” but most quickly began to bond with them to the point where they call the horses their “best friends.” One parent noted that they had always known the therapeutic value of horses, as the parent had grown up riding. They believed in the therapeutic benefits, such as core strength and balance, and that horses can help teach respect and responsibility and give an emotional outlet and sense of accomplishment.

### **3.3 Results, Summary and Discussion**

#### **3.3.1. Evaluation of CARS-2 and Children’s Sleep Habits Questionnaires**

Reviewing the results as a whole, 2/16 subjects (14 and 30) showed improvements on both CARS-2 and the Children’s Sleep Habits questionnaire, whereas 3/16 (20, 28 and 33) showed worsening on both questionnaires, and 11/16 (02, 03, 06, 07, 10, 24, 26, 27, 34, 35, 40) showing mixed results. Table 3.7 summarizes the demographic data of each participant. Those that improved on both questionnaires had anxiety and high functioning autism as diagnoses. Those that worsened between questionnaires had chromosomal abnormality 2q37 deletion, ADHD/ODD, and cerebral dysgenesis as diagnoses. Subjects varied by age, gender, farm, and duration of equine therapy experience. No conclusions regarding the efficacy of equine assisted psychotherapy could be made based on these results.

### 3.3.1.1. Summary of CARS-2 Results

The CARS-2 questionnaire was selected to specifically address socialization and communication skills. Tables 3.3 and 3.4 summarize the overall results of the CARS-2 questionnaire. Overall, 9 out of 16 participants recorded a worsening of behavior, with an average change of -4.94%, indicating a slight worsening of behaviors. When inspected according to age, gender, prior experience, farm, or diagnosis, the results of the CAR2-2 indicate no strong trends in the data could be discerned (Table 3.7).

Table 3.5 and 3.6 show the CARS-2 results for the subset of riders with autism spectrum disorder. The average percent change for riders with an autism spectrum diagnosis is a positive 1.117%, but is not sufficient to draw any conclusions. There was a possible age effect in participants with an autism diagnosis, improvements only being seen in children older than 9 years. This could possibly suggest that equine-assisted activities and therapies may be more beneficial in older children with an autism spectrum disorder, but more research would be needed to validate this claim.

When the CARS-2 questionnaire was broken down per question (Tables 3.9 and 3.10), there were no strong trends towards an improvement or worsening. However, one of the strongest positive changes was seen in Question 14 (31.3%: *Is responsive to social initiations from others*). However, one of the most negative changes was seen in Question 16 (43.8%: *Sustains an interaction with others in an easy, flowing, back-and-forth manner*). During the course of equine-assisted activities and therapies, children may be learning to initiate and respond to conversations and social cues from others more readily. However, they may be unable to sustain these interactions. This is contrast to previously published research which has

shown improvements in the initiation of social interactions in children with an autism spectrum disorder following an equine-intervention, including a maintenance of these interactions (Ghorban, 2013).

### **3.3.1.2. Summary of Children's Sleep Habits Questionnaire Results**

The Children's Sleep Habits Questionnaire was used as a non - invasive method to look at stress, anxiety, and the HPA axis and to reveal any stress reducing aspects of equine-assisted activities and therapies. It was felt that sleep might be disturbed if anxiety is high, and therefore that sleep patterns could indicate disruption of the HPA axis. Tables 3.11 and 3.12 summarize the overall results of the Children's Sleep Habits Questionnaire. Overall, there is an average change of -2.48% (Table 3.12), indicating a slight worsening of behaviors, but insufficient for statistical significance.

Table 3.13 and Table 3.14 show Children's Sleep Habits Questionnaire results for the subset of riders that had an autism spectrum disorder diagnosis. The average percent change overall is -1.53 %. Although negative, the change is insufficient to draw any conclusions about the efficacy of Equine Assisted Psychotherapy in reducing stress and improving sleep habits in autistic children.

Overall, a trend to improvement or worsening was not seen in the Children's Sleep Habits Questionnaire (Tables 3.16 and 3.17) when viewed on a per question basis. The most positive changes were seen in Question 11(31.3%: *Child is restless and moves a lot during sleep*)

and Question 6 (26.7%: *Child needs special object to fall asleep (doll, special blanket, stuffed animal, etc.)*). The most negative changes were seen in Question 2 (26.7%: *Child falls asleep within 20 minutes after going to bed*) and Question 20 (26.7%: *Child wakes up very early in the morning (or, earlier than necessary or desired)*). These results do not show a clear trend towards improvement or worsening.

### **3.3.2. Evaluation of Perceived Pre and Post Enjoyment and Benefits**

Much information was provided by the pre and post survey questions. Specific questions focused on the parents' (raters/participants) perceived enjoyment and benefit of the equine-assisted sessions for their children, and significant differences were detected. Participants who did not complete the study rated previous therapies significantly more highly than those who did complete the study. Furthermore, participants who did not complete the study tended to rank upcoming (equine) therapy more highly than those who did complete the study. Also, in participants who completed the study, there was a tendency to expect less benefit from the upcoming therapy than from previous therapy (Figure 3.3). It is unclear why those that ranked the upcoming equine therapy more highly were also more likely to not complete the study. Participants may still be taking their child to their equine sessions but failed to respond to the researcher. It could also be possible that those who failed to complete the study had unrealistic expectations about the therapeutic experience. According to existing literature, parents generally perceive benefits for their children while they participate in an equine-assisted therapeutic activity. Benefits are generally perceived to be psychological and physical, with reports for perceived improvements in relationships, communication, confidence, independence, and senses of achievement and overall well-being (Lemke, 2014).

Of the 16 participants who completed the study, 7 (44 %) felt that the equine therapy received was "extremely" helpful, while 9 (54%) felt it "very" helpful. While the participants did not feel that the received therapy was superior to their previous therapy, their impression of the received therapy nevertheless appeared to be consistent with their high expectations. Furthermore, the benefits were felt to be consistent with the child's enjoyment of the experience. In other words, there did not appear to be a significant difference between the child's enjoyment of the received therapy *versus* parents' feelings about benefits of the therapy received previously, or *versus* parents' expectations of the equine therapy they received (Figure 3.3). Previous research has suggested that parents perceive equine-assisted therapies and activities to be beneficial to multiple areas of functioning, and it is a source of enjoyment, self-confidence, and normalcy for the children participating (Lemke, 2014). However, there is limited previous literature addressing expectations versus perceived outcome of therapy received in terms of participant retention.

Overall, the responses to subjective questions indicated that the equine-assisted therapeutic activity was enjoyable and beneficial to the children. Since parents/participants pay large sums of money for equine-assisted activities and therapies, one would expect that the perceived enjoyment and benefits would be high. Therefore, these results would indicate that people feel that they receive the benefits from equine-assisted therapies that they expect to receive. Reports of negative experiences were few in this study, especially in follow-up measures. However, this observation may be biased since those that did not perceive enjoyment or benefit from this form of therapy may have stopped participating and might not have submitted a follow-up questionnaire.

Even though objective results, based on the CARS-2 and Children's Sleep Habits questionnaires, do not allow us to conclude anything about the efficacy of equine assisted psychotherapy, the subjective data indicate a perceived benefit consistent with expectations. Because people continue to return and pay for these therapies they presumably consider them as beneficial and enjoyable.

In the absence of any measured objective effects, it is not clear if the perceived benefits of equine assisted psychotherapy which we have identified merely represent a placebo effect, or a valid treatment effect we have failed to capture. It is possible that factors dealing with expectations and feelings are affecting growth and healing, and they may also be important for showing the effects of this form of therapy. This could be a future direction that may be valid in other psychotherapies. There is an abundance of anecdotal evidence in the field of equine-assisted activities and therapies. Although meta-analyses of these reports might show statistically significant trends, variability in study designs make comparisons difficult.

### **3.3.3. Evaluation of the Methodology**

Previous literature in the field of equine-assisted activities and therapies have some methodological issues. This study tried to address those issues. Most of the literature is plagued by small sample sizes, lack of proper control groups, and inconsistent methodologies (Aetna, Inc., 2009, Aetna, Inc., 2016; Bachi, 2012; Hofmann, 2010). This study aimed to collect a variety of qualitative and quantitative data in order to help demonstrate the effectiveness of equine-assisted activities and therapies in the emotional, physical, psychological, and physiological healing process. The lack of consensus regarding the appropriate methods for an equine intervention and/or evaluation. Consequently, there is great variability in the length of treatment/intervention, types of interventions, group versus individual setting, the number and

type of facilitators/professionals, the types of questionnaires or other assessment tools, etc. (Bachi, 2012; Hofmann, 2010; Lentini, 2015). The design of this project was somewhat hampered by lack of any consistent methodology in the literature.

Although wide variety of qualitative and quantitative data were collected at various sites, the same methodology was employed across multiple farms and states. To our knowledge, this is the first study in equine-assisted psychotherapy in which multiple farms have participated with a consistent methodology. Having additional farms and participants in the future would be desirable. Each farm displayed interest in this project, whether they could participate or not. Individuals were used as their own controls. The nature of this field makes comparing waitlist individuals (or those not yet receiving treatment/interventions) to those that are currently receiving treatment/interventions difficult, when access to waitlists is not always available or granted. A repeated measures ANOVA, as initially desired, where individuals could be compared to themselves, would be ideal for this type of study. However, there were not enough participants to employ this method in the present study. Nevertheless, individuals were still compared to themselves and between individual comparisons were performed on a case-by-case basis.

Although this project has merit, it presented some notable challenges. First, the breadth of this project was large. Many farms were contacted within a large area. With initial questionnaires, follow-up questionnaires, and facility questionnaires, it was a lot for one researcher to collect and organize. Although a great deal of data was collected, more data per farm is needed, as well as per diagnosis and age. This would help to show the impact of the equine interventions across various demographics and allow for more valid statistical analyses. In retrospect, the amount of data that needed to be collected would probably exceed the resources



available for this study. It is recommended that multiple researchers collaborate in future studies in order to collect more data under the same methodology. In this study one researcher collected and compiled the data for subsequent analysis. It is possible that studies in equine-assisted psychotherapy may be conducted more effectively using large registries of patient data accumulated by collaborators in which many patients are followed for long periods of time (Gliklich & Dreyer, 2014).

Unfortunately, we did not have sufficient resources to collect physiologic data, such as blood or salivary cortisol. These types of samples are more invasive to the participants but can provide a direct assessment of the HPA axis. Heart rate monitors for participants is also an area to explore in the future, being less invasive than taking blood or salivary cortisol samples. Similarly, heart rate monitors on the horses could be used to evaluate stress and physical activity of the “equine-co-therapists” during interventions.

#### **3.3.3.1. Comparison with Other Studies**

Of other studies in this field, a valuable comparison can be made to a 2015 study conducted by Dr. Robin L. Gabriels and colleagues (Gabriels et al., 2015). This is a randomized, single blinded clinical trial, preceded by a 2012 pilot study (Gabriels, 2012). Both studies looked into the effects of therapeutic horseback riding in children with an autism spectrum disorder diagnosis in a highly controlled environment. In the full study, the effectiveness of therapeutic horseback riding was examined in relation to the self-regulation, socialization, communication, adaptive, and motor behaviors in children with an autism spectrum disorder. Subjects were randomly assigned to one of two groups: an intervention group that participated in a weekly therapeutic riding activity for 10 weeks and a barn activity group that went to a barn, but did not interact with a real horse. Participants could not be blinded to the intervention (both children and

caregivers). Participants were evaluated within one month pre- and post- intervention. While evaluators were blinded to the intervention received by the participants, non-blinded caregiver questionnaires were also used. The study was conducted at a premiere PATH-certified center.

The selected participants were between 6 and 16 years, met the autism spectrum disorder screening cut off of greater than or equal to 15, as according to the Social Communication Questionnaire (SCQ). In addition, they had an autism spectrum diagnosis, met the clinical cut-offs for autism based on the Autism Diagnostic Observation Schedule (ADOS), and had a combined score on the Irritability and Stereotypy subscales of the Aberrant Behavior Checklist-Community (ABC-C) of 11 or greater and a Leiter-R Brief nonverbal IQ standard score of 40 or greater. Exclusion criteria included having a previously identified genetic disorder with a presentation similar to an autism spectrum disorder, medical or behavioral histories that would have made participation dangerous, histories of animal abuse or a phobia of horses, and having had more than two hours of equine-assisted activities and/or therapies within in the past 6 months.

There were 116 participants in this study (58 per subject group). Both types of interventions lasted a minimum of 45 minutes and consisted of 2-4 participants. Many visual aids, praise, and use of personal interests to engage a participant were used. A major difference between groups was that the barn activity/control group had no contact with a horse. They interacted with a life-size, stuffed horse while learning horsemanship skills. Many different assessments were used to determine pre/baseline and post functioning levels. The data showed significant improvements in the treatment group compared to the control/‘barn activity’ group, specifically when looking at measures of irritability ( $P = 0.02$ ), hyperactivity ( $P = 0.01$ ), social cognition ( $P = 0.05$ ), and social communication ( $P = 0.003$ ). These results were seen by week

five of the study. Significant improvements were also seen in the treatment group on measures of social cognition and social communication. Overall, the researchers believed that their results were consistent with literature. However, they noted that non-blinding of patients and caregivers could have led to bias and a possible placebo effect. The researchers hope for better blinding methods in the future, but true double-blinding may be impossible in this type of study, due to the impossibility of creating a surrogate placebo treatment to replace a live horse. Participants and caregivers may always be aware which group they are in. The researchers also suggested needing some objective observational measures and looking in to the nonverbal communication aspect between horse and rider during future projects (Gabriels, 2015).

A major difference between the present study and that of Gabriels (2015), is that the latter was a randomized clinical trial conducted at a single facility, attended by participants solely for the purpose of the study, all of whom had an autism diagnosis. Participants were not receiving concurring therapeutic riding lessons at another location, regardless of whether they were riding or part of the barn activity group. Exclusion criteria for participation in the Gabriels (2015) project included having had more than two hours of equine-assisted activities and therapies within in the past 6 months. Thus, participants were not riding at any other farm and may not have ever ridden before the study. The present study was conducted at the farms where participants were regularly riding – they did not have to stop riding before participant or move to a different farm. Nevertheless, the timeline of data collection in Gabriels (2015) was similar to the present study and both studies included a pre and post assessment. The large pool of subjects and selection of autism patients is a significant advantage of the Gabriels (2015) study.

The conditions of the Gabriels (2015) study were heavily controlled and may not represent entirely what is encountered in the field. In contrast, the patients in the present study varied greatly in demographics and case history, which hindered our ability to detect therapeutic effects. In other words, the data presented in this thesis may be more representative of what patients, parent, and clinicians may encounter in equine assisted psychotherapy programs in the present study or more typical facilities (Möller, 2011).

#### **3.3.3.1.1. Randomized Double Blinded Control Studies (RDBC)**

Randomized double-blind, placebo-controlled (RDBC) studies are considered to be the “gold standard” for clinical trials (Misra, 2012). In these types of studies, some participants are given the treatment, while others are given a surrogate/control treatment (placebo) (Misra, 2012; Patsopoulos, 2011). Interventions are randomly assigned and methodologies are designed to help control for most, if not all, biases (often with extension inclusion and exclusion criteria) (Patsopoulos, 2011). Neither researchers nor participants know which intervention participants receive until the study is finished, thus researchers are “blind” to the treatment conditions (Misra, 2012). In contrast, Gabriels (2015) reported a single blinded where the researchers were blinded, but non-blinded caregiver reports were also used. Parents and participants in that study could easily infer to which group they were assigned because “barn activity” participants did not interact with a real horse.

A randomized double-blinded, placebo-controlled study design is considered to be advantageous because it can help demonstrate causality and draw inferences about potential effects on target populations (Misra, 2012). However, these studies can be expensive and time consuming (Misra, 2012; Patsopoulos, 2011). These studies have also been prone to non-compliance, withdrawals after randomization, attrition/losses to follow-up, as well as ineligible

patients enrolled and misclassifications of outcomes (Misra, 2012). Furthermore, their applicability to the “real world” may be questionable (Patsopoulos, 2011).

Thus, although randomized control-group studies are considered the gold standard of evidence-based medicine, these studies may not always be fully generalizable (Möller, 2011; Patsopoulos, 2011). In other words, randomized double or single-blinded studies may have high internal validity, but limited external validity (Möller, 2011; Patsopoulos, 2011). Participants are usually strictly selected or excluded based upon specific characteristics or qualifications. This may not illustrate everyday clinical practice or the average participant (Möller, 2011; Patsopoulos, 2011). More researchers have been advocating for a more “real world” approach in effectiveness studies (Möller, 2011), or at least for the consideration of nonrandomized approaches in systematic reviews (Paulus, 2014).

In recent years, “effectiveness studies,” also called “real world studies” or “pragmatic trials,” have been gaining popularity and increasing in importance in the field of evidence-based medicine (Möller, 2011; Patsopoulos, 2011). “Pragmatic trials” can produce data that is more reflective of the “real world,” and thus more likely to be a representative sample of the study population and therefore more generalizable to that population (Kelley, 2003; Patsopoulos, 2011). Survey research, appropriately conducted, maybe in such studies (Kelley, 2003). Policy makers are also keenly interested in pragmatic study designs because they can possibly help answer questions relevant to their area of interest, to help determine whether interventions are effective in routine practice in the “real world,” along with cost-effect analyses (Patsopoulos, 2011).

Effectiveness studies are designed to show the effectiveness of treatments under real-world conditions with participant samples that are more representative of everyday clinical practices. These studies can have a randomized-control approach, but a less demanding design is also allowed. Blinding in these studies is not always necessary and participant selection is not as restrictive, allowing for factors such as comorbidity and co-medication (Möller, 2011; Patsopoulos, 2011). Effectiveness studies are not immune to methodological problems (Möller, 2011; Patsopoulos, 2011), such as those in the field of equine-assisted activities and therapies. This makes results challenging to interpret. Including participants with additional confounding variables and parameters and a non-blinded design can induce different biases. In addition, increases of a trial's "within study" heterogeneity may not necessarily increase its external validity (Patsopoulos, 2011). Thus, caution should always be applied when interpreting any trial results. Studies can also be designed to have aspects that are pragmatic and other aspects that are explanatory, and some explanatory studies are needed to verify the pragmatic ones (Patsopoulos, 2011). Effectiveness/pragmatic studies may not be better than classical RDBC methodologies, but they can provide a complementary picture of reality (Möller, 2011; Patsopoulos, 2011).

It can be argued that the current methodology is representative of the "real world" and typical of the participants, farms, and practices in the field. In contrast, highly controlled studies may eliminate some important variables. As long their limitations are recognized, "real world" studies may play an important, if limited, role in advancing knowledge.

### **3.3.3.2. The Future of Equine-Assisted Therapy and Psychotherapy Research**

As previously mentioned, effectiveness studies are a necessary direction for current and future research in the field of equine-assisted activities and therapies and psychotherapies. Studies with less control and restrictions may allow for the inclusion of more participants and provide a more “real world” depiction into what these therapies can achieve.

Clinical trials often involve a comparison of a novel treatment to an existing control arm, which is usually a placebo or a standard of care (Viele, 2014). However, there is a growing interest for using an individual’s historical data as the control arm of a study, or single-arm studies (Hobbs, 2012; Philip, 2014; Viele, 2014). Single-arm studies evaluate longitudinal outcomes in cohorts of subjects that receive a single intervention where there is no concurrent control group. These studies can be observational or experimental. Single-arm studies may report comparative statistics or qualitative analyses and can compare results with historical data or with existing databases. Quantitative synthesis of randomized and nonrandomized studies, and single-arm studies in particular, are uncommon in medical literature (Paulus, 2014).

Large amounts of clinical data are available prior to the start of the study. Relevant historical data of an individual can provide the information for the control “arm” of a study. More resources can be applied towards the novel treatment, instead of developing a control treatment. Estimates of control parameters can be determined from an individual’s history – and patients can serve as their own control (Viele, 2014).

Single-arm studies lack a direct, concurrent comparison/control group. Therefore, they are often deemed as non-informative in comparative effectiveness measures (Paulus, 2014). However, a single-arm study design can provide more accurate point estimates, increased power, and reduce Type I errors in clinical trials – if the historical information that is collected is

sufficiently similar to data obtained from the study (Viele, 2014). This study design relies on before-after, implicit, or historical comparisons as the proxy for the ideal comparison group. These designs may also be able to provide information on causal treatment effects by extrapolating expected outcomes (Paulus, 2014). Using this design may allow for statistical results to be obtained from studies that are smaller in participant numbers (Philip, 2014; Viele, 2014). An unequal randomization may be used to place proportionately more (or all) individuals in the experimental treatment arm. It may make statistical (and financial) sense to capitalize on historical data whenever it is possible (Philip, 2014; Viele, 2014). Proper balancing of risks and benefits regarding the borrowing of historical information can help develop methodologies that can streamline research in many different fields (Philip, 2014). Single-arm approaches are most appropriate for experimental therapies, and where there is a well-defined historical control database available (Paulus, 2014; Philip, 2014).

Single-arm studies are often used in systematic reviews of therapeutic interventions and can provide valuable evidence, particularly in emerging treatments, such as equine-assisted activities and therapies where certain control groups may be inaccessible or where measuring individual change is more desirable. Systematic reviewers considering a single-arm approach to their research are encouraged to seek the help of epidemiologists and statisticians to assure that assumptions are made accurately (Paulus, 2014).

Once necessary tools and outreach are in place, continuing to build a soundly developed registry of participants that can be constantly updated would be a valuable tool for future, longitudinal analyses in the field (Gliklich & Dreyer, 2014; Paulus, 2014; Philip, 2014). Different states have developed their own autism registries. In 2007, the Kennedy Krieger Institute launched the first national autism registry (Autism Speaks, 2018b). It was designed to



drive autism research forward (Autism Speaks, 2018b), as large samples are required to uncover epidemiologic trends (Daniels, 2012). Parents of children with an autism spectrum disorder engage online and provide genealogical, environmental, and treatment data, which enables researchers to explore hypotheses from a pool of data (Autism Speaks, 2018b). Many studies are often not completed because researchers cannot find enough qualified participants in a timely manner. The ongoing development of registries will help facilitate the process of research recruitment (Autism Speaks, 2018b). Research has been conducted to verify parent-reports of professional autism spectrum disorder diagnoses to autism-related databases. Results of these studies have suggested that information collected from parents participating in online autism registries is valid and researchers can confidently use this data in their studies (Daniels, 2012). Continuous updates and ongoing participation are needed in registries (Philip, 2014) and may prove difficult to achieve, but may be especially suited to the study of equine-assisted activities and therapies. Web-based planning and analysis is a possibility for the future where participants could reach out to the researchers. As registries grow, they may be continuously refined (Philip, 2014). This could be in the future for equine-assisted activities and therapies—if researchers and farms collaborate effectively. Detecting large changes in individuals over time may demonstrate the effectiveness of this approach.

The current study employed a single-arm design where there was no control group. Participants served as their own control with their initial/historical data used as the tool for comparisons. More participants will be needed to determine effectiveness in equine-assisted activities and therapies. More individuals can be placed in the treatment/experimental arm of the study (Philip, 2014; Viele, 2014). This can help address the issues of sample sizes as well as

some control issues, where participants are serving as their own controls. Using historical references for controls and using participants as their own controls, while also using less exclusion criteria will allow for a better reflection of the real world.

### **3.3.4. Future Studies and Conclusions**

Overall, these data did not show major statistically significant benefits of equine activities. Nevertheless, this study has provided a possible framework for analysis of more cases on additional farms and states through which statistical significance and power might be achieved on parameters of clinical importance.

From a more subjective approach, based on participant interviews, and after watching riders participate in equine activities, it is apparent that the lessons are being enjoyed and have a positive impact. Although it was not a primary objective of this study, there may be merit in trying to capture narrative responses in a more systematic way. Families continue to seek for various forms of therapy, are drawn to equine therapies, speak highly of their benefits, and pay large sums of money even when they are not covered by insurance. Although the present study detected, at best, a very modest therapeutic benefit, the subjective positive impact of equine activities appears high on patients and their families, and merits further study.

In addition, the way to approach research in the field of equine-assisted activities and psychotherapy may not be through a randomized, double-blinded, heavily controlled approach. Instead, studies based on information accumulated in large patient registries and databases may provide new insight, since it is in the variable and sometimes unpredictable environment of a stable where these experiential therapies occur and show their effectiveness.

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## APPENDICES

### Appendix A. Facility Questionnaire

#### Facility Questionnaire:

Address	Name of facility:
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1. Briefly describe your facility and what you do.
2. Do other riding lessons take place at your facility? Are there boarders? Is your facility strictly run as a therapeutic riding facility?
3. Briefly describe the certification process that your instructors and horses have to go through before they can teach therapeutic riding lesson.
4. Briefly describe what happens in a therapeutic lesson. How much grooming and groundwork is involved? How much riding is involved? Is the same trainer/guide present at each lesson or do instructors rotate?
5. How long is each therapeutic riding lesson?
6. What is the pricing structure for your therapeutic lessons? Do people pay per lesson or a block of lessons? How much do you charge per lesson? Does insurance help cover these costs?

## **Appendix B. Cover Letter of the Initial Participant Questionnaire**

You are invited to participate in a research project being conducted by Amy Hofmann, a graduate student in the departments of Animal and Veterinary Sciences, Psychology, and Social Work at the University of Maine. The faculty sponsor is Dr. Robert Causey of the Department of Animal and Veterinary Sciences at the University of Maine. The purpose of the research is to learn about the effects of equine assisted activities in children with autism spectrum disorders, but anyone is welcome to participate.

### **What Will You Be Asked to Do?**

If you decide to participate, you will be asked to fill out two simple questionnaires. The questionnaires assess behaviors and sleep patterns of children. These are questionnaires designed for parents to fill out, so your children will not be asked to do anything for this project, aside from continuing in their regular riding sessions as usual. We would like you to fill out the questionnaires once at the beginning of your child's session period and once at the end of a 7-week period. In order to conduct the follow-up questionnaires, you will be asked to provide an address in order for us to be able to contact you, if you choose.

### **Risks**

Except for your time and inconvenience, there are no risks to you from participating in this study (approximate time to complete the questionnaires is 30 minutes). The demographics could possibly identify families to the researchers. However, all of the answers/data will remain confidential. The data will be reported only in summary, and the demographics will be used to describe the sample in general. Findings will be reported in a way that will not identify specific individuals in any way.

### **Benefits**

While this study will have no direct benefits to you, this research may help us learn more about the effects of equine therapies on the social and communication skills in children and how to help yours and other children in the future.

### **Compensation**

If you complete the follow-up portion of the questionnaire and send it back to Amy Hofmann (stamped and addressed envelopes will be sent to you with the questionnaire), we would like to offer you a \$25 Amazon gift card for your efforts.

### **Confidentiality**

Data will be kept in the faculty advisor's locked office. Only Amy Hofmann, faculty advisor, Dr. Robert Causey, and graduate committee members (Dr. Marie Hayes, Dr. Sandra Sigmon, Dr. Robert Lehnhard, Dr. Shihfen Tu, and Dr. Steve Butterfield) from the University of Maine will have access to the data. Your name or other identifying information will not be reported in any publications. Identifiable data will be destroyed after one year and any de-identifiable data entered into a private computer will be stored with secure software and will be kept indefinitely.

**Voluntary**

Participation is completely voluntary. Your participation will not affect the services given to your child in any way. If you choose to take part in this study, you may stop at any time. You may also skip any questions you do not wish to answer.

**Contact Information**

If you have any questions about this study, please contact me (Amy Hofmann) by email at [amy.hofmann@umit.maine.edu](mailto:amy.hofmann@umit.maine.edu). You may also reach the faculty advisor on this study by email at [robert.causey@umit.maine.edu](mailto:robert.causey@umit.maine.edu). If you have any questions about your rights as a research participant, please contact Gayle Jones, Assistant to the University of Maine's Protection of Human Subjects Review Board, at 207-581-1498 (or e-mail [gayle.jones@umit.maine.edu](mailto:gayle.jones@umit.maine.edu)).

Your signature below indicates that you have read the above information and agree to participate. You will receive a copy of this form.

---

Signature

---

Date

## **Appendix C. Cover Letter of the Final Participant Questionnaire**

Thank you for participating in the research project conducted by Amy Hofmann, a graduate student in the departments of Animal and Veterinary Sciences, Psychology, and Social Work at the University of Maine. The faculty sponsor is Dr. Robert Causey of the Department of Animal and Veterinary Sciences at the University of Maine. The purpose of the research is to learn about the effects of equine assisted activities in children with autism spectrum disorders, although anyone is welcome to participate.

### **What Will You Be Asked To Do?**

If you decide to participate, you will be asked to fill out two simple questionnaires. The questionnaires assess behaviors and sleep patterns of children with autism spectrum disorders. These are questionnaires designed for parents to fill out, so your children will not be asked to do anything for this project, aside from continuing in their regular riding sessions as usual. Since you have filled out an initial questionnaire, we are sending you this follow-up questionnaire.

### **Risks**

Except for your time and inconvenience, there are no risks to you from continuing to participate in this study (approximate time to complete the questionnaire is 30 minutes). The demographics could possibly identify families to the researchers. However, all of the answers/data will remain confidential. The data will be reported only in summary, and the demographics will be used to describe the sample in general. Findings will be reported in a way that will not identify specific individuals in any way.

### **Benefits**

While this study will have no direct benefits to you, this research may help us learn more about the specific effects of equine therapies on the social and communication skills in children and how to help yours and other children in the future.

### **Compensation**

If you complete this follow-up portion of the questionnaire and send it back to Amy Hofmann (stamps and an addressed envelope will be sent to you with the questionnaire), we would like to offer you a \$25 Amazon gift card for your efforts.

### **Confidentiality**

Data will be kept in the faculty advisor's locked office. Only Amy Hofmann, faculty advisor, Dr. Robert Causey, and graduate committee members (Dr. Marie Hayes, Dr. Sandra Sigmon, Dr. Robert Lehnhard, and Dr. Shihfen Tu) from the University of Maine will have access to the data. Your name or other identifying information will not be reported in any publications. Identifiable data will be destroyed after one year and any de-identifiable data entered into a private computer will be stored with secure software and will be kept indefinitely.

**Voluntary**

Your continued participation is completely voluntary. Your participation will not affect the services given to your child in any way. If you choose to continue to take part in this study, you may stop at any time. You may also skip any questions you do not wish to answer.

**Contact Information**

If you have any questions about this study, please contact me (Amy Hofmann) by email at [amy.hofmann@umit.maine.edu](mailto:amy.hofmann@umit.maine.edu). You may also reach the faculty advisor on this study by email at [robert.causey@umit.maine.edu](mailto:robert.causey@umit.maine.edu). If you have any questions about your rights as a research participant, please contact Gayle Jones, Assistant to the University of Maine's Protection of Human Subjects Review Board, at 207-581-r1498 (or email [gayle.jones@umit.maine.edu](mailto:gayle.jones@umit.maine.edu)).



## Appendix D. Pre-Assessment, Researcher Designed Questions

Start date of riding lessons:		Anticipated end of riding lessons:		Today's date:	
Address/Email Address for follow-up		Gender: (of child)		Male	Female
		Current age of child:			
Professional diagnosis (circle one):	Asperger Syndrome	High Functioning Autism	Other:		
Is this your child's first time riding a horse? Yes/No					
Is this your child's first time receiving a therapeutic riding lesson? Yes/No					
If this is not your child's first time receiving a therapeutic riding lesson 1. Approximately how long has your child participated in a therapeutic riding activity?  2. Is this your child's first therapeutic riding lesson at this facility? Yes/No  3. If this is not your child's first lesson at this facility, approximately how long has your child participated in a therapeutic riding activity at this facility?					

1. What types of therapy has your child had so far?

2. How would you rate your child's therapeutic experience thus far? (Choose one)

Not helpful	Slightly helpful	Very helpful	Extremely helpful
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3. Why did you choose therapeutic riding for your child?

4. Why did you choose to come to this particular riding facility?

5. How beneficial do you think your child's therapeutic riding experience will be? (Choose one)

Not helpful	Slightly helpful	Very helpful	Extremely helpful
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## Appendix E. Post-Assessment, Researcher Designed Questions

Start date of riding lessons:	Anticipated end of riding lessons:	Today's date:	
Address	Gender: (of the child)	Male	Female
	Current age of the child:		

1. How many weeks were in this riding session and approximately how many hours per week did your child participate in a therapeutic riding activity?
2. Have you noticed any changes in your child since they started this session of riding lessons? If yes, please describe.
3. Do you plan to continue bringing your child for riding lessons? Yes/ No, why?
4. What does your child like and not like most about riding lessons?

5. How much does your child enjoy riding lessons? (Choose one)

No Enjoyment	Enjoyed Slightly	Enjoyed very much	Enjoyed Extremely
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6. How beneficial do you think your child's therapeutic riding experience was? (Choose one)

No Enjoyment	Enjoyed Slightly	Enjoyed very much	Enjoyed Extremely
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## Appendix F. Participant Questionnaire – CARS-2

### QUESTIONNAIRE FOR PARENTS OR CAREGIVERS CARS2-QPC

Date: \_\_\_\_\_ Date of birth of person to be rated:

Case ID Number: \_\_\_\_\_ Name of person to be rated:

Your name: \_\_\_\_\_ Your relationship to the person being rated:

\_\_\_\_\_

#### Instructions

This form asks about behaviors in several areas where people may have difficulty. The person you are rating may or may not have ever shown these behaviors.

For each behavior listed, please make a check mark under the description that best described the person you are rating. Check the box under *Don't Know* if you do not have enough information about a behavior to give a rating. It is important to provide an answer for every behavior. After each section, there is a space for you to give one or more brief, specific examples that relate to your ratings in that section. Use the blank page at the end of the form if you need extra space. The final section of this questionnaire provides spaces where you can describe any other behaviors that you would like us to know about.

## **SECTION 1**

**How does the person you are rating communicate?**

	<i><b>Not a problem</b></i> (Does very well)	<i><b>Mild to Moderate Problem</b></i> (Sometimes a problem)	<i><b>Severe problem</b></i> (Often or always a problem)	<i><b>Not a problem now, but was in the past</b></i>	<i><b>Don't know</b></i>
1. Imitates sounds, words, and movements of others.					
2. Responds to facial expressions, gestures, and different tones of voice used by others.					
3. Responds to his or her name being called by turning and making eye contact with the person calling his or her name.					
4. Directs facial expressions to others to show the emotions he or she is feeling.					
5. Uses a variety of gestures (pointing, nodding the head, showing the size of something) that are coordinated with words or used to explain things when he or she doesn't have words to do so.					

**If the person you are rating is not using words, skip ahead to SECTION 2.**

	<i><b>Not a problem</b></i> (Does very well)	<i><b>Mild to Moderate Problem</b></i> (Sometimes a problem)	<i><b>Severe problem</b></i> (Often or always a problem)	<i><b>Not a problem now, but was in the past</b></i>	<i><b>Don't know</b></i>
6. Uses made-up words or repeats specific words or phrases.					
7. Has an unusual tone, rhythm, loudness, or rate of speech.					
8. Speech is overly formal; for example, uses vocabulary that seems more sophisticated than usual for a person of his or her age or for the situation.					
9. Carries on a conversation with another person that flows back and forth, at a level you would expect for someone of his or her age.					
10. Can talk with another person about that person's interests.					

**Examples:** Give one or more brief, but specific, examples of the problem behaviors rated above. If you need more space to write, use the blank pages at the end of this form.

## **SECTION 2**

**How does the person you are rating relate to others and show emotion?**

	<i><b>Not a problem</b></i> (Does very well)	<i><b>Mild to Moderate Problem</b></i> (Sometimes a problem)	<i><b>Severe problem</b></i> (Often or always a problem)	<i><b>Not a problem now, but was in the past</b></i>	<i><b>Don't know</b></i>
1. Makes eye contact when speaking or listening to another person.					
2. Points to and shares things of interest with others.					
3. Follows another person's gaze or points toward an object that is out of reach.					
4. Is responsive to social initiations from others.					
5. Initiates social interactions with adults and peers (not just to get a basic need met).					
6. Sustains an interaction with others in an easy, flowing, back-and-forth manner.					
7. Makes and maintains friendships with peers of same developmental level.					
8. Shows a range of emotional expressions that match the situation (for example, smiles, frowns, conveys different emotions through eyes and facial expressions, etc.).					
9. Understands and responds to how another person may be thinking or feeling (for example, tries to comfort someone in distress, does something because he or she thinks the other person will like it).					

**Examples:** Give one or more brief, but specific, examples of the problem behaviors rated above. If you need more space to write, use the blank pages at the end of this form.

**Examples cont.:**

### **SECTION 3**

**How does the person you are rating move his or her body?**

	<i><b>Not a problem</b></i> (Does very well)	<i><b>Mild to Moderate Problem</b></i> (Sometimes a problem)	<i><b>Severe problem</b></i> (Often or always a problem)	<i><b>Not a problem now, but was in the past</b></i>	<i><b>Don't know</b></i>
1. Has unusual ways of moving fingers, hands, arms, legs; or spins or rocks body.					
2. Does things that might result in self-injury, like scratching, head banging, or picking at his or her skin, etc.					
3. Is clumsy, stumbles, or has an awkward walk or run.					
4. For school-aged children or adults: Has difficulty tying shoes or difficulty with handwriting or other tasks that require fine motor coordination.					

#### **SECTION 4**

**How does the person you are rating play?**

**(For an older individual, how did he or she play as a child?)**

	<i><b>Not a problem</b></i> (Does very well)	<i><b>Mild to Moderate Problem</b></i> (Sometimes a problem)	<i><b>Severe problem</b></i> (Often or always a problem)	<i><b>Not a problem now, but was in the past</b></i>	<i><b>Don't know</b></i>
1. Uses only parts of toys instead of whole toys, or plays with objects (e.g. opens and closes toy barn doors, spins wheels on cars, wobbles or spins household objects).					
2. Plays with the same things in the same way over and over.					
3. Uses toys or other materials to represent something they are not (e.g., uses a banana as a phone or microphone).					
4. Engages in make-believe play, taking on a role (not based on scripts from movies or TV shows).					

**Examples:** Give one or more brief, but specific, examples of the problem behaviors rated above. If you need more space to write, use the blank pages at the end of this form.



## **SECTION 5**

**How does the person you are rating react to new experiences and changes in routine?**

	<i><b>Not a problem</b></i> (Does very well)	<i><b>Mild to Moderate Problem</b></i> (Sometimes a problem)	<i><b>Severe problem</b></i> (Often or always a problem)	<i><b>Not a problem now, but was in the past</b></i>	<i><b>Don't know</b></i>
1. May show anxiety or worry in facial expression or body movement, or by becoming overly impatient.					
2. May show worry about the same thing over and over.					
3. Copes with changes in routine or the environment (for example, moving furniture).					
4. Has specific routines or specific ways things must be done by self or others.					
5. Has special interests or topics (for example, dinosaurs, trains, clocks, weather, or license plates, etc.).					

## **SECTION 6**

**How does the person you are rating use his or her sense of vision, hearing, touch, and smell?**

	<i><b>Not a problem</b></i> (Does very well)	<i><b>Mild to Moderate Problem</b></i> (Sometimes a problem)	<i><b>Severe problem</b></i> (Often or always a problem)	<i><b>Not a problem now, but was in the past</b></i>	<i><b>Don't know</b></i>
1. Tends to look at objects from unusual angles or out of the corner of his or her eyes.					
2. Is overly interested in light from mirrors or light reflecting off objects.					
3. Is overly sensitive to some sounds, smells, or textures; seeks some out, actively avoids others.					
	<i><b>Not a problem</b></i> (Does very well)	<i><b>Mild to Moderate Problem</b></i> (Sometimes a problem)	<i><b>Severe problem</b></i> (Often or always a problem)	<i><b>Not a problem now, but was in the past</b></i>	<i><b>Don't know</b></i>
4. Has an unusual response to touch; may overreact to touch or pain or may not respond to things that others would find uncomfortable or painful.					

**Examples:** Give one or more brief, but specific, examples of the problem behaviors rated above. If you need more space to write, use the blank pages at the end of this form.

## **SECTION 7**

### **Other behaviors**

1. Does this individual have any extremely unusual mathematical, reading, or artistic abilities?

No      Yes

If yes, please explain.

2. Are there other unusual behaviors you have noticed that you would like to tell us about?

Please list the specific behaviors, and give an example or two.

### **Additional Behavior Examples or Comments:**

Please specify the number of the question that is related to your example or comment:

---

### **Additional Behaviors Examples or Comments:**

Please specify the number of the question that is related to your example or comment:

---

### **Additional Behaviors Examples or Comments:**

## Appendix G. Participant Questionnaire – Children’s Sleep Habits Questionnaire

### CHILDREN’S SLEEP HABITS QUESTIONNAIRE (ABBREVIATED)

The following statements are about your child’s sleep habits and possible difficulties with sleep. Think about the past week in your life when you answer the questions. If the last week was unusual for a specific reason, choose the most recent typical week. Unless noted, check Always if something occurs every night, Usually if it occurs 5 or 6 times a week, Sometimes if it occurs 2 to 4 times a week, Rarely if it occurs once a week, and Never if it occurs less than once a week.

#### **BEDTIME**

Write in your child’s usual bedtime: Weeknights: \_\_\_\_:\_\_\_\_ am/pm  
Weekends: \_\_\_\_:\_\_\_\_ am/pm

	7 Always	5-6 Usually	2-4 Sometimes	1 Rarely	0 Never
1. Child goes to bed at the same time at night.					
2. Child falls asleep within 20 minutes after going to bed.					
3. Child falls asleep alone in own bed.					
4. Child falls asleep in parent’s or sibling’s bed.					
5. Child falls asleep with rocking or rhythmic movements.					
6. Child needs special object to fall asleep (doll, special blanket, stuffed animal, etc.).					
7. Child needs parent in the room to fall asleep.					
8. Child resists going to bed at bedtime.					
9. Child is afraid of sleeping in the dark.					

#### **SLEEP BEHAVIOR**

Write in your child’s usual amount of sleep each day (combining nighttime sleep and naps):  
\_\_\_\_ hours and \_\_\_\_ mins

	7 Always	5-6 Usually	2-4 Sometimes	1 Rarely	0 Never
10. Child sleeps about the same amount each day.					
11. Child is restless and moves a lot during sleep.					
12. Child moves to someone else's bed during the night (parent, sibling, etc.).					
13. Child grinds teeth during sleep (your dentist may have told you this.)					
14. Child snores loudly.					
15. Child awakens during the night and is sweating, screaming, and inconsolable.					
16. Child naps during the day.					
Write in the number of minutes the nap usually lasts: _____ minutes					

### **WAKING DURING THE NIGHT**

	7 Always	5-6 Usually	2-4 Sometimes	1 Rarely	0 Never
17. Child wakes up once during the night.					
18. Child wakes up more than once during the night.					

### **MORNING WAKE UP**

Write in the time child usually wakes up in the morning: Weekdays: \_\_\_\_\_:\_\_\_\_\_ am/pm  
Weekends: \_\_\_\_\_:\_\_\_\_\_ am/pm

	7 Always	5-6 Usually	2-4 Sometimes	1 Rarely	0 Never
19. Child wakes up by him/herself.					
20. Child wakes up very early in the morning (or, earlier than necessary or desired).					
21. Child seems tired during the daytime.					
22. Child falls asleep while involved in activities.					

## Appendix H. Raw Demographic Data of Participants

ID	Farm	Gender	Age	Diagnosis	Types of Therapy
01	1	F	7	Asperger, ADHD, Turner syndrome, Aortic Bicuspid Valve	Neuro-feedback
02	2	M	4	Autism, Global Delay	Therapeutic play, Floor time, PT, OT, Equine
03	2	M	18	Physically/Cognitively delayed (severe)	Vision, OT, PT, ST
04	2	M	8	High functioning autism	OT, ST
05	2	F	6	Autism	ABA, OT, PT, ST, Music, Dance, Swim, Biomedical, Diet
06	3	M	15	Developmental disorder, Tourette's syndrome	
07	3	M	9	Autism	OT, ST, Equine
08	3	M	9	Asperger	OT, PT, ST, Behavioral
09	3	M	18	PDD-NOS	OT, ST, Equine
10	4	M	8 *Twin	ADHD, Learning disability	OT, PT
11	4	M	8 *Twin	ADHD, Learning disability	OT, PT
12	4	F	9	Tetrasomy 13 mosaic, Dandy Walker Syndrome	OT, PT, ST, Hearing, Sign Language, Equine
13	4	F	11	Multiple disabled	OT, ST, PT
14	5	F	6	Anxiety	Counseling, Medication
15	5	M	11		
16	5	F	10		
17	5	F	8		
18	5	F	9	Other	Retention of memory
19	5	F	11		None
20	6	F	29	Chromosomal abnormality 2q37 deletion	OT, PT, ST, Aquatic therapy
21	6	F	10	Asperger syndrome, Bipolar, ADHD	OT, PT, ST, Mobile therapy, under care of psychiatrist
22	6	M	11	Other	OT, PT, ST
23	6	F	18	Autism	OT, ST

24	6	M	11	Autism, PDD-NOS	OT, PT, ABA Therapy, Hippotherapy
25	7	M	10	High functioning autism	OT, PT, ST, Mobile therapy, TSS Services, education support
26	7	M	11	Asperger, developmental coordination disorder	OT, PT, Social skills therapies
27	7	F	10	Kabuki syndrome	OT, PT, ST, Equine
28	7	F	9	ADHD/ODD	One-on-one cognitive behavior therapy
29	7	F	6	Cockayne syndrome	Horseback riding, water therapy
30	7	M	10	High functioning autism	OT, PT, ST
31	7	F	14	PDD and scoliosis	OT, ST, Group therapy
32	7	M	15	Asperger	Therapeutic riding lessons
33	8	M	15	Cerebral dysgenesis	OT, PT, ST
34	8	M	8	Autism	OT, ST, EI Intervention for PT
35	8	M	12	Interstitial deletion 22	OT, PT, ST, Swim
36	8	F	7	High functioning autism	OT, PT, ST, Hippotherapy
37	8	F	9	High functioning autism	OT, Swimming, Riding
38	8	F	32	Cerebral palsy	PT
39	8	F	11	High functioning autism	OT, PT, ST, Therapeutic riding
40	9	M	8	Static motor encephalopathy, ADHD, Low tone, apraxia	OT, PT, ST
41	9	F	25	High functioning autism, Cerebral palsy	OT, PT, ST, Therapeutic riding
42	10	F	4		Speech class
43	11	M	9	Asperger	OT, ST, social group therapy, wrap around behavioral health, out-patient psychological therapy, DIR floor time therapy

\*Numbers that are highlighted indicate participants that completed an initial and follow-up questionnaire and were included in the full analysis

## Appendix I. Riding History of Child

Participant	First time on a horse?	First time receiving therapeutic lessons?	First therapeutic lesson at this facility?	How long receiving therapeutic lessons?	How long riding at this facility?
01	Y	Y	Y	3 months	
02	Y	Y	Y	1 month	N/A
03	N	N	N	7 years	4 years
04	Y	Y			
05	N	N	Y	1 year	
06	N	N	N	6 years	6 years
07	N	N			
08	N	N	N	3 years	3 years
09	N	N	N	4 years	4 years
10	N	Y		13 months	13 months
11	N	Y		13 months	13 months
12	N	N	N	7 years	5 years
13	Y	N	N	1.5 years	1.5 years
14	N	N	N	2 years	2 years
15					
16					
17					
18	N	N	N	5 years	5 years
19	Y				
20	Y	Y	N/A	N/A	N/A
21	N	N	N	2 years	2 years
22	N	N	N	2 years	
23	N	N	N	2 years	2 years
24	N	N	N	4 years	7 months
25	N	N	N	2.5 years	2.5 years
26	Y	Y	N/A	N/A	N/A
27	N	N	N	1 year	1 year
28	Y	N	N	2 years	2 years
29	N	N	N	2 years	1 year
30	N	N	N	5 years	5 years
31	N	N	N	2 years	2 years
32	N	N	N	3 years	3 years
33	N	N	N	4-5 years	4-5 years
34	Y	Y			
35	N	N	N		7+ years
36	N	N	N	3 years	3 years
37	Y	Y			
38	N	N	N	1 year	1 year
39	N	N	N	7 years	7 years
40	N	N	N	3 years	3 years
41	N	N	N	20 years	20 years
42	N	Y	N/A	N/A	N/A
43	N	N	N	3 months	3 months

This table shows a brief look at the riding history of each participant. Participants in dark gray were individuals that completed an initial and follow-up questionnaire. Other participants



only completed an initial questionnaire. This table shows how long a rider has been riding and how long they have been riding at the facility where the parent was interviewed.

## **Appendix J. Qualitative and Demographic Results**

Within each questionnaire set, there was a variety of qualitative data that was also collected. These data included age and diagnoses of the riders, and therapies used, as well as how long the riders had been riding and how helpful the parents believed the individual therapeutic techniques to be. It was also asked why parents chose therapeutic riding for their child and even why they selected the particular facility. The qualitative data comes from the pre and post assessments in the questionnaire documents. These questionnaires were written by the researchers for the purpose of gaining additional demographic and qualitative information. These questionnaires, along with all other questionnaires, can be found in the Appendix of this document. Selected raw data on each participant can also be found in the Appendix of this document.

There were 43 participants that completed at least the initial portion of the questionnaire. This included 21 male riders and 22 female riders that were evaluated by their parents. Ages ranged from 4-32 overall, and 4-18 for males and 4-32 for females. The average age of the 43 riders being evaluated was 11.37 years. The average age for male riders was 10.86 years and the average for female riders was 11.86 years. Participants with older children were allowed to participate if they wished. Some noted that their older children had the mental capacity of someone much younger. Participants were told that some questions of the questionnaire might not apply to their child because the questionnaires were designed for children and adolescents. They were not turned down if they wished to include their child. Of the 43 participants, 16 completed the initial and the follow-up questionnaire. Of the 16 participants that completed all of the requirements for the study, the ages of the riders ranged from 4-29. The average age was

11.44 years. There were 12 male riders and 4 female riders. Ages for the male riders ranged from 4-18 and 6-29 for the female riders. The average age for male riders within the 16 participants was 10.75 years. The average age for female riders within the 16 participants was 13.5 years.

The 43 participants noted that their children had various diagnoses/reasons for receiving treatment. Even though the main focus of this study was to be on autism spectrum disorders, participation was open to anyone that wished to participate. Of the 43 participants, 21 of them noted an autism or an autism-related diagnosis for their child (including Asperger and PDD). Of the 16 participants that completed the initial and follow-up portions of the questionnaire, 6 of those individuals noted an autism or autism-related diagnosis for their child. There was an array of diagnoses amongst the riders. There were various psychological and physical diagnoses. In order for a better analysis regarding the effects of equine-assisted activities and therapies per diagnosis, greater numbers per diagnosis should be represented in future studies.

Of the 43 participants that completed a portion of the questionnaire, 38 participants noted various other therapies that their children were receiving or had received (as asked in the pre-assessment questionnaire). Only one person included only therapeutic riding lessons as the type of therapy that their child had received so far. ABA therapy (Applied Behavior Analysis), aquatic therapy, behavioral therapy, biomedical therapy, counseling, dance therapy, diet changes/monitoring, education support, EI Intervention for PT (Early Intervention for Physical Therapy), equine therapies/hippotherapy/therapeutic riding, DIR/floor time therapy (Developmental Individual-difference Relationship-based model), group therapy, hearing therapy, medication, mobile therapy, music therapy, neuro-feedback therapy, occupational therapy, one-on-one cognitive-behavior therapy, out-patient psychological therapy, physical

therapy, retention of memory therapy, sign-language training, social skills therapies, social group therapy, speech class or therapy, swim therapy, therapeutic play, TSS Services (Therapeutic Support Staff), under care of psychiatrist, vision therapy, water therapy, and wrap around behavioral health were the other therapies/therapeutic techniques that the participants included as the types of therapies that their children had received so far. This collection of data from 38 people clearly demonstrates the fact that equine therapies and activities are usually seen as an adjunct to an existing therapeutic framework and are commonly combined with other therapies (Klontz, 2007; Hofmann, 2010; Millhouse-Flourie, 2004; Nimer, 2007; Yorke, 2008).

Appendix9 shows some additional data that the participants provided in the pre-assessment. This includes data from the 43 individuals that completed the initial questionnaire. In this assessment, it was asked if it was their child's first time riding a horse, and if this was their child's first time receiving a therapeutic riding lesson, to which the participant would answer "yes" or "no." It was also asked if this was their child's first therapeutic riding lesson at this facility, to which the participant would also answer "yes" or "no." Then, it was asked for approximately how long their child had participated in a therapeutic riding activity. Next, it was asked if this was not their child's first lesson at this particular riding facility, for approximately how long had their child participated in a therapeutic riding activity at that facility. Blank spaces indicate that there was no response from the participant and a response of "N/A" indicates that the participant noted that the question in particular was not applicable to their case.

The data shown in Appendix9 indicates that at the time of assessment, it was usually not the rider's first time on a horse. There were 10 parents that chose "yes," indicating that it was their child's first time on a horse. In-person interviews between parents and the primary researcher at the time of the first assessment, as well as open-ended questions within the

questionnaires, revealed that, in fact, no child was getting on a horse for the very first time on the day that the initial questionnaire was answered. If “yes” was chosen as the answer to this question, it seemed that the child had only been riding for a short duration of time. However, if a parent had chosen “yes” to say that it was their child’s first time riding a horse and noted years for the duration of time for how long the child had been receiving therapeutic riding lessons or riding at the current facility (Participants 13 and 28), this obviously indicates to the researcher that the child was not new to riding a horse. In-person interviews and/or open-ended questions seemed to reveal that the children had never ridden before beginning their equine-assisted activities or therapies. How a person chose to answer a question was seemingly determined by their subjective interpretation of the question. For example, Participant 05 chose to answer that it was not their child’s first time riding, but that it was their child’s first time riding at a new facility. The duration of time that the child of Participant 05 had been receiving therapeutic riding lessons was noted as 1 year. This is shorter than the duration of time that the children of Participants 13 and 28 had been receiving therapeutic riding lessons (recorded as 1.5 years and 2 years respectively). However, both Participants 13 and 28 chose to answer that it was their child’s first time on a horse.

## **Appendix K. Open-Ended Responses**

On the initial questionnaire, participants were asked to open-endedly describe why they chose therapeutic riding for their child and also why they chose the particular facility that they did. Answers varied, but generally parents had heard promising things about the benefits of therapeutic riding and/or were also looking to provide their child with a different form of therapy (that either did not feel like therapy or was more enjoyable, and/or provided their child with additional benefits that they may not have been receiving in their more traditional/other therapies).

Parents noted many different reasons why they had chosen therapeutic riding for their child. Some parents mentioned how their child loves animals/horses and took an interest/liking to the new activity of riding. These parents often mentioned that they had heard great things about therapeutic riding. Additional families elaborated that their child loves horses and riding, and therapeutic riding helped their child learn a new skill and build confidence. Other parents also mentioned how animals seem to calm their child down and how it seemed more enjoyable than other therapies. Some parents chose therapeutic riding for their child because they hoped that their child would enjoy riding and that it would calm their child, and they thought that their child would enjoy the responsibility of taking care of an animal. Another parent elaborated how they wanted a therapy for their child that didn't feel like therapy. Their child does not look forward to going to any of the other therapies and actually complains about going. Their child has never complained about going to horse therapy. One parent noted that due to some issues, the participant's child was not able to attend school and needed one-on-one tutoring. They had a lot of open time and wanted to fill the time with therapeutic and community activities rather than

staying at home. Their child loves animals and they calm him when he touches them, so they thought grooming and riding would be something that he would enjoy. Overall, enjoyment seemed to be a big factor in why therapeutic riding was chosen for the children riders, in addition to many other benefits. This indicates that people seem to be drawn to therapeutic riding activities because of the perceived benefits as well as due to how enjoyable it is for the participants.

Other families chose therapeutic riding for their child because they had received funding through a grant and those chose to try therapeutic riding because they felt that therapeutic riding addresses many things that cannot be duplicated in traditional therapy sessions. Many families hoped that riding would help their child's muscles and self-confidence. Another family added that they wanted their child to experience some social interaction. Furthermore, that family's child also has special physical needs and they believe that therapeutic riding would help with trunk strengthening, muscle tone, flexibility, and motor skill improvement and maintenance. Additional families also noted these reasons, as well as balance and core strengthening as why they were drawn to therapeutic riding. Another family wrote that they were drawn to therapeutic riding because they believed it would help strengthen their child's legs and back so that they could gain the strength to walk. Many parents noted that they wanted a therapy to help their child's trunk stability, spasticity, and/or muscle strength and flexibility for movement. Additionally, benefits to attention span and improvements to fine and gross motor skills were also mentioned as reasons parents cited for choosing therapeutic riding for their child. Other parents mentioned social and speech improvements as reasons for choosing therapeutic riding for their child as well. Many families were drawn to therapeutic riding because they wanted to give their child a variety of therapeutic services. Horseback riding involves both physical and

mental/education benefits. One family noted how they were drawn to therapeutic riding because it combined physical therapy, occupational therapy, and exercise techniques. Therapeutic riding also allows the rider to experience non-stop activity/exercise during the entire lesson, where they can also focus and learn to follow directions. Benefits to bonding and learning to paying attention were surprise benefits to some parents. These parents felt that the structure of the therapeutic riding lessons was appropriate and clear/rigid in what needed to be done to benefit the riders, but there were also unexpected benefits, like the horse/child partnership. Initially, some children were “scared to death of horses,” but most quickly began to bond with them to the point where they call the horses their “best friends.” One parent noted that they had always known the therapeutic value of horses, as the parent had grown up riding. They believed in the therapeutic benefits, such as core strength and balance, and that horses can help teach respect and responsibility and give an emotional outlet and sense of accomplishment.

There are many different senses that are impacted by horses and the farm/outdoor environment, with so many different sights, sounds, smells, and situations. Horseback riding is such a different experience for many individuals. One family was drawn to therapeutic riding because they believed that it would help improve their child’s ability to be around dirt and bugs. Others noted that they wanted to expose their child to outdoor activities, different people, and different stimulations that are “better than computer games.” Another family chose therapeutic riding for their child because they wanted to see their child’s progress through a new experience.

Often time, doctors, counselors, or friends recommend therapeutic riding or other therapeutic techniques to a parent. Some families in this study commented that therapeutic riding was recommended by their child’s neuro-doctor and once the family looked into it, the child was hooked. When their child was in contact with animals, their child becomes extremely

happy. It has made their child so happy, proud, and confident, and they feel it has “truly been a blessing.” Other families reiterated that therapeutic riding was recommended by their child’s Medicaid case coordinator. Their child has also always been fascinated by and loves animals, so it seemed like a natural fit. Other families had heard about therapeutic riding from the therapists at their child’s school, or from a friend who also had a child receiving therapeutic riding for a similar/same diagnosis as their child, or it was recommended by word of mouth.

Some families did talk about the cost of therapeutic riding. Often times, the costs of therapeutic riding are not covered by insurance and parents/participants have to pay out of pocket. This can be a major deterrent for some people, as costs can quickly become too expensive for some families. Many families have noted how much the therapeutic riding experience has helped their child in many different ways, often in many more ways than they had even expected. Sometimes grants or scholarships can become available to families. One family had tried therapeutic riding before, but had to stop at various times due to costs. They mentioned that they had found it to be helpful for their child in the past, but due to the costs, they were unable to afford it at certain times – they even put in a request through a neurologist insurance, but costs were not covered. Most families try to do their best, despite the costs, because they strongly believe in all of the benefits that their child is receiving.

Enjoyment and perceived benefits are a big factor in the employment of therapeutic riding activities. As a generality, it is not within human nature to pay for something that is not enjoyed, not perceived as helpful, and/or not wanted. We usually put our resources towards things that we gain benefits, enjoyment, and/or happiness from. Generally, those that are interviewed about therapeutic riding will almost always describe how they find it beneficial. Those that do not find it beneficial are usually not found because therapeutic riding is generally



paid for out of pocket. People that do not like therapeutic riding or find that they do not benefit from it will start spending their money elsewhere.

Once the decision has been made to try therapeutic riding, a facility needs to be chosen. There are many reasons why a facility might be chosen. Location, reputation, cost, and lesson structure are all often cited as important factors. Some farms go through no certification processes for their instructors and provide “therapeutic riding lessons.” These farms may have their own merit, but they were not included in this study because only farms following the PATH Intl. certification/structure/format were contacted. There are other certification processes as well that other farms may follow. The facility certification/structure may be an important factor for some parents/participants if they believe more in a certain philosophy. Specific certifications were not cited by any of the parents in this study as reasons why they chose a particular facility. However, some families did note that they went to an information session or open house held at the farm where the therapist spoke about the program and they could see what the farm offered. They realized that they liked the instructor, staff, philosophy, and/or process that they do at the farm, as well as the rates (costs).

In most cases, the first reason that is listed for why a facility was chosen is location. If a facility is local/“close to home,” it is more likely that one facility will be chosen over another. One family noted that they chose their particular facility because it was closer to their home, but they also knew the instructor. The instructor had also previously worked with their child in an occupational therapy setting in the school system. Families often choose a particular riding facility because it was close to home and the atmosphere at the farm was comfortable to them. Parents noted that they often chose a facility because they found the facility and/or program director very professional, responsive (to phone calls), and felt like the director was taking good

care of the program. Location, as well as the facility's responsiveness to the family's request to begin therapy, are important selection criteria. Scheduling ease/no waiting period are often important factors for a facility's selection.

Other reasons for choosing a particular riding facility were the facility's reputation ("best around") and/or location ("close to home"). A recommendation from a family member, friend, doctor/counselor/therapist, or another facility would often carry a lot of weight as well. In some notable cases, the facility was recommended to the family because one of the staff members was a family friend or family member or other family members were riders at the same facility. Some family members had also previously volunteered at the chosen riding facility in some cases. In other cases, the chosen because it was on a list of activities that a rehabilitation organization provided or the facility and the benefits of therapeutic riding were otherwise advertised. One family described how the facility was recommended to the family. They spoke to the therapist at the facility before committing 100%.

A family must feel comfortable with the instructor and facility. This also goes back to the philosophy of the facility and how an instructor will direct the lesson program. If a family does not feel comfortable or safe, they will probably not choose a particular riding facility. Some parents might want a private lesson/one-on-one time, while some might want their child to experience lessons in a group setting. Parents will choose a facility where they are more likely to get the type of experience that they want for their child. If a family enjoys their experience at a farm and sees benefits in their child, they will also be more likely to recommend a particular facility to another individual. For example, one family mentioned that they came for a lesson at their current and they have been at the same facility ever since. They and their child love all of the instructors. Their child and the horse have a special bond. They truly feel that riding has

helped their child's confidence and they would highly recommend the facility to anyone else. Other families noted that the equine professional/director was amazing to talk to when they inquired about lessons. Some families also noted that they chose a particular facility because they had previously worked with the therapist. Clearly, liking their experience, surroundings, and the people that are working with their child is of utmost importance – as with almost all cases in life. This is especially true when costs are coming out of pocket. A family, or any person, is not likely to put money towards something that they do not enjoy, see as beneficial, or feel comfortable with.

Similarly, lower cost/ability to pay, or scholarship fund provided are also other main reasons that parents cite for choosing a particular facility. Facilities that offered significant scholarships often made it possible for a family to afford therapeutic riding lessons.

On a whole, there are many different reasons why a facility might be selected as the location where a participant receives therapeutic riding lessons. Each person has their own set of reasons. Cost and location are often big factors for individuals as therapeutic riding activities are often not covered by insurance companies, so all costs need to be factored into a family's budget.

## **Appendix L. Facility Information**

In order to be a part of this study, all instructors/facilities had to be PATH International (PATH Intl.) certified and follow the PATH standards. Often, a licensed occupational therapist was the certified therapeutic riding instructor, but that wasn't always the case. Some farms had additional certification processes per state, such as requiring a certification through the Pennsylvania Council on Therapeutic Horsemanship. Or, the facility itself had a required training program that must be completed, in addition to the PATH certification.

Equine-Facilitated Therapy, Riding Therapy, Equine-Assisted Learning and Therapy, Equine-Assisted Activities, Equine-Facilitated Psychotherapy, Equine-Facilitated Learning are all various terms that the different facilities within this study used to describe their lesson programs. Each term is different and has specific meanings. However, this is a challenging aspect of research in this field because researchers may not know how to compare these terms or realize that they can. This is a methodological issue within this field of research.

Each facility was given a questionnaire to describe their lesson programs. PATH Intl. is not the only certification available for therapeutic riding – some farms might not even have a certification. This does not mean that participants do not receive benefits from these farms. For comparison purposes and to eliminate some confounding variables, PATH Intl. was chosen as the certification process that farms had to have in order to participate. There is some knowledge about the lesson structure/philosophy of the participating farms because they were all PATH Intl. certified farms and instructors. However, the researchers asked further questions to learn even more about each farm. Each facility was a little different.

Some facilities were only therapeutic riding facilities. Some facilities were some combination of therapeutic and able-bodied lessons. Some facilities have boarders, some do not.

Some facilities are separate entities within another farming operation – often renting stalls and arena time in which to run their therapeutic program. Different facilities may have certain rider requirements (usually age or weight restrictions). Certain restrictions are made for the safety of the riders and horses. Weight restrictions are something that many participants do not understand. These restrictions are made for the safety and comfort of the equine therapists. Horses can generally comfortably carry 20% of their body weight. This may change with the age and conformation of the horse and the job that the horse is being asked to do. Farms might not have the availability of larger horses, such as draft horses, that can carry more weight. Furthermore, larger and taller horses pose an additional challenge of how to safely hold a rider in place, if necessary. Sometimes only smaller horses might be available. A farm certainly holds the right to look after the safety and comfort of their equine therapists. They should not and usually will not put their horses in an uncomfortable situation. Furthermore, facilities will usually only accept riders that have diagnoses within their skill-base and they may connect riders to another farm that may be able to more appropriately meet their needs. Farms may focus more on physical therapy or psychotherapy or both, meeting a wide array of needs. Some farms may not have the equipment necessary to help certain riders, such as ramps or lifts. This may dictate the types of clients that a facility can accept. Some facilities are smaller larger, depending on funding, available personnel, available horses, and their farm (leased or owned space). Some facilities run programs throughout the year, while others only operate in the warmer months. This may be due to amenities at a facility, such as an indoor. For example, email correspondence with a farm in Alaska described how this farm does not have an indoor arena and the cold, snowy winters in Alaska prevent this farm from offering lessons in the winter – especially without an indoor arena. Other facilities might not operate lessons in the winter, even with an

indoor, because of the decreased likelihood of riders coming when it is cold or inclement conditions. Each facility is a little different, but they all have the larger goal of helping individuals through the healing power of the horse-human interaction.

Facility directors described their facilities on the questionnaire that was given to them. Some farms had lesson programs, some farms were only therapeutic farms, some farms used leased space, some farms were huge operations, and some farms were at universities. Each farm was a little different, but still similar and operating within their means. One facility described themselves as a training, boarding, and lesson facility. This farm hosts a variety of students of all levels, but they also run the therapeutic riding lessons on Mondays and Thursdays. Thus, this particular farm is not strictly run as a therapeutic riding facility. Approximately 15% of the farm's business is dedicated to therapeutic riding. The facility provides therapeutic riding for conditions such as cerebral palsy, blindness, Turner Syndrome, autism spectrum disorders, Asperger's, ADHD, wheelchair bound conditions, Globally Delayed, recovering alcoholics, behavioral issues, Down Syndrome, etc. A similar facility described themselves as a farm that provides therapeutic riding and hippotherapy, with therapeutic riding lessons being offered for all types of conditions. However, this facility is not strictly run as a therapeutic riding facility, in that they do have boarders and other types of riding lessons. The facility director estimated that approximately 25% of their business is therapeutic riding. Another similar farm described themselves as a facility that runs multiple programs – one for “able bodied” riders and one for Equine-Facilitated Therapy. The breakdown of business for therapeutic riding at this farm is approximately 50%. Anyone who wants to come to the facility is welcome as long as their physician will allow them to participate.

Another farm is strictly run as a therapeutic riding facility. They do include equine-assisted activities for the able-bodied siblings of those with special needs. They also conduct equine-facilitated psychotherapy and equine-facilitated learning lessons (mostly ground lessons) and Services for Heroes (a program designed to serve the needs of veterans). 100% of this farm's business is nonprofit services to the disabled. They have no boarders or other activities there. The farm provides equine-assisted activities to anyone with a disability over the age of three. This includes physical, behavioral, emotional, and learning disabilities of great variety. Only those conditions which present a hazard to the participant as detailed by PATH Intl. standards are exempt. The farm also requires a physician's referral indicating that the potential participant does not have a contraindication to the safe participation in the activity of riding a horse (e.g. head and neck instability). A similar facility described themselves as a privately owned facility where they offer therapeutic horseback riding for children and adults with disabilities. At their farm they have helped individuals with just about any disability including, cerebral palsy, spina bifida, multiple sclerosis, Rett's Syndrome, autism, Downs Syndrome, intellectually challenged, ADHD, PDD, chromosomal abnormalities, vision and/or hearing impaired, etc. Riders must have permission from their doctor. They run the program as a strictly therapeutic riding facility.

Another facility described themselves as a small riding facility that serves the local community with riding for people (ages 2-99) with physical, emotional, cognitive, and behavioral issues. All physical, mental, cognitive, and/or behavioral disabilities that are not a contraindication to riding and within the physical limits of rider and horse are welcome at the facility. This facility is strictly run as a therapeutic riding facility. A similar facility described themselves as a small facility for individuals living with varied mental health, physical, and

intellectual disabilities. This facility is home to 18 program horses only and is strictly run as a therapeutic facility. A PATH certification is required for instructors, but not required to begin instruction.

Another facility within this study is a small organization of only 4 horses and about 50 clients that ride on a weekly basis. This facility only provides private and semi-private lessons. The organization is run out of a larger farm, where they lease stalls and arena time. The farm on a whole has boarders and teaches able-bodied riders. However, the therapeutic organization is run as a separate entity and strictly teaches therapeutic riding for almost all disabilities.

A final facility described themselves as a privately operating facility. This facility is run at a college where they run a college equine studies program as well as therapeutic riding instructor training programs. The equine program on a whole does offer a wide variety of lessons/instruction in hunt seat, dressage, and other lessons. However, the specific section of the barn for therapeutic riding is only for therapeutic riding (it is a very large facility on a whole). Boarding at the farm is only for students of the college and for college-owned horses, but the boarders and various lesson horses are all in separate barns. Anyone who is cleared to ride by their doctors or those needing hippotherapy, except those with senior mental health issues, are welcome to ride at the facility.

Similar to the varying descriptions of the farms that the directors provided, each facility director described their lessons in a different way. There are similar themes throughout. The biggest differences between farms are usually regarding whether they are open/operate all year or not or sell lessons in packages/seasons or per lesson. The structure/philosophy of the instruction period is generally similar, as per PATH Intl. requirements and individualized per



client needs. Overall, almost all of the participants have to pay for lessons out of pocket, as they are almost always not covered by insurance. Prices vary per region.

One farm described a common theme amongst the facilities that were studied for this project. Sessions at that farm, as the others, are run dependent on the individual goals and abilities of the clients. They can incorporate grooming, tacking, and leading skills on the ground. Most clients spend a majority of their time riding/mounted. Basic riding skills are taught, depending on the ability of the rider. Various manipulative and arena set ups are used to accomplish their goals. This organization tries to have the same instructor and volunteers each week. Further descriptions go on to say that lessons try to incorporate grooming/tacking, riding time while integrating games and riding skills, and untacking. They aim for limited to no instructor rotation (same instructor for each rider, each week). Most lessons incorporate exercises specifically for that particular rider. Some lessons try to incorporate some Centered Riding, position, steering, two-point, and games to enhance the lesson, such as “find the pink ring,” which encourages steering, color recognition, and following directions. They look toward the participant as being as independent as possible, but taking care of their individual needs as well. Generally, the same instructor is used, but occasionally there are substitutes. These are all common themes

Generally, lessons can be paid in packages or as you go, per lesson, per month, or per season. Charges vary per farm. Some lessons can be around \$90 per session, which insurance does not cover (Maryland). Other noted costs were a half hour lesson for \$35 and an hour for \$45. Insurance does not cover these costs, as the state (Maine) does not consider hippotherapy valid. Other lessons were \$25 at a facility in rural Maryland for a group lesson of 5. Semi-private lessons are \$45 and \$60 for private lessons. Costs for lessons at a particular New Jersey

farm are \$35/hour or for a private lesson. They also offer a block of 6 lessons that can be paid for together. \$185 is the cost for a week of summer camp. Each lesson at a Pennsylvania farm costs \$45 per lesson and participants pay per lesson. Some participants opt to pay per month, up front. Insurance may allow for partial coverage, however, most insurance companies do not. Most participants pay out of pocket, or with some combination of funding and grants. Costs for lessons are set at \$150/month for lessons at another Pennsylvania farm. Parents are also asked to contribute \$60 per year to help obtain liability insurance for the volunteers at the farm. Parents/participants pay at the beginning of each month. If someone wishes to commit to only single lessons at a time, it is \$60 per lesson. There is a one-time initial evaluation fee to assess the applicant's needs, goals, and to determine the equine and volunteer staff that are best suited to meet those needs. Financial aid is offered to the best of the facility's ability for those that cannot pay fees. Insurance usually does not cover the costs, unfortunately. Participants pay per session (season packages), with costs ranging from \$32.50-33.75 per lesson at a New York farm (depending on how long their season-session lasts). Insurance usually does not help at all. Lessons cost \$50 per hour for a therapeutic riding lesson or \$80 for a 45 minute hippotherapy session with the physical therapists onsite at a New Jersey farm. The therapeutic riding students usually purchase lessons for a 10 week session. Riding every week is \$500 for 10 lessons and every other week is \$250 for 5 lessons at this farm. The vast majority of students are unable to collect insurance benefits. Only some of the hippotherapy students are able to have some costs paid for with the help of insurance money. Finally, for costs at another farm, "tuition" is charged for each session and it must be paid in advance. It costs \$200 for an 8-week session and \$175 for the 7-week session. This farm is not an insurance provider, so insurance does not pay for lessons. However, some organizations such as certain mental health agencies will cover all or

part of the tuition for a rider. The farm also grants half-tuition financial aid to riders whose families can demonstrate need. Overall, whatever the costs may be, a general consistency is that participants get no money from insurance companies.

Some farms said that they do not run their program as “lessons.” They consider their instruction periods as private “sessions”, which last 30 minutes. Clients can stay for as long as they benefit. Clients are reassessed every 6 months. On other farms, lessons could be one hour or a half hour. Lessons are run as open-ended (not as set “packages” or seasons) – and clients can continue for as long as they would like. This facility is also open year round. Another farm describes how lessons are set for 90 minutes. The participants help groom the horse, tack them up, ride for about 45 minutes, then help untack and groom. The participants are well supervised. Sometimes a student cannot tack up their own horse, but they always have the participant do some grooming. Lessons at yet another farm typically last for about 40 minutes for a group and 25 minutes for a private lesson. Lessons runs for 45 weeks out of the year. Costs for lessons vary between semi-private and private lessons. They also offer a blocks lessons that can be paid for together. Groundwork and grooming is only covered in summer camp sessions. Generally, each lesson works on riding skills, exercises, games, and horsemanship knowledge. Trainers and volunteers are rotated, as many are being trained as well.

Other farms described their lesson protocols in a little more detail. Another farm described how their lessons are conducted for a 45 minute period. There are no set sessions or number of lessons that need to be committed to. Everything in the lessons are individualized. Enrollees generally commit to one month of lessons at a time with a guarantee of four lessons in a month. Depending on the day they choose to come, they may get in five lessons a month. Participants can continue for as long as they believe that they are receiving benefits from the

involvement. Aside from repeated late cancellations or “no show” incidences, only behavioral incidents which risk injury to the student, staff, volunteers, or the horses would cause the farm to ask the student to leave the program. Medical clearance for participation must be received annually from the physician caring for the student. Lessons are completely individualized and directed by the PATH Intl. certified instructor, who works with the farm as an independent contractor. The instructor is offered suitable potential applicants and the instructor then decides to accept the new student or not. The family and the instructor then arrange the lesson schedule in accordance with the existing lessons scheduled and the arena use anticipated by the program. The instructor may have the student assist with grooming and tacking the horse, or not, depending upon the therapeutic goals and the student’s abilities. Equine preparation is considered part of the lesson time, when applicable. Approximately 10-15 minutes of the lesson is spent on preparation and warm-up exercises (leading the horse in the arena) prior to mounting. Each horse, at this facility, is groomed prior to the student’s arrival by volunteers as well. Each lesson starts with riding in an enclosed arena after a warm-up until a determination is made as to the kind of day that it is for the student and the horse. As long as the two are working well and the weather cooperative, a property walk is frequently included. Some students are ridden through a “sensory trail” as part of their lesson. The “sensory trail” at this farm is on a wooded section of the property that gives the riders the feeling of going on a “trail ride.” The rider visits stations that stimulate their senses and offer a greater appreciation of nature. Most lessons include games and obstacle course activities in the arena, prior to the property walk. Students might throw and catch a soft basketball while the horse is moving at a walk or while it is standing still. Students are expected to see themselves in the arena mirrors while mounted and learn to correct their position. They learn to sit centered and learn to become fully aware of their

body position relative to the horse. Exercises involving control and steering of the horse are always included. Lessons in this facility are generally private, unless it is felt that a semi-private lesson would benefit the students in question. Instructors sometimes fill in for each other when necessary, but in general, the student has the same instructor and volunteers for each lesson.

Other farms go on to describe that lessons at their farms run for 45 minutes with about 15 minutes dedicated to equine-facilitated learning. 30 minutes are dedicated to mounted activities. Lessons vary per client, based upon abilities. Some riders fatigue more quickly than others. Some riders would rather ride than interact with the horse on the ground. Lessons are run with the same instructor and this farm tries to keep each student with the same horse and same riding team (side-walkers and leaders). During lessons, each rider practices a warm-up, learns riding skills, plays a game, cools-down, and dismounts during their riding lesson. Lessons are run as open-ended sessions where participants can ride for as often or as little as they would like, and when they would like to.

Further farms describe how lessons at their farm are run as 1 hour group lessons or 40 minute private lessons. Lessons can also be purchased in a package of 4, 5, or 6 week sessions, running from March to November. One hour group lessons usually have up to 4 riders. Mounted time ranges, depending on mounting time, but they try to get riders in the saddle for 40-45 minutes, if not more. Riders can help with grooming if they arrive early. The facility tries to keep the same instructors/volunteers for each rider. Riders participate in games and activities relating to their disability and the goals that they have set for themselves.

The majority of students at another farm groom and tack their horses prior to their lesson. The farm has a handful of students that are “ride only” due to their age or ability. The majority of the lessons that they run are private with the instructor. The entire lessons are an hour long,

which includes 20-25 minutes of grooming and tacking and then 35-40 minutes of riding. The instructor remains the same instructor, unless the student or family asks to switch instructors or days/time and the same instructor is not available.

Another farm runs two 8-week sessions of lessons and one 7-week session of lessons (in the fall). This runs from April through the end of October. Riders can choose to ride in one session or all three. They also may return year after year, as many riders do. However, this farm has a 150lb weight limit, so if the participants grow to reach this weight, the facility can no longer accommodate them. The farm offers private half-hour lessons for riders who are either too young or else too physically, mentally, or emotionally challenged to be able to help get their horses ready to ride. These riders spend the full half-hour on their horse. Riders who are capable of helping to get their horse ready receive a one-hour lesson. Part of their lesson is spent helping to groom and tack up their horse prior to riding. They do so for approximately 15 minutes. The volunteers encourage the rider to do as much as he or she possibly can. Once everyone is mounted, the instructor spends approximately 5 minutes directing warm-up exercises. Approximately 25 minutes is spent working on a riding skill or goal-oriented tasks. Weather permitting, this may even include a 10 minute trail ride through the fields with a stop at the farm pond to feed the fish. Often, the last several minutes on the horses are spent playing games such as “Red Light/Green Light” or “Simon Says.” After the mounted part of their lessons, the riders lead their horses back to their “parking spots” where they spend about 10 minutes unsaddling and grooming their horse again. The instructors remain the same throughout each session of lessons. Wherever possible, the volunteer helpers remain the same with each rider for every lesson.

Overall, there are similar themes of trying to keep things consistent with instruction for the participants. How a particular farm is run is generally varied, as well as their payment protocols. Each lesson is individualized for the client under the same umbrella of teaching philosophies within PATH Intl.

How the facilities obtain their horses also generally varies within a certain range. All of the horses go through a trial period at each farm and are slowly incorporated into a program with on-going training. Horses have to be deemed quiet and need to have an accepting disposition. Sometimes trial horses are brought into lessons and walked around as a lesson is instructed with another horse. This is so the trial horse can slowly begin to experience the therapeutic setting. Handlers work-with and slowly expose the new horse to what they might experience in a therapeutic riding lesson. Sometimes trainers employ Natural Horsemanship or other training techniques. Training and specialized desensitization to multiple stimuli is important. The horses must also learn to stand quietly at the mounting ramp and mounting block for the rider to mount. All of the horses used in a therapeutic setting are well known to their handlers and handled each day. Some particular horses may be better with certain clients than others and thus these horses may take on more of a lesson load than others. Horses are usually carefully monitored to make sure that they are not strained too heavily or overworked. If a horse becomes unable to handle therapeutic riding lessons, another home or program may need to be found for the safety of everyone involved.

What varies per program is how the facility comes by their horses. Some horses are owned by the directors or volunteers of the program. Some horses are leased or otherwise borrowed. Sometimes if a horse is leased, only a certain instructor may have permission to use that horse. Lease/borrowing agreements have specific protocols that need to be followed or the

use of the horse may be taken away. Many of the horses have been owned by the facility for a long time, sometimes even since birth. Horses can be owned or leased by a particular individual. They may also be owned or leased by a specific business (the riding facility or farm). Horses may be donated to the facility or the found/executive director. Some horses used in therapeutic settings have very interesting stories, such as being the son of 1978 Triple Crown winner, Affirmed. Furthermore, many farms are offered donations horses. Sometimes farms have to turn away horse donations because the horse may not meet the needs of their facility. Occasionally the horses that are offered for donation are old or lame horses that others are moving on from. Therapeutic farms may want to help these horses, but may need to look for a fitter horse that can handle the stress of riding lessons. If a horse cannot comfortably walk or trot under saddle, or even carry a rider comfortably, the stress of riding lessons may be too much for them. Cantering is not always done in therapeutic riding lessons, but it is used occasionally for some riders. When horses are evaluated, all things are considered – such as what the horse can do and what it would need to be able to do, as well as its diet and care needs. The comfort of the horse must always be considered. If the budget allows, additional horses may be purchased as well. Fundraising efforts are often needed when additional horses are needed for a program. All horses go through an evaluation, orientation-trial period, and on-going training by trainers. The amount of horses per farm varies per the size of the facility and their individual funding and clientele.



## **BIOGRAPHY OF THE AUTHOR**

Amy Hofmann started her college career at Bucknell University in Lewisburg, Pennsylvania. It was her dream since kindergarten to attend Bucknell University, following her grandfather and uncle. While at Bucknell University, she studied Animal Behavior and Environmental Studies. During that time, she did some research on tool use in new world monkeys. She received her B.S. in Animal Behavior and minored in Environmental Studies in 2008. In the fall of 2008, she began attending the University of Maine in Orono, Maine, following her dream of moving to Maine and working with horses. She began her Master's degree in Animal Science, studying Equine-Facilitated Psychotherapy for veterans with Posttraumatic Stress Disorder, which was completed in 2010. At that time, she also bought two retired race horses from the University of Maine, who have supported her through everything. In 2010, she began and Interdisciplinary Ph.D., coming course-work in the departments of Animal and Veterinary Sciences, Social Work, and Psychology. Her Ph.D. work involved hands-on research at various farms throughout the northeast region of the United States. She studied the efficacy of Equine-Facilitated Psychotherapy in children with autism spectrum disorders. Amy moved to Pennsylvania worked as a Program Assistant for her county's 4-H program through Penn State University Cooperative Extension while finishing her degree. Amy is a candidate for the Doctor of Philosophy degree Interdisciplinary in Equine-Assisted Psychotherapies from the University of Maine in August 2018.