THE EFFECTS OF EQUINE-ASSISTED PSYCHOTHERAPY ON EMOTION REGULATION: SELF-EFFICACY AND SELF-AWARENESS AS POTENTIAL MEDIATORS

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DEDICATION

In loving memory of Steven Dampsey, and Irving and Helen Silvers.

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PART A

A REVIEW OF THE LITERATURE

by

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Abstract

The Effects of Equine-Assisted Psychotherapy on Emotion Regulation: Self-Efficacy and Self-Awareness as Potential Mediators

Review of the Literature – Part A

by

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The evolving field of Equine-Assisted Psychotherapy (EAP) is centered upon the therapeutic benefits inherent in the nature of horses. Quantitative and qualitative studies suggest that EAP can improve self-efficacy (the belief in one's own abilities to achieve goals and influence outcomes), self-competence, self-awareness, and emotion regulation, while decreasing depression, anxiety, negative affect, and maladaptive behaviors. Overall, there is a paucity of research in this area; future studies would benefit from more rigorous methodology. In addition, examining the neurobiological underpinnings of attachment theory, nervous system regulation, and emotion regulation capacities that directly relate to EAP might reveal subtler yet potentially significant explanations for its benefits.

Key Words: equine-assisted psychotherapy, equine therapy, emotion regulation, self-efficacy, self-awareness

Introduction

Pet facilitated therapy (PFT), or the use of animals in the treatment of mental health issues dates back to 1792, when patients learned to care for themselves through caring for animals (Altschuler, 1999). In the 1960s, child psychologist, Dr. Boris Levinson developed animal assisted therapy (AAT) by using his dog to help facilitate psychotherapy with children (Lentini & Knox, 2009). Since then, research studies have shown improvement in psychological and physical symptoms when animals are used as part of the therapy experience (Klontz, Bivens, Leinart, & Klontz, 2007). Other studies have shown positive effects of AAT on social attention, self-efficacy, interpersonal interactions, mood disorders, and physiological changes in heart rate and cortisol levels (Beetz, Uvnas-Moberg, Julius, & Kotrschal, 2012; Berget, Ekeberg, & Braastad, 2008; Chardonnens, 2011; Odendaal, 2000).

One type of AAT involves the use of horses and is known as Equine Assisted Psychotherapy (EAP). The roots of EAP began in Europe over two centuries ago and mainly involved horseback riding for treating such psychological ailments as hypochondria and hysteria, as well as physical problems related to decreased motor function (Frewin & Gardiner, 2005). More recently, therapeutic horseback riding involving mounted activities and the practice of various riding disciplines was developed along with hippotherapy, which involves controlled and modified mounted work to improve motor functioning (Hallberg, 2008). Both have been helpful for people with various special needs associated with both psychomotor and psychological issues (Frewin & Gardiner, 2005). EAP involves solution-focused activities that emphasize the connection with the horse to facilitate awareness of self and others, and gain insight into personal issues.

Theory Related to the Nature of Horses

The theory behind EAP relates to specific qualities inherent in the nature of horses, which involves their biological makeup (Hamilton, 2011; Lentini & Knox, 2009, Peters & Black, 2012). As prey animals, horses are keenly sensitive to their environment in order to ensure their safety. Their expanded visual field with evolved olfaction and hearing allow them to detect potential predators or other threats to their survival (Hamilton, 2011; Siporin, 2012). These powerful yet vulnerable creatures have a large limbic system, the part of the brain responsible for emotion and intuition, which greatly contributes to their keen ability to detect danger (Hallberg, 2008; Hamilton, 2011; Peters & Black, 2012). Horses often act from their instincts to fight or flee based on what is present in their environment.

Horses do not think in language, but rather feel the energy within and around them, which makes them highly intuitive and emotionally attuned to the slightest gesture, body posture or tension, tone of voice, or glance (Bachi, 2013; Hamilton, 2011). Neurosurgeon and horse trainer, Allan Hamilton, posits that, “horses infuse emotional meaning into every body movement” (Hamilton, 2011, p. 4). Thus, they have a heightened sensitivity to human emotion, which is what they are most attuned to when around us, including those emotions that are often out of our conscious awareness (Bachi, 2013; Burgon, 2011; Hallberg, 2008; Hamilton, 2011; Kemp, Signal, Botros, Taylor, & Prentice, 2014). They respond to our behavior and feelings through their body language, which is clear and immediate; thus they can teach us how we impact those around us (Frewin & Gardiner, 2005). Horses are considered “living, breathing biofeedback machines because they externally reveal internal processes in real time” (Lentini & Knox, 2009, p. 52).

Horses function similarly to the right hemisphere of the human brain, which is non-verbal, emotional, and intuitive (Hamilton, 2011). In addition, horses function, as does our intuition, in the present moment (Frewin & Gardiner, 2005; Hamilton, 2011). They are not thinking about the past, or planning the future, and although they are constantly assessing for potential threats in the environment, they do not judge themselves or us on a personal level. They are simply responding to each moment as it arises. Our intuition is also involved with appraising relationships and connection, much like horses are instinctively social and focused on inclusion in their herd (Hallberg, 2008; Hamilton, 2011; Lentini & Knox, 2009). "Horse-human encounters provide opportunities for learning about relationship. It is through mutual trust and respect that a horse and a human engage in a productive relationship" (Frewin & Gardiner, 2005, p. 4).

The size and power of horses require a certain level of attentiveness in the moment to safety, which increases awareness of oneself and the environment. Their size can trigger fear for many and an opportunity to overcome that fear while increasing self-confidence and self-efficacy through the successful completion of horse-handling tasks (Frewin & Gardiner, 2005; Hallberg, 2008; Hamilton, 2011; Lavender, 2006). The issue of boundaries also arises when dealing with the horse's size and power. Horses have clear boundaries, which they assert freely with each other and with us. Learning to attune to a horse's subtle and sometimes not so subtle boundary cues has the potential to further increase awareness of one's own physical and emotional boundaries (Hallberg, 2008; Lavender, 2006). Since boundary setting can be a struggle for many, working with horses provides an opportunity to practice sending clear messages both verbally and nonverbally, which in turn fosters awareness of one's own patterns of communication.

Furthermore, learning to clearly communicate with horses involves awareness of our thoughts, intentions/feelings, and the body language we use to convey what we are asking (Hallberg, 2008; Lavender, 2006). Experienced horse trainers talk about the importance of visualizing one's intention and conveying it through congruent body language (Hallberg, 2008; Hamilton, 2011). The ability to clearly and congruently communicate with a horse can be quite empowering for many people dealing with mental health issues, and help cultivate a sense of self-efficacy in other areas of one's life.

The effects of EAP on emotion regulation may be examined through the research on affective neuroscience including self-regulation of the autonomic nervous system (ANS), particularly the sympathetic and parasympathetic responses to one's environment. More specifically, there is a correlation between the development of the ANS and the ability to emotionally regulate, which includes regulating both body and behavior states, and also engaging socially with others in effective and affirming ways (Porges, 2005). Self-regulation can also be explained through attachment theory (Bachi, 2013; Bowlby, 1973; Siegel, 1999; Trevarthen, 1999, as cited in Porges, 2011), which proposes that poor attunement from caregivers early in life leads to maladaptive attachment patterns, greater difficulty with emotion regulation, and greater risks to healthy social engagement later in life (Schore, 2002; Siegel, 1999). In this regard, attunement is "feeling felt" (Siegel, 1999, p. 70) or deeply understood by another, and involves sensitivity and the ability to align with another's state via non-verbal and verbal signals.

Horses that have been successfully raised instinctively know how to self-regulate (Hallberg, 2008, Hamilton, 2011; Levine, 1997). The fear response to a potential threat will activate a horse's sympathetic nervous system, much like a human. However, once the horse perceives there is no real threat, their parasympathetic nervous system will be stimulated leading to reduced sympathetic activation, and they will readily return to a relaxed state (Levine, 1997; Peters & Black, 2012). This is not always the case for humans because "our rational brains may become confused and over-ride our instinctive impulses" (Levine, 1997, p. 18). Furthermore, since horses are emotionally attuned and focused on connection/relationship, the horse-human bond provides an opportunity for social engagement/attachment that can lead to growth in terms of physiological and affective self-regulation.

Participation in EAP can increase self-awareness and self-efficacy, both of which could mediate the effects of EAP on emotion regulation. Increased self-awareness is common for participants during an EAP session due to the inherent safety issues of being close to a 1,000-pound animal such as a horse (Burgon, 2013; Hallberg, 2008). Attention to physical safety in this context increases awareness of one's physical body in the environment. Additionally, being around a horse often results in an awareness of mood changes to one of increased calmness and the ability to breathe easier (Burgon, 2013). Furthermore, learning to intentionally communicate with a horse facilitates increased awareness of body language, emotions, and behaviors. Learning to modulate one's behavior and emotions leads to increased self-regulation. Similarly, practicing assertiveness and clear communication with the horse during EAP activities often results in an experience of increased self-efficacy.

Several studies suggest that self-awareness contributes to emotion regulation (Herwig, Kaffenberger, Jancke, & Bruhl, 2010; Kemeny et al., 2012; Vago & Silbersweig, 2012). Specifically, mindfulness training, which increases self-awareness, has been shown to improve the ability to emotionally self-regulate while increasing prosocial behaviors. Additionally, coping self-efficacy known as the "confidence in one's own ability to effectively cope with difficult or threatening events" (Chesney et al., 2006, as cited in Luberto, Cotton, McLeish, Mingione, & O'Bryan, 2014, p. 374), has been found to increase the ability to manage negative emotional states.

Definition of Terms

The term EAP is one of a few being used in the field of therapy and education involving equines. A review of the research below includes a few of these variations, and is therefore important to clarify. As mentioned earlier, therapeutic horseback riding came into existence in Europe and was later supported by the North American Riding for the Handicapped Association (NARHA). Although NARHA's initial focus was on the physical and cognitive benefits associated with mounted work, it later recognized the psychological benefits (Hallberg, 2008). Equine Facilitated Learning (EFL) was developed to facilitate life skills including social and communication skills among special needs populations such as those with learning disabilities, processing issues, and severe mental illness (Hallberg, 2008). Equine-Facilitated Psychotherapy (EFP) emphasizes the connection with and reflective feedback from the horse that can facilitate insight into personal issues (Hallberg, 2008). EFP pioneer, Barbara Rector developed this method roughly 24 years ago at a renowned treatment center in Arizona. EAP was developed by the founders of the Equine Assisted Growth and Learning Association (EAGALA), and primarily includes solution-oriented, teambuilding activities involving a horse or horses, where individuals learn about themselves and their effect on others (EAGALA, 2012). Although there are differences between EAP, EFP, and EFL, there is also a great deal of overlap. All three target populations with a variety of psychological issues such as violent offenders, youth at-risk, inpatient psychiatric and substance abuse patients, those seeking personal growth, and many others (Frewin & Gardiner, 2005; Klontz et al., 2007). Furthermore, EAP, EFP, EFL, and therapeutic horseback riding have the potential to foster personal growth, self-awareness, self-efficacy, and self-regulatory capacities. For the purpose of this research study, the term EAP will be used and will primarily include methods from both EAP and EFP.

The following literature review seeks to highlight the interrelationship between processes associated with emotion regulation, and those inherent in the nature of horses and the efficacy of EAP. The review will begin with an investigation of the effects of EAP on self-efficacy and self-awareness, and how these factors are associated with emotion regulation. Theories related to emotion regulation, such as nervous system regulation and attachment theory, will be examined in terms of their link to similar processes in horses and EAP. Following will be a review of the specific research in support of the effects of EAP on emotion regulation, which will include studies that have utilized heart rate variability as a measure of emotion regulation. Lastly, counter studies on the efficacy of EAP will also be reviewed.

Enhancing Self-Efficacy and Self-Awareness with EAP

Research on the effects of EAP has shown consistent findings in terms of improvements in areas related to self-efficacy, or the belief in one's own abilities to achieve goals and influence outcomes, and self-awareness, or the capacity for introspection and ability to be aware of one's traits, behaviors, and feelings (Bachi, 2013; Burgon, 2013; Klontz et al., 2007; Pendry & Roeter, 2013; Schultz, Remick-Barlow, & Robbins, 2007; Trotter, Chandler, Goodwin-Bond, & Casey, 2008). Most of these studies have been conducted with populations of at-risk youth (Bachi, Terkel, & Teichman, 2011; Burgon, 2013; Kemp et al., 2014; Pendry & Roeter, 2013), whereas only a few have examined the effects of EAP on these variables with adults (Cumella & Lutter, 2014; Klontz et al., 2007; Yorke, Adams, & Coady, 2008). In reviewing the research, it is important to mention that several of these studies used measures related to self-efficacy and self-awareness such as a sense of adequacy or mastery, self-esteem, self-control, self-confidence, and mindfulness. Mindfulness is the moment-to-moment awareness of one's internal and external experience, and results in greater self-awareness (Burgon, 2013).

EAP Studies with Youth

The studies that examined the effects of EAP on self-efficacy, self-awareness, and other related variables with at-risk youth include those with maladaptive social, emotional, and behavioral problems (Bachi et al., 2011; Pendry & Roeter, 2013; Stiltner, 2013; Trotter et al., 2008; Whitely, 2009); those who experienced intra-family violence (Schultz et al., 2007), abuse, and trauma (Kemp et al., 2014); and those in foster care (Burgon, 2011, 2013). For example, Pendry and Roeter (2013) conducted a randomized controlled trial (RCT) to determine the efficacy of an EFL program on social competence among children with mental health issues who were referred by counselors and mental health agencies. The researchers defined social competence as, "the ability of the child to successfully interact with other children and adults in a way that demonstrates an awareness of and ability to manage emotions in an age- and contextually appropriate manner" (Pendry & Roeter, 2013, p. 4). Parents of the children in both EFL and waitlist control conditions rated their children's social competence pre- and post-treatment. Results showed an increase in social competence, self-awareness, and emotional regulation among the EFL condition compared to the waitlist control condition. Furthermore, children in the waitlist control group also exhibited higher social competence levels after completing the same EFL program 11 weeks following the first cohort. One possible limitation of this study is that parents' ratings might indicate expectations they had about the efficacy of EFL. However, this RCT is one of the more robust studies on EFP/EAP.

Other studies showed similar results but they were not randomized controlled trials. Trotter, Chandler, Goodwin-Bond, and Casey (2008) examined the difference between an EAP condition and classroom-based counseling condition known as Rainbow Days (RD), on measures of social and behavioral adjustment among at-risk youth. The youth's self-report as well as parental ratings showed improvement in adaptive skills and sense of adequacy for the EAP group compared to the RD group. Limitations of this study include participant bias in that participants chose which group they wanted to enroll in; difference in group sizes (EAP group *N*=126; RD group *N*=38); and difference in length of treatment (EAP – 2 semesters at 2 hours/week; RD – 1 semester at 1 hour/week).

Another study examined the effects of EAP on self-image, self-control, trust, and general life-satisfaction among at-risk adolescents residing in an inpatient treatment center for adjustment and adaptive issues related to family and legal problems (Bachi et al., 2011). The EAP group showed an increase in trust, self-control, and general life-satisfaction compared to the control group, which was residential treatment as usual. A similar study of at-risk adolescents at a residential treatment facility utilized self-report and guardian-report measures of emotional distress and social and behavioral problems for two identical EAP groups 6 weeks apart (Whitely, 2009). In addition, qualitative, semi-structured interviews of participants' experiences in the EAP groups were thematically coded. Quantitative results found that guardians' post measures showed improvement in children's overall functioning with "adaptive behavioral changes" (Whitely, 2009, p. 74), whereas children's post measures indicated a significant decrease in anxiety, depression, and hopelessness. The qualitative results found an increase in self-efficacy, self-awareness, self-control, emotional awareness, and relational skills (Whitely, 2009). Although the small sample size (*N*=20), lack of control group, and researcher bias present limitations in this latter study, results from the mixed-methods design suggests consistent evidence in support of the efficacy of EAP.

Yet another qualitative study on the effects of EAP among adolescents in an all-male treatment facility showed increased self-confidence and self-esteem, a reduction in anxiety and anger, and more willingness to engage in treatment (Stiltner, 2013). The small sample size and using a population of males only suggest limitations of this study in terms of its generalizability.

The effects of EAP among children who experienced intra-family violence were found to increase Global Assessment of Functioning (GAF) scores, which are related to psychological and social functioning and self-efficacy (Schultz et al., 2007). Additionally, results showed greater improvement in functioning among children who suffered from physical abuse and neglect as compared to those who did not suffer from these adversities. However, it is important to note the use of only one measure in this study, which may compromise its construct validity.

Similarly, Kemp, Signal, Botros, Taylor, and Prentice (2014) found significant improvements in measures of maladaptive social, emotional, and behavioral problems as well as trauma symptoms among children and adolescents who had been sexually abused. The results showed no significant improvement in children's scores using standardized, self-report measures between Time 1 – intake into the sexual assault referral center, and Time 2 – after 6 weeks of in-clinic counseling and before EAP. However, a significant improvement in behavior and depression scores among children, and improvement in anxiety, behavior, and trauma symptoms among adolescents was found between Time 2 and Time 3 – after 9-10 weeks of EAP. The authors posit that improvements in functioning resulted from the horse's natural capacity to provide unconditional positive regard, which is an uncommon experience for abused children. Additionally, horses can act as a bridge to the therapeutic alliance in that children find it easier to connect with horses, which can gradually transfer to the therapist. Although there were no significant differences between genders and ethnicity groups, the small sample size poses a limitation when interpreting these results.

A qualitative study conducted over a 2-year span showed improvements in self-efficacy and mindfulness from a therapeutic horseback riding program (Burgon, 2011, 2013). Seven at-risk youth in foster care participated in the program for various lengths of time, mainly due to being placed in a foster home sometime during the program. Thematic results of semi-structured interviews conducted by the researcher suggested an increase in self-efficacy, self-confidence, self-awareness, trust, and fulfilling ways of expressing affection, nurturing, and empathy among the participants (Burgon, 2011, 2013). An important consideration and possible weakness in this study is the potential of experimenter expectancies.

EAP Studies with Adults

Five studies examined the effects of EAP on measures of self-actualization and self-efficacy among adult populations. Self-actualization refers to the motivation to reach one's full potential (Maslow, 1968). Klontz, Bivens, Leinart, and Klontz (2007) conducted research with adults from the general population who voluntarily attended a 4-½ day residential EAP program. Standardized, self-report questionnaires measuring psychological distress and self-actualization were administered to participants before the program, right after the program, and at 6-month follow up. From pre-test to post-test and follow up, results showed a reduction in psychological distress and an increase in psychological well-being and mindfulness, and an increase in feelings of independence and self-efficacy (Klontz et al., 2007). The lack of a control group and non-random selection weaken this study's external validity.

Another study using an adult sample examined the effects of EAP on the drive for thinness, self-efficacy, and impulse dysregulation among women at an inpatient eating disorder

(ED) treatment facility (Cumella & Lutter, 2014). All participants were randomly selected from the treatment population, and then randomly assigned to either the EAP or control (treatment as usual) condition. Results from pre- and post-test standardized questionnaires showed a significant reduction in the drive for thinness, depression, and anxiety, as well as improved self-efficacy, interpersonal trust, and impulse dysregulation among the EAP condition compared to the control condition.

A pilot study by Whittlesey-Jerome (2014) examined the effect of EAP on self-efficacy among adult female victims of interpersonal violence. A convenience sample consisting of marginalized, under-served women were recruited by a human services agency. All participants were in abusive relationships. EAP sessions were added to the existing treatments for the experimental group, and were compared to those receiving regular group therapy - comparison group (COM). Self-report measures of self-efficacy, depression, anxiety, and general functioning were administered before and after 8 weeks of treatment for each group. In addition, qualitative data were gathered through participants' journal entries about their thoughts and feelings throughout the study. Results showed that the EAP group had greater improvement in self-efficacy, depression, and general functioning as compared to the COM group. Furthermore, qualitative data indicated that those in the EAP group had meaningful experiences in the arena with the horses that were relevant to their interpersonal relationships. Qualitative data from those in the COM group centered on the details of what was happening in their interpersonal relationships and were less focused on their thoughts and feelings during the study (Whittlesey-Jerome, 2014). Limitations of the study include convenience sampling and a small sample size.

One qualitative study among adult women who experienced abuse examined the effects of EFP on their recovery (Meinersmann, Bradberry, & Roberts, 2008). Anecdotal data support

EFP as an effective modality for this population. Themes that arose in the participants' stories included self-empowerment, self-efficacy, and the ability to make changes in their lives.

Lastly, a study conducted by Zasloff (2009, as cited by Shambo, Young, & Madera, 2013), which replicated a pilot study by Shambo, Seely, and Vonderfecht (2010, as cited in Shambo, Young, & Madera, 2013) examined the effects of EAP on depression, anxiety, dissociation levels, and overall functioning among 10 adult female trauma survivors. Psycho-education and cognitive behavior therapy were used in conjunction with EAP. Quantitative measures were conducted pre-, mid-, post, and follow up at 4 months. In addition, the researcher utilized semi-structured interviews at post and follow-up points. Results showed a reduction in depression and anxiety, as well as improvement in overall functioning at post and follow-up periods. Qualitative outcomes reflected themes of empowerment, confidence, trust, bonding, self-esteem, and self-efficacy. Potential limitations in terms of the generalizability of this study include a small sample size and use of only female participants. Furthermore, it did not employ a control condition.

The studies just reviewed share similar methodological weaknesses, with the exception of the RCT first mentioned in this section. Many of the studies had small sample sizes, and lacked randomization and control conditions, which limits the potential validity of these studies. In addition, since many of the studies have utilized the specific population of at-risk youth, more research is needed with other populations of children as well as adults in various forms of mental and behavioral health treatment (i.e., inpatient, outpatient, weekly therapy).

Linking Self-Efficacy and Self-Awareness to Emotion Regulation

Research suggests that both self-efficacy and self-awareness can contribute to emotional self-regulation (Kemeny et al., 2012; Luberto et al., 2014; Vago & Silbersweig, 2012). Generally speaking, self-regulation refers to the "ability to effectively modulate one's behavior" (Vago & Silbersweig, 2012, p. 1), and emotions. For example, Kemeny et al. (2012) conducted a RCT to evaluate whether meditation/emotion regulation training, developed by experts in both meditation traditions and emotion science, reduces emotion dysregulation. They administered self-report and behavioral task measures to participants in the training and waitlist control groups, before and after the 8-week intensive training as well as at 5 months post-training. The results showed that an increase in self-awareness and mindfulness positively influenced the ability to emotionally self-regulate. In addition, training participants reported reductions in negative emotions, anxiety, and depression, and an increase in positive affect and mindfulness compared to participants in the control group (Kemeny et al., 2012). In support of these results, Vago and Silbersweig (2012) propose that developing self-awareness, self-regulation, and self-transcendence – transcending self-focused needs in order to foster positive relationships with others - through mindfulness practices are in turn supported by neuropsychological processes such as attention regulation, emotion regulation, and pro-social behaviors.

Furthermore, Luberto, Cotton, McLeish, Mingione, and O'Bryan (2014) examined whether coping self-efficacy mediates the link between mindfulness skills such as awareness and emotion regulation. They found that mindfulness skills were linked to coping self-efficacy, and that coping self-efficacy "partially explains the relationship between mindfulness and emotion regulation difficulties" (Luberto et al., 2014, p. 373). The researchers posit that mindfulness practice can cultivate increased self-control, which in turn increases coping self-efficacy as well as the ability to manage negative emotions.

Emotion Regulation

Before examining the sparse literature on the effects of EAP on emotion regulation, it is important to briefly review some of the theories on emotion regulation in humans; and how some of the same processes in horses may contribute to the efficacy of EAP in improving the ability to self-regulate. Emotion regulation involves using awareness and various strategies to manage the cognitive, behavioral, and physiological responses to emotions as they arise. Emotional expression is more likely to result in adaptive responses when expressed "with sensitivity to the situational context . . . both in terms of timing/occurrence and magnitude" (Appelhans & Luecken, 2006, p. 229). Thus, the ability to emotionally self-regulate is essential for healthy social and mental functioning (Eisenberg, 2001; Gross & Munoz, 1995).

Nervous System Regulation and Attachment Theory

Further research on affective neuroscience highlights some of the neurobiological processes associated with emotion regulation that may play a part in determining the efficacy of EAP. More specifically, self-regulation of the ANS, including sympathetic and parasympathetic activation is linked to the ability to emotionally regulate (Porges, 2005, 2011). This includes regulating both body and behavior states, and also engaging socially with others in effective and affirming ways (Porges, 2005). Porges (2005) developed what is known as the *polyvagal* theory, which "proposes that the evolution of the mammalian ANS provides the neurophysiological substrates for the emotional experiences and affective processes that are major components of social behavior" (p. 38). This theory emphasizes the two branches of the vagus nerve – dorsal and ventral - each with its neurophysiological and neuroanatomical functions (Porges, 2005, 2011).

Porges (2005, 2011) went on to discover that the ventral vagus consists of a network of myelinated neurons originating in the nucleus ambiguus of the vagus nerve, which are involved in the parasympathetic system related to calm behavioral states often associated with safe social engagement with others. The dorsal vagus consists of unmyelinated neurons originating in the dorsal motor nucleus of the vagus nerve, and involves the "immobilization system" otherwise known as the freeze state in mammals during an event that is physically or emotionally threatening (Porges, 2005, p. 38). Additionally, is the activation of the sympathetic nervous system that promotes fight or flight behavior, known as the "mobilization system" (Porges, 2005, p. 38). Ideally, the ability to self-regulate autonomically and therefore emotionally, occurs when the sympathetic activating system (fight/flight), and the calming, parasympathetic system can physiologically engage when needed based on visceral states and social interactions (Porges, 2011).

The notion of social engagement in Porges' theory is very similar to the constructs in attachment theory, which are also linked to emotion regulation. That is, healthy development of the right brain and ANS, along with the ability to self-regulate is dependent upon healthy attachment experiences early in life (Schore, 2002). According to Schore (2002), attachment is an interactive regulation of emotion between two organisms. Early in life, it occurs when "the mother is synchronizing and resonating with the rhythms of the infant's dynamic internal states and then regulating the arousal level of these negative and positive states" (Schore, 2002, p. 256). Also known as affect mirroring (Gergely & Watson, 1996; Nichols, Gergely, & Fonagy, 2001), this interactive dynamic involving a caretaker's empathic reflection of the infant's emotional expression leads to development of the infant's emotional self-awareness and self-regulation. The caretaker's imitative facial expressions and vocal responses are linked to innervations of the myelinated ventral vagus, which involve motor functions in the face (expression), eyes (gaze and gesture), ears (recognition of vocal tones), throat (vocalizing, swallowing), and head (head tilting/turning in social gestures; Porges, 2011). Thus, neurobiological effects of attachment transactions are built into the nervous system of the infant, and involve a right-brain to right-brain interaction between infant and caregiver. The attachment bond is formed through "a conversation between limbic systems," and "spontaneous emotional communications" (Schore, 2002, p. 257), initiated by the adult's ability to attune to the infant.

Regulation and Attachment in Horses

When horses are raised successfully, they instinctively know how to self-regulate (Peters & Black, 2012). As mentioned earlier, when faced with a threat in the environment, a horse's sympathetic nervous system will activate the fight or flight response. Once they recognize there is no danger, they are able to discharge the physiological stress associated with fight or flight mode, and return to a state of equilibrium and social engagement in the herd.

Additionally, the developed intuitive functioning in horses bestows them an implicit appreciation of social engagement and attachment with members of their herd (Hallberg, 2008; Hamilton, 2011). They "derive their very essence from inclusion in a herd" (Hamilton, 2011, p. 7). Their acute sensitivities and regulatory capacities allow them to be keenly attuned to each other's slightest movement if one were to sense danger looming. Although there is a hierarchy in the herd, there is also an inherent, mutual respect horses have for each other regardless of their status, which allows for functionality and organization within their community (Hallberg, 2008).

Horses value partnership and connection, and respect each other's unique strengths as essential to the herd.

The Application of Nervous System Regulation and Attachment Theory to EAP: Research in Support of the Effects of EAP on Emotion Regulation

Several of the concepts in nervous system regulation and attachment theory are similar to some of the central elements in EAP. A horse's innate ability to quickly return to a parasympathetic state of calm after a potentially threatening stimulus, along with their ability to emotionally attune and socially engage, can potentially facilitate an interactive experience of regulation and attachment for humans. Similar to the way caregivers reflect and regulate emotions in the infant, a horse's "innate tendency to mirror affect" (Bachi, 2013, p. 192) can potentiate a neurobiological attachment transaction. Thus, "a friendly therapy horse can serve as a supplemental attachment figure. The sheer solidity of a 2000 pound but trustworthy animal can provide palpable reassurance unmatched by any human" (Siporin, 2012, p. 460).

The qualitative study by Yorke et al. (2008) provides evidence in support of an attachment bond in EAP. Following EAP and therapeutic riding sessions with trauma survivors, semi-structured interviews revealed several bond themes related to participants' connections with the horses. The most poignant bond theme was the *intimacy/nurturing bond,* which emphasized participants' feelings towards the horses. The *identity bond* related to "feelings about the self in relation to the horse" (Yorke et al., 2008, p. 23); and the *partnership bond* emphasized mutual respect and a sense of equality in participants' relationships with the horses. These findings suggest that an attachment relationship with a horse can provide an experience of emotional attunement and expression that can lead to better self-regulation. A possible limitation in terms of the study's validity is that participants were not randomly selected but instead were chosen based on their pre-existing relationship with the horse.

Research involving the neurobiological explanations of attachment and emotion regulation as a result of EAP can be seen in a small amount of studies, some of which involve other animals such as dogs. Although dogs are a different species than horses, the commonality of both as animals can help substantiate the limited research in this area. Beetz, Uvnas-Moberg, Julius, and Kotrschal (2012) reviewed the literature related to the role of oxytocin in human-animal interactions or AAT. Oxytocin is a peptide hormone produced in the brain during social engagement activities such as breastfeeding, touch, warmth, and sexual relations. It promotes bonding, empathy, and trust in relationships. AAT has been shown to increase oxytocin levels in both humans and dogs after petting and stroking a dog (Odendaal, 2000; Odendaal & Meintjes, as cited in Beetz et al., 2012).

A similar study by Beetz et al. (2011) examined whether an attachment figure helped regulate stress levels among 7- to 12- year-old boys with insecure/disorganized attachment. Salivary cortisol levels were measured to assess stress levels before, during, and after a socially stressful situation using the Trier Social Stress Test for Children (TSST-C). Participants were assigned to one of three conditions during the TSST-C including the presence of a real dog, a friendly human, or a toy dog. Results showed that salivary cortisol levels were significantly lower in the real dog condition than in the friendly human and toy dog conditions (Beetz et al., 2011). The researchers also found a further reduction in stress response when the children stroked the dog.

Further support for the effects of AAT on the neurobiological components of emotion regulation is evident in the research study by Motooka, Koike, Yokoyama, and Kennedy (2006).

Heart rate variability (HRV) or changes in the beat-to-beat heart rhythm, was used to measure parasympathetic activity among senior citizens walking with and without a dog, and during domestic activities at home. Results showed an increase in HRV and therefore increased parasympathetic activity, during walks with the dog and when the dog was present at home (Motooka, Koike, Yokoyama, & Kennedy, 2006). Although the small sample size limits this study's generalizability, it provides more physiological evidence in support of the effects of animal-assisted therapy.

Two studies on the effects of EAP on neurobiological factors related to emotion regulation involved measurements of salivary cortisol level and HRV (Pendry, Smith, & Roeter, 2014; Walters & Baldwin, 2010). Pendry, Smith, and Roeter (2014) conducted a RCT to examine the effects of EAL on stress and well-being as measured by salivary cortisol levels among children in grades 5 through 8. Salivary cortisol samples of children in both the EAL and waitlist conditions were taken six times at pretest and six times at posttest. Results indicated that children in the EAL condition had lower overall cortisol levels per waking hour as well as lower afternoon cortisol levels at posttest compared to children in the waitlist condition. Researchers have suggested a link between lower cortisol levels and protection against the development of psychopathological problems, which most often involve emotional dysregulation (Lupien et al., as cited in Pendry et al., 2014). These findings suggest that EAL potentially lowers cortisol levels in adolescents, which in turn supports psychological well-being and emotional self-regulation. Given that the students and their parents chose whether the student took part in the study, this lack of randomization poses a threat to its validity.

Lastly, a pilot study was conducted to examine HRV in humans and horses during horse-human interactions (Walters & Baldwin, 2010). Although this study did not utilize EAP methods per se, the findings contribute important information in terms of the effects of horse-human interactions on the neurobiological processes of emotion regulation, which in turn may be applied to EAP. Researchers in this experiment looked for a state of coherence in both horses and humans, which is when HRV increases and becomes more ordered and balanced, indicating an increased potential for emotional self-regulation. HRV as a measure of emotion regulation will be briefly reviewed in the next section. Thus, coherence involves a state of resonance and synchronization within the "body's oscillatory systems" (Walters & Baldwin, 2010, p. 2) such as heart rhythms, respiration, and alpha rhythms in the brain, and is associated with increased self-regulatory capacity and overall well being (Shaffer, McCraty, & Zerr, 2014).

The horse-human interactions in this pilot study involved a human paired with a horse who was at liberty in the arena. Both horse and human HRV measurements were recorded via an ambulatory monitor. Results indicated a correlation between horse and human heart rate rhythms for various times throughout the experiment (Walters & Baldwin, 2010). A cross-correlation analysis revealed that the horse's coherent heart rate rhythm influenced the human's heart rate rhythm to oscillate in a similar frequency. Additionally, human participants were instructed to cultivate thoughts and feelings of appreciation, which was shown to be associated with a state of coherence. Eliciting a state of coherence by sending appreciation to the horse resulted in greater amounts of shared oscillation frequencies between the human and horse (Walters & Baldwin, 2010).

Heart Rate Variability as a Measure of Emotion Regulation

HRV is essentially a non-invasive measure that is able to estimate the interactions of parasympathetic and sympathetic control of the heart (Appelhans & Luecken, 2006; Porges, 2011). These two branches of the ANS are continually interacting in response to changes in external and internal conditions. Whereas sympathetic nerves accelerate heart rate, parasympathetic nerves slow it down. Although sympathetic activation increases heart rate, it does so at a slow rate. That is, peak effect of sympathetic activation occurs after approximately 4 seconds and returns to baseline after about 20 seconds. Alternately, parasympathetic regulation occurs at a faster rate, with peak effect after about 5 seconds and return to baseline after about 1 second (Appelhans & Luecken, 2006). It is this rapid modulation of cardiac activity by the parasympathetic system that allows for physiological and emotional regulation to occur in response to changing environmental demands (Appelhans & Luecken, 2006; Segerstrom & Nes, 2007). Thus, higher HRV, or more variability between heartbeats, is an indicator of self-regulatory capacity (Segerstrom & Nes, 2007). HRV is therefore an indicator of physiological resilience to stress, behavioral flexibility, and emotion regulation (Porges, 2005, 2011).

Research in support of HRV as a measure of self-regulation can be seen in a study conducted by Segerstrom and Nes (2007). Participants who had fasted for 3 hours prior to the experiment were randomly assigned to either a low or high self-regulatory condition. In the low self-regulatory condition, participants were asked to eat only the cookies and candies that were on a tray with carrot sticks. Participants in the high self-regulatory condition were instructed to eat only the carrots on the tray and not the cookies or candies. Participants were then given difficult to impossible anagrams to solve, after which they rested quietly. All participants wore monitors that measured their HRV throughout, and were administered self-report mood measures after the food, anagram, and rest periods (Segerstrom & Nes, 2007). Results showed elevated HRV for the high self-regulatory condition compared to the low in both the food and anagram tasks. These findings suggest a strong correlation between HRV and self-regulation.

In another study by Geisler, Vennewald, Kubiak, and Weber (2010), the authors examined whether adaptive self-regulation, as measured by resting HRV, was linked to subjective well-being and mediated by emotion regulation strategies. Participants were given self-report measures of mood, life satisfaction, and emotion regulation strategies following a brief time period when their HRV measures were taken. Results showed that HRV was positively associated with positive mood and mediated by the use of emotion regulation strategies (Geisler, Vennewald, Kubiak, & Weber, 2010). Although this study cannot assume causality due to the limitations related to cross-sectional designs, it is worth noting for its associations between HRV, self-regulatory strength, and emotion regulation.

Studies Not Supporting the Efficacy of EAP

Few studies exist that found no significant effects of EAP on mental health measures, including those related to self-efficacy, self-awareness, and emotion regulation (Anestis, Anestis, Zawilinski, Hopkins, & Lilienfeld, 2014; Drinkhouse, Birmingham, Fillman, & Jedlicka, 2012; Ewing, MacDonald, Taylor, & Bowers, 2007). For example, one study examined the potential benefits of EAP by correlating human and horse heart rates as a measure of involuntary stress (Drinkhouse et al., 2012). Heart rates were recorded among at-risk youth with mental and/or behavioral issues, as well as the horses during 12 EAP sessions. Results did not show empirical support for the correlation between human and horse heart rates during EAP. The researchers found it difficult to determine the source of correlation due to the external variables present during the experiment. These included periods of physical activity in the humans and horses as well as external events such as when the horse interacted with a cat. The lack of random assignment also weakened the study (Drinkhouse et al., 2012).

Another study examined the effects of EFL on measures of self-worth, self-esteem, interpersonal empathy, and internal locus of control among youth with learning disabilities and severe behavioral issues (Ewing et al., 2007). The researchers also utilized qualitative measures including interviews and observations of the participants by the facilitators. Results showed no statistically significant effects of EFL on any of the quantitative measures, although findings from the qualitative measures showed positive changes in some of the participants in terms of improvement in emotional awareness, social skills, self-esteem (Ewing et al., 2007). The authors offer several explanations for the lack of significant results on the quantitative measures. They posit that the participants' low IQ and cognitive functioning interfered with their ability to answer the test items. Additionally, the small number of EFL sessions was not adequate enough to detect any changes in a population with such diminished self-worth and self-esteem. Lastly, the authors' explanation for the lack of significant changes in the locus of control measure was associated with the intense changes in the participants' home life over the course of the experiment, which included death of a parent, and changes in custody and foster placement (Ewing et al., 2007).

Lastly, in a review of equine-related treatments (i.e., EAP, EFP, and Therapeutic Horseback Riding) for mental disorders (Anestis et al., 2014), the authors suggest that claims are being made about the efficacy of EAP without the use of sound empirical procedures. Among the studies they investigated, several threats to validity were found including threats to internal, external, and construct validity. As was mentioned earlier in this literature review, the authors also identified the lack of experimental control groups, and lack of random assignment as additional obstacles in establishing empirical support for EAP (Anestis et al., 2014). Furthermore, the absence of manualized treatment that has a specific set of processes poses another issue along with the lack of longitudinal research designs that can provide "consistent follow-up data" (Anestis et al., 2014, p. 1127).

Summary and Recommendations

Research on the effects of EAP suggest that there are qualities inherent in the nature of horses that are beneficial for humans. Studies indicate an increase in self-efficacy, self-awareness, self-competence, and the ability to regulate emotionally as a result of an EAP intervention. In addition, similar EAP studies show a decrease in depression, anxiety, and negative affect. Most of the current research has been conducted with at-risk adolescents and children whereas a small number of studies involve adults. Even fewer studies exist with adults residing in inpatient psychiatric hospitals or behavioral health treatment facilities who are struggling with specific psychological conditions.

Furthermore, there is a paucity of empirical research on the efficacy of EAP, particularly related to emotion regulation. Future studies utilizing larger sample sizes, randomization, and control conditions could provide evidence for a stronger link between EAP and emotion regulation. In addition, the investigation of factors that may mediate this relationship could also offer valuable information related to EAP's efficacy. Lastly, the use of specific physiological measures of emotion regulation could shed light on the neurobiological underpinnings of EAP and ways it can facilitate better self-regulatory capacities.

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THE EFFECTS OF EQUINE-ASSISTED PSYCHOTHERAPY ON EMOTION REGULATION: SELF-EFFICACY AND SELF-AWARENESS AS POTENTIAL MEDIATORS

PART B

By

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Abstract

The Effects of Equine-Assisted Psychotherapy on Emotion Regulation: Self-Efficacy and Self-Awareness as Potential Mediators

Part B

by

Elizabeth Dampsey

Research in the field of Equine-Assisted Psychotherapy (EAP) has begun to reveal the therapeutic benefits inherent in the nature of horses. The existing quantitative and qualitative studies on EAP suggest improvement in self-efficacy, self-awareness, and emotion regulation, while decreasing negative affect, and maladaptive behaviors. This study examined the effects of EAP on self-efficacy, self-awareness, positive and negative affect, and emotion regulation among 95 adult inpatient psychiatric residents dealing with substance abuse, mood disorders, and trauma. Residents were assessed using the physiological measure of heart rate variability (HRV) for emotion regulation, as well as self-report measures on self-efficacy, self-awareness, and positive and negative affect. Although results did not show causality, they revealed significant changes between pre- and post-tests on self-report variables. In addition, changes from baseline to post-HRV recordings indicated a significant correlation among HRV variables most associated with parasympathetic activity, which is related to emotion regulation. Findings suggest that the number of EAP sessions may have contributed to an increase in participants' HRV measures, self-efficacy, self-awareness, positive affect, and a decrease in negative affect.

Key Words: equine-assisted psychotherapy, equine therapy, emotion regulation, self-efficacy, self-awareness

Introduction

Animal-assisted therapy (AAT), or the use of animals in the treatment of mental health issues dates back to 1792 (Altschuler, 1999). Since then, research studies have shown improvement in psychological and physical symptoms when animals are used as part of the therapy experience (Klontz, Bivens, Leinart, & Klontz, 2007). One type of AAT involves the use of horses and is known as Equine Assisted Psychotherapy (EAP). EAP and other equine-related modalities have been helpful for those with decreased motor functioning, learning disabilities, processing issues, severe mental illness, substance abuse, mood and conduct disorders, and trauma (Frewin & Gardiner, 2005; Hallberg, 2008; Yorke, Adams, & Coady, 2008).

The theory behind EAP relates to specific qualities inherent in the nature of horses, which involves their biological makeup (Hamilton, 2011; Lentini & Knox, 2009, Peters & Black, 2012). As prey animals, horses are keenly sensitive to their environment in order to ensure their safety. These powerful yet vulnerable creatures have a large limbic system, the part of the brain responsible for emotion and intuition, which greatly contributes to their heightened ability to detect danger, and quickly attune to the slightest gesture, body posture or tension, tone of voice, or glance (Bachi, 2013; Hallberg, 2008; Hamilton, 2011; Peters & Black, 2012). Thus, they have a heightened sensitivity to human emotion, which is what they are most attuned to when around us, including those emotions that are often out of our conscious awareness (Bachi, 2013; Burgon, 2011; Hallberg, 2008; Hamilton, 2011; Kemp, Signal, Botros, Taylor, & Prentice, 2014).

Horses are right-brain focused, and much like our right-brain functioning, they are more concerned with relationships and inclusion in their herd, which is key to their ability to emotionally attune (Hallberg, 2008; Hamilton, 2011; Lentini & Knox, 2009). Furthermore, the size and power of horses require attentiveness in the moment to safety, which increases awareness of oneself and the environment. Their size can trigger fear for many and an opportunity to overcome that fear while increasing self-confidence and self-efficacy through the successful completion of horse-handling tasks (Frewin & Gardiner, 2005; Hallberg, 2008; Hamilton, 2011; Lavender, 2006). A horse's size and power has the potential to increase awareness of one's own physical and emotional boundaries (Hallberg, 2008; Lavender, 2006). Lastly, developing the ability to clearly and congruently communicate with a horse can be quite empowering for many people, and help cultivate a sense of self-efficacy in other areas of one's life.

Existing Research on the Effects of EAP on Self-Efficacy and Self-Awareness

Research on the effects of EAP has shown consistent findings in terms of improvements in areas related to self-efficacy and self-awareness (Bachi, 2013; Burgon, 2013; Klontz et al., 2007; Pendry & Roeter, 2013; Schultz, Remick-Barlow, & Robbins, 2007; Trotter, Chandler, Goodwin-Bond, & Casey, 2008). Most of these studies were conducted with at-risk youth dealing with maladaptive social, emotional, and behavioral problems (Bachi, Terkel, & Teichman, 2011; Pendry & Roeter, 2013; Stiltner, 2013; Trotter et al., 2008; Whitely, 2009); those who experienced intra-family violence (Schultz et al., 2007), abuse and trauma (Kemp et al., 2014); and those in foster care (Burgon, 2011, 2013).

For example, Pendry and Roeter (2013) conducted a randomized controlled trial (RCT) to determine the efficacy of an Equine-Facilitated Learning (EFL) program on social competence among children with mental health issues, who were referred by counselors and mental health agencies. Results showed an increase in social competence, self-awareness, and emotional regulation among the EFL condition compared to the waitlist control condition. Furthermore, children in the waitlist control group also exhibited higher social competence levels after completing the same EFL program 11 weeks following the first cohort.

Trotter, Chandler, Goodwin-Bond, and Casey (2008) examined the difference between an EAP condition and classroom-based counseling condition known as Rainbow Days (RD), on measures of social and behavioral adjustment among at-risk youth. The youth's self-report as well as parental ratings showed improvement in adaptive skills and sense of adequacy for the EAP group compared to the RD group. Limitations of this study include participant bias in that participants chose which group they wanted to enroll in, difference in group sizes (EAP group *N*=126; RD group *N*=38), and difference in length of treatment.

Three studies examined the effects of EAP among at-risk youth at inpatient behavioral health treatment centers. Bachi, Terkel, and Teichman (2011) examined the effects of EAP on self-image, self-control, trust, and general life satisfaction, and found an increase in all measures among participants in the EAP group compared to the control group. A similar study using both quantitative and qualitative measures showed improvement in children's overall functioning with "adaptive behavioral changes" (Whitely, 2009, p. 74), as well as a significant decrease in anxiety, depression, and hopelessness. The qualitative results found an increase in self-efficacy, self-awareness, self-control, emotional awareness, and relational skills (Whitely, 2009). Although the small sample size (*N*=20), lack of control group, and possible researcher bias present limitations in this latter study, results from the mixed-methods design suggest consistent evidence in support of the efficacy of EAP.

The effects of EAP among children who experienced intra-family violence were found to increase Global Assessment of Functioning (GAF) scores (Schultz et al., 2007). Additionally, results showed greater improvement in functioning among children who suffered from physical abuse and neglect as compared to those who did not suffer from these adversities. Similarly, Kemp, Signal, Botros, Taylor, and Prentice (2014) found significant improvements in measures of maladaptive social, emotional, and behavioral problems as well as trauma symptoms among children and adolescents who had been sexually abused. Although there were no significant differences between genders and ethnicity groups, the small sample size poses a limitation when interpreting these results.

Three studies examined the effects of EAP on measures of self-actualization and self-efficacy among adult populations. One study with adults from the general population who voluntarily attended a 4½-day residential EAP program found a reduction in psychological distress and an increase in psychological well-being (Klontz et al., 2007). Another study with adults in treatment for eating disorders found that the effects of EAP showed a significant reduction in the drive for thinness, depression and anxiety, as well as improved self-efficacy, interpersonal trust, and impulse dysregulation compared to the control condition. The last study showed a reduction in depression and anxiety, and improvement in overall functioning among adult female trauma survivors as a result of EFP (Zasloff, 2009, as cited in Shambo, Young & Madera, 2013).

Emotion Regulation

Participation in EAP can increase self-awareness and self-efficacy, both of which could mediate the effects of EAP on emotion regulation. Several studies suggest that mindfulness training, which increases self-awareness contributes to emotion regulation (Herwig, Kaffenberger, Jancke, & Bruhl, 2010; Kemeny et al., 2012; Vago & Silbersweig, 2012). Additionally, coping self-efficacy has been found to increase the ability to manage negative emotional states (Luberto, Cotton, McLeish, Mingione, & O’Bryan, 2014).

The effects of EAP on emotion regulation may be examined through the research on affective neuroscience including self-regulation of the autonomic nervous system (ANS), particularly the sympathetic and parasympathetic responses to one's environment. More specifically, there is a correlation between the development of the ANS and the ability to emotionally regulate, which includes regulating both body and behavior states, and also engaging socially with others in effective and affirming ways (Porges, 2005). Self-regulation can also be explained through attachment theory (Bachi, 2013; Bowlby, 1973; Siegel, 1999; Trevarthen, 1999, as cited in Porges, 2011), which proposes that poor attunement from caregivers early in life leads to maladaptive attachment patterns, the inability to emotionally regulate, and lack of healthy social engagement later in life (Schore, 2002; Siegel, 1999).

When horses are successfully raised, they instinctively know how to self-regulate (Hallberg, 2008, Hamilton, 2011; Levine, 1997). The fear response to a potential threat will activate a horse's sympathetic nervous system, much like a human. However, once the horse perceives there is no real threat, their parasympathetic nervous system will activate, leading to a physiological discharge of the sympathetic activation, and they will readily return to a relaxed state (Levine, 1997; Peters & Black, 2012). This is not always the case for humans because "our rational brains may become confused and over-ride our instinctive impulses" (Levine, 1997, p. 18). Furthermore, since horses are emotionally attuned and focused on connection/relationship, the horse-human bond provides an opportunity for social engagement/attachment that can potentiate an interactive, neurobiological attachment transaction.

Existing Research on the Effects of EAP on Emotion Regulation

The sparse research in the area of EAP and emotion regulation includes a few empirical studies that show attachment transactions, as well as positive changes in physiological measures such as cortisol levels (Pendry, Smith, & Roeter, 2014) and heart rate variability (HRV) levels (Walters & Baldwin, 2010), during human-horse interactions. A qualitative study by Yorke, Adams, and Coady (2008) provides evidence in support of an attachment bond in EAP among trauma survivors. The semi-structured interviews revealed several bond themes related to participants' connections with the horses. Their findings suggest that an attachment relationship with a horse can provide an experience of emotional attunement and expression that can lead to better self-regulation.

Pendry, Smith, and Roeter (2014) conducted a RCT to examine the effects of EFL on stress and well-being as measured by salivary cortisol levels among children in grades 5 through 8. Results indicated that children in the EAL condition had lower overall cortisol levels per waking hour as well as lower afternoon cortisol levels at posttest compared to children in the waitlist condition. Researchers have suggested a link between lower cortisol levels and protection against the development of psychopathological problems, which most often involve emotional dysregulation (Lupien et al., as cited in Pendry et al., 2014). These findings suggest that EAL potentially lowers cortisol levels in adolescents, which in turn supports psychological well-being and emotional self-regulation.

A pilot study involving horse-human interactions utilized HRV as a measure of emotion regulation (Walters & Baldwin, 2010). HRV, or the beat-to-beat pattern of the heart, is a non-invasive measure that is able to estimate the interactions of parasympathetic and sympathetic control of the heart (Appelhans & Luecken, 2006; Porges, 2011). Essentially, higher HRV, or more variability between heartbeats, is an indicator of self-regulatory capacity (Segerstrom & Nes, 2007). HRV is therefore an indicator of physiological resilience to stress, behavioral flexibility, and emotion regulation (Porges, 2005, 2011).

The above-mentioned pilot study was conducted to examine HRV in humans and horses during horse-human interactions (Walters & Baldwin, 2010). Although this study did not utilize EAP methods per se, the findings contribute important information in terms of the effects of horse-human interactions on the neurobiological processes of emotion regulation, which in turn may be applied to EAP. Researchers in this experiment looked for a state of coherence in both horses and humans, which is when HRV increases and becomes more ordered and balanced, indicating an increased potential for emotional self-regulation. Thus, coherence involves a state of resonance and synchronization within the “body’s oscillatory systems” (Walters & Baldwin, 2010, p. 2) such as heart rhythms, respiration, and alpha rhythms in the brain, and is associated with increased self-regulatory capacity and overall well-being (Shaffer, McCraty, & Zerr, 2014).

The horse-human interactions in this pilot study involved a human paired with a horse who was at liberty in the arena. Both horse and human HRV measurements were recorded via an ambulatory monitor. Results indicated a correlation between horse and human heart rate rhythms for various times throughout the experiment (Walters & Baldwin, 2010). A cross-correlation analysis revealed that the horse’s coherent heart rate rhythm influenced the human’s heart rate rhythm to oscillate in a similar frequency. Additionally, human participants were instructed to cultivate thoughts and feelings of appreciation, which was shown to be associated with a state of coherence. Eliciting a state of coherence by sending appreciation to the horse resulted in greater amounts of shared oscillation frequencies between the human and horse (Walters & Baldwin, 2010).

Purpose of the Present Study

Overall, there is a paucity of empirical research on the efficacy of EAP, particularly related to emotion regulation. Many of the research studies just reviewed that examined the effects of EAP have utilized qualitative methods, and have found beneficial results in terms of increased self-awareness, self-efficacy, trust, and assertiveness, as well as decreased psychological distress, improved mood, and better overall functioning for youth and adults with mental health issues (Burgon, 2013; Whitely, 2009; Yorke et al., 2008). The quantitative studies in this area have found similar results in terms of increased social competence (Pendry & Roeter, 2013), adaptive skills (Kemp et al., 2014; Trotter et al., 2008), self-control and self-efficacy (Bachi et al., 2011; Cumella & Lutter, 2014; Schultz et al., 2007; Whitely, 2009), self-awareness (Klontz et al., 2007), and emotion regulation (Pendry, Smith & Roeter, 2014; Walters & Baldwin, 2010).

Experimental research methods and designs utilizing clear theoretical rationales are needed in determining the efficacy of EAP in terms of its effects on emotion regulation. The purpose of this study was first to propose a relatively new conceptualization of the efficacy of EAP in terms of the neurobiological processes in both horses and humans, associated with attachment, nervous system regulation, and emotion regulation capacities. A second purpose of this study was to expand the quantitative research on the effects of EAP and emotion regulation and explore how self-efficacy and self-awareness could mediate these effects. The current hypothesis predicted that the effects of EAP would increase measures of self-efficacy and self-awareness, which would in turn contribute to improved emotional self-regulation as measured by HRV. In order to substantiate the potential relationship between EAP and emotion regulation, positive and negative affect were also examined as outcomes.

Methods

This study examined the effects of EAP on self-efficacy, self-awareness, positive and negative affect, and emotion regulation among 95 adult, inpatient psychiatric residents with substance abuse, mood disorders, and trauma. Residents participated in EAP groups and were assessed using the physiological measure of heart rate variability (HRV) for emotion regulation, as well as self-report measures of self-efficacy, self-awareness, and positive and negative affect. The proposed study hypothesized that EAP would improve emotion regulation reflected by increased HRV and positive affect, as well as decreased negative affect; and that these effects would be mediated by increased self-efficacy and self-awareness.

Participants/Program

A power analysis was conducted in order to determine the sample size required for this study. Several studies showing effect sizes were found that examined the effects of EAP or AAT on measures of physiological arousal, similar to HRV (Pendry et al., 2014); as well as measures most similar to self-awareness and self-efficacy (Kemp et al., 2014; Klontz et al., 2007; Pendry & Roeter, 2013). After inputting these effect sizes into G*Power 3, with an alpha level of .05 and a beta level of .20, the results initially indicated a sample size of 200 participants. However, due to limitations associated with field research that were discovered within the first month of the project, another power analysis was conducted which yielded a sample size of 95.

Participants were adult residents at an inpatient psychiatric hospital/behavioral health treatment center, with the average length of stay between 30-45 days. Residents from the addiction, mood disorder, and trauma programs were included in the study. Each program track is focused on the particular issues related to the primary problem, although secondary problems may also be addressed within that group. These groups are equivalent in that residents attend individual and group psychotherapy, psycho-education lectures, and a set amount of integrative therapy sessions including Eye Movement Desensitization Reprocessing (EMDR), Somatic Experiencing (SE), Dialectical Behavior Therapy (DBT), biofeedback, acupuncture, and weekly Adventure Therapy and/or EAP groups. As part of their regular programming, all residents were required to attend EAP groups.

The typical demographics include primarily Caucasian males and females, over the age of 18 from various parts of the United States and on occasion, from other countries. The common socio-economic status of participants is middle to upper class, most with a college degree or enrolled in a college or university program.

EAP team members consisted of one master's-level EAP therapist and one EAP specialist who co-facilitate EAP sessions and manage safety around the horses. Since there were three master's-level EAP therapists--all of whom are also EAP specialists, and one EAP specialist, participants received any combination of two EAP staff members for their EAP group sessions. All members of the EAP team had worked at the treatment facility where Barbara Rector developed EFP, which is the same inpatient treatment facility in which this study was conducted. Since the EFP model has been passed down through equine professionals and mental health therapists who trained with Ms. Rector, all EAP team members in this study had received training in EFP. Additionally, all EAP staff had received training in the EAGALA model of EAP.

EAP sessions included working on the ground with the horse; due to safety issues, mounted work did not take place. A safety protocol was reviewed with the participants prior to engagement in any activities.

Description of EAP Setting

Chairs were set up approximately 70 feet from the round pen, which is 60 feet in diameter. EAP groups consisted of 2-9 participants at any given time. A walking track is within a few yards from this area; anywhere between 1-7 people, not connected to the experiment, walked by during the EAP sessions. A total of 8 horses were involved in the group EAP sessions. A description of them follows:

- Stilts: age 29, Quarter horse, trained in trail riding and EAP
- Gunner: age 20, Quarter horse, trained in trail riding and EAP
- Rojo: age 28, Welsh pony, trained in trail riding and EAP
- Dakota: age 12, Quarter horse, trained in trail riding and EAP
- Boogie: age 7, Paint, trained in trail riding and EAP
- Tucker: age 15, Paint, trained in trail riding and EAP
- Stony: age 22, Quarter horse, trained in trail riding and EAP
- Sandy: age 7, Quarter horse, trained in trail riding and EAP

Measures/Instrumentation

The number of EAP group sessions were measured over the course of their time in treatment. Some residents received individual EAP sessions and/or attended grooming groups, as ordered by their treatment team; these residents were accounted for and factored into the analysis as a demand characteristic, which refers to something that causes participants to be aware of what the experimenter expects and in turn may influence their behavior. Furthermore, each resident's program track was factored into the analysis in order to clearly distinguish any differences in results between program tracks.

As part of the admission process, residents completed a two-item questionnaire about their past experience with horses as well as their past experience with EAP. Emotion regulation was assessed via a physiological measure of autonomic nervous system activation that involves the beat-to-beat heart rate pattern or heart rate variability (HRV; Porges, 2011). The Positive and Negative Affect Schedule (PANAS), a 20-item measure of positive and negative affect, was used to determine any state-specific changes related to the effects of EAP, and provide support for the relationship between EAP and HRV. The Mindfulness Attention Awareness Scale (MAAS) is a self-report measuring internal and external attentiveness and awareness. The General Self-Efficacy Scale (GSE) measures an individual's belief in his or her ability to respond to challenging situations along with any related or subsequent setbacks. Please see Appendix B for a complete description of all the measures.

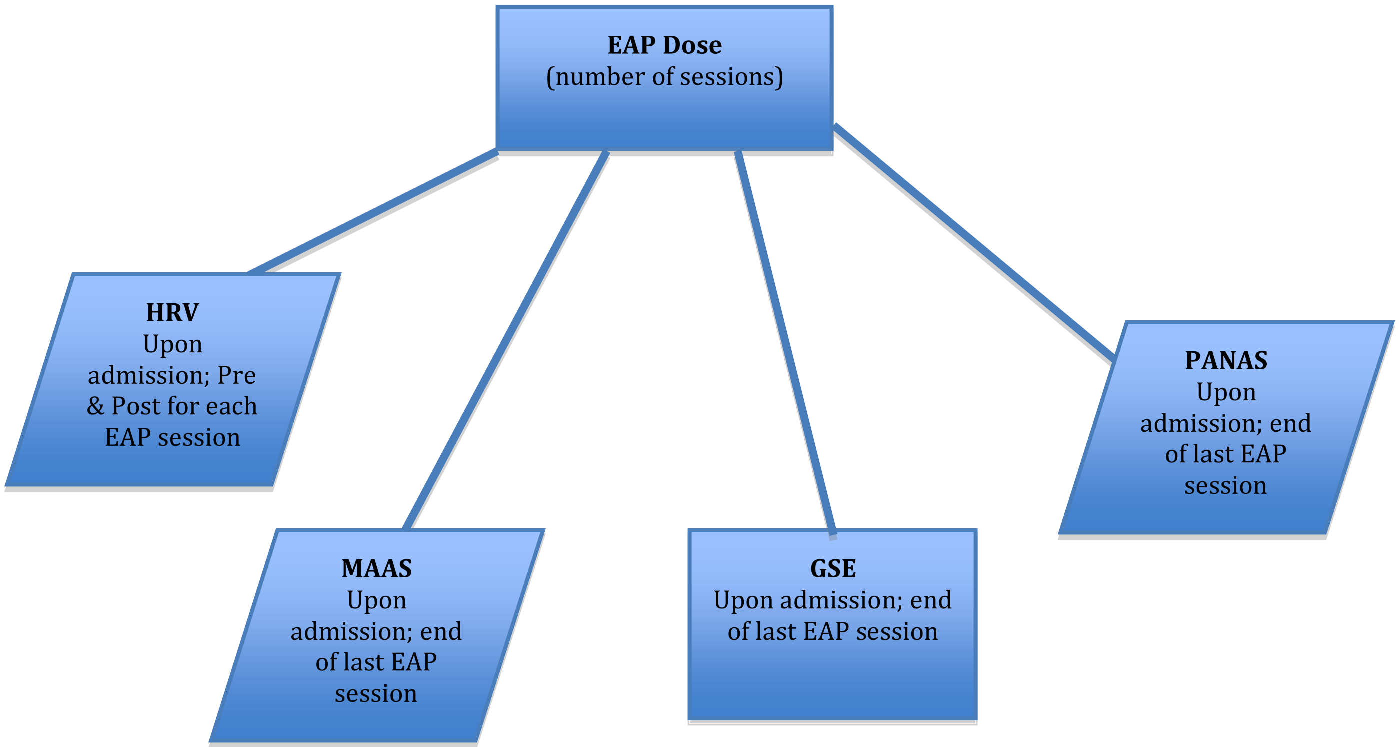
Procedures

Upon admission while in the Level 1 unit, each resident met with a member of the EAP team to obtain informed consent. Residents who did not wish to participate were eliminated from the study. The EAP team member then administered a 5-minute HRV recording to those consenting residents, followed by the Horsemanship and EAP Experience questionnaire (administered one time upon admission), the MAAS, GSE, and PANAS.

During each EAP session, consenting residents received a portable *emWave-2®* and were instructed by members of the EAP team to sit quietly in chairs outdoors near the round pen for 5 minutes before the EAP session and 5 minutes after the EAP session while their HRV was being recorded. All EAP sessions took place in the same location. Following the post-test HRV recordings, those residents attending their final EAP session were administered the GSE, MAAS, and PANAS. The questionnaires were placed in a folder and taken by the facilitators to a locked cabinet at the facility. Scoring of the questionnaires was completed by several of the facilitators. Four offsite research assistants were emailed the HRV data that were coded for confidentiality. They ran the data through *Kubios*, and then organized and input the data into an Excel sheet.

The computer software provided with the *emWave-2*® device measured HRV through detection of the pulse from the earlobe with an electronic sensor. HRV inter-beat interval (IBI) raw data were accessed from the portable *emWave-2*®. Any abnormal beats (outliers) were manually removed from each data file. The corrected data files were then uploaded into the computer program. *Kubios,* which analyzes the signal in terms of the time domain and frequency domain parameters, was downloaded from http://kubios.uef.fi/. The time domain parameters provide an overall measure of HRV by quantifying the standard deviation of the IBI data, known as SDRR, and also the parasympathetic component of HRV in terms of the "root mean square of successive differences in IBI (RMSSD)" (Baldwin & Schwartz, 2012, p. 301).

Figure 1. Number of EAP sessions with measurements and their frequency of administration. The Horse Experience Questionnaire was administered one time upon admission.



Data Analysis

As the primary researcher interacted with some of the participants, a test for demand characteristics was warranted prior to running the primary analyses. This was to account for possible confounding effects that may occur in participants' responses as a result of knowing the primary researcher was facilitating the EAP group. A series of two-sample t-tests was performed on self-efficacy, self-awareness, HRV, and PANAS in which primary research involvement (dichotomous) was the grouping variable. In the event that demand characteristics are found between those who had the primary researcher as facilitator and those who did not, the analyses described below will be run separately for those two conditions.

The current hypothesis predicts that the effects of EAP would increase measures of self-efficacy and self-awareness, which would in turn contribute to an increase in HRV and Positive Affect but a decrease in Negative Affect. Measures of HRV were compared pre- and post-treatment for each EAP session. Additionally, the overall temporal stability of HRV measures was assessed using a bootstrapped within subjects ANOVA using a percentile method (Efron & Efron, 1982).

In order to test for mediation, a regression cascade (Figueredo, Garcia, Cabeza de Baca, Gable, & Weise, 2013) was performed using sequential general linear models in SAS v.9.4, SPSS, or R. This procedure uses nested regression models to determine the presence of mediation, and is flexible enough to permit the use of several categorical or continuous covariates such as Horse Experience and effects from other treatments, if determined necessary by the preliminary analysis (see Figure 2 below). Additionally, other potential confounds such as diagnoses, and types and amounts of other treatments they receive during their stay were measured in the preliminary analysis to determine if there were any significant effects. Those variables that were significant were factored into the overall analysis as covariates.

Positive Affect and Negative Affect were also factored into the two mediation models just described (see Figure 3 below). Prior to these mediation tests, program track was tested using a one-way ANOVA against the study variables for possible differential effects of EAP by track type. No significant differential effects were detected. The assumptions underlying parametric statistics were tested. A bootstrapping procedure was used when possible to estimate the effect sizes.

Figure 2. Nested regression models used to determine presence of self-efficacy and self-awareness as mediators in the relationship between EAP and HRV

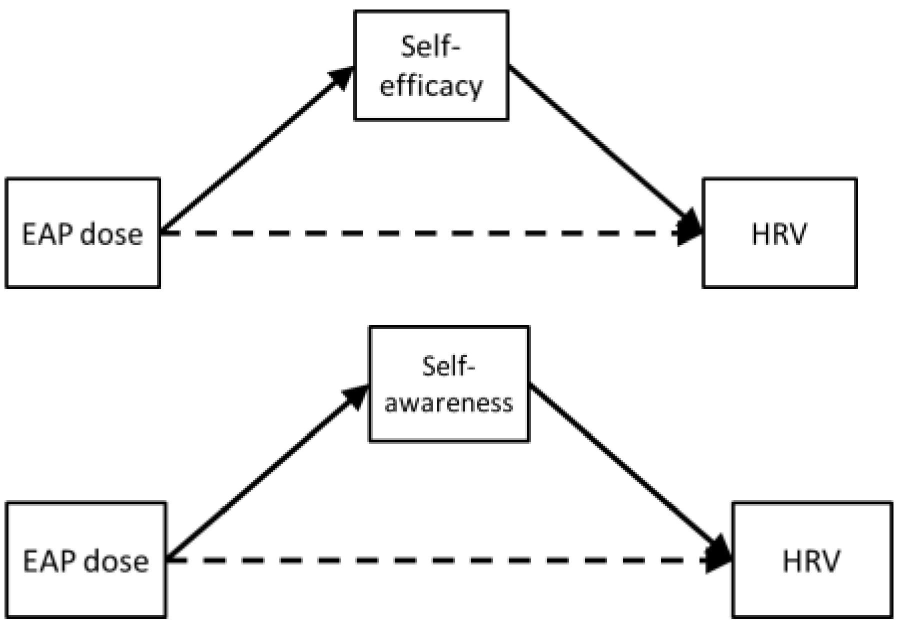
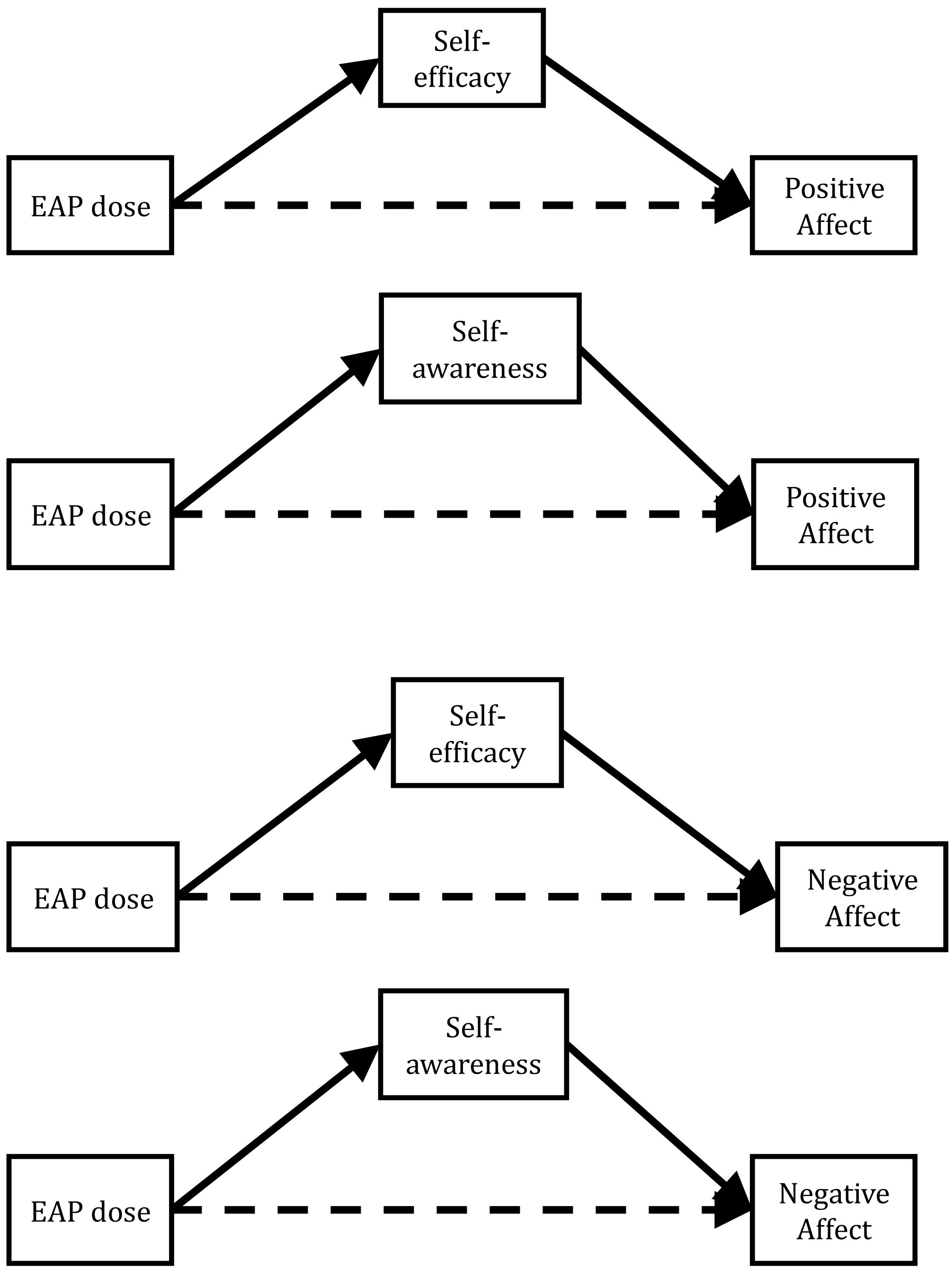


Figure 3. Nested regression models used to determine presence of self-efficacy and self-awareness as mediators in the relationship between EAP and Positive Affect, and EAP and Negative Affect



Study Limitations

One limitation in this study related to the potential problems inherent in having the principal investigator involved in providing the intervention and collecting the assessment data. The principal investigator could not be eliminated from administering the intervention and assessment data in this study, which therefore increased the potential for demand characteristics and experimenter expectancy effects. In order to account for these potential confounds, as much as possible, the study minimized the number of participants with whom the principal investigator interacted. Lastly, the data analysis indicated any differences between participants with whom the principal investigator interacted and those with whom she did not.

Results

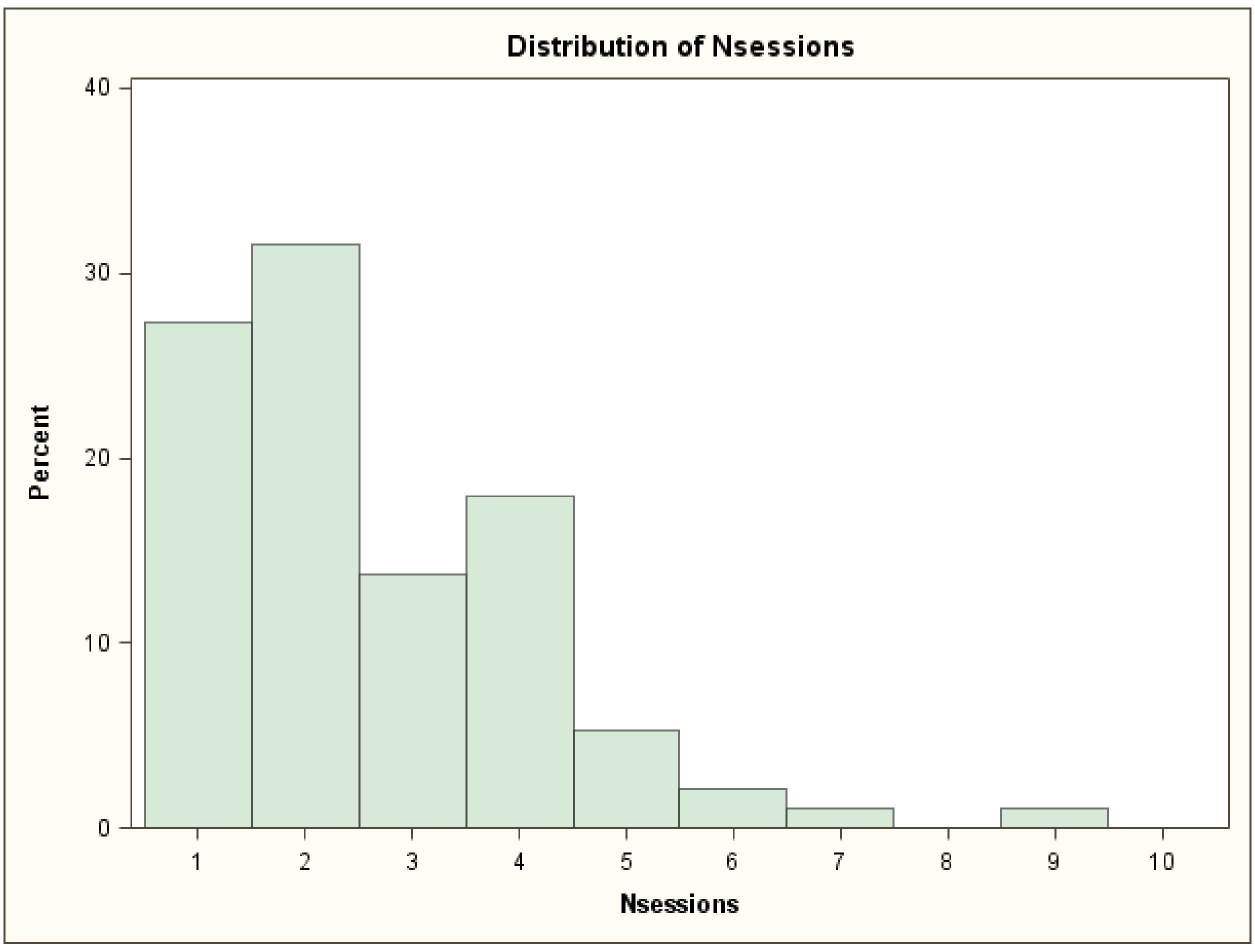
Participants (*N*=95) were 47 males and 48 females ranging in age from 18 to 70 years old. Race/ethnicity of the participants was 95% Caucasian, 2% Latino, and 3% biracial; 3.8% of the participants identified as LGBTQ. The inpatient facility serves residents from a primarily high socioeconomic status. Sixty-four percent of participants were in the addictions track, 20% were in mood disorder track, and 16% were in the trauma track. Due to the low census in the eating disorder and pain management tracks, data collection was not initiated for these groups. There was one exception involving an eating disorder participant who started in the study at the beginning of data collection when it was unclear that these tracks would remain low in census. The descriptive statistics and correlations (Tables C1-C5) factor all participants including the one eating disorder participant.

The Shapiro-Wilk test for normality was conducted for each variable. Additionally, estimates of skew and excess kurtosis were assessed along with a visual inspection of variable q-q plots and histograms to determine the severity of the normality violation. Eight variables failed the Shapiro-Wilk test: NSessions (Shapiro-Wilk W = .96, p < .01), EAP1 (Shapiro-Wilk W = .84, p < .01), EAP2 (Shapiro-Wilk W = .53, p < .01), POS2 (Shapiro-Wilk W = .96, p < .01), NEG2 (Shapiro-Wilk W = .91, p < .01), MAAS2 (Shapiro-Wilk W = .97, p = .04), SDNN (Shapiro-Wilk W = .95, p < .01), and ΔGSE (Shapiro-Wilk W = .96, p < .01). Of these, only NSessions and EAP2 had high estimates of skew and excess kurtosis (greater than + 1.0, indicating positive skew and leptokurtosis). Further, EAP1, POS2, NEG2, MAAS2, SDNN, and ΔGSE visually appeared normally distributed according to the q-q plots and histograms. For the purposes of these preliminary analyses, these were deemed sufficient to obtain preliminary effect size estimates.

Track type did not significantly predict differences on any of the variables used in this study with the exception of one: the second question on the Horse Experience Questionnaire ($F(2,91) = 9.29$, $p < .01$, $R^2 = .17$, $r_{95\%\ C.I.}$ = [.04, .30]). Bonferroni post hoc tests indicated that when asked to “rate [their] past experience with equine-assisted psychotherapy” the Trauma group (mean = 1.75, Bonferroni C.I. = [1.12, 2.38]) had higher ratings than the Addiction (mean = 1.20, Bonferroni C.I. = [1.07, 1.33]) group (p < .001), or Mood Disorder (mean = 1.06, Bonferroni C.I. = [.91, 1.20]) group (p < .001), who were not statistically significantly different from each other (p = .88). Since this has no bearing on any other analyses, all tracks were combined for all additional analyses. Note: when testing differences among tracks, one case was dropped (ED group), so the sample size is 94. In all other analyses, the sample size is 95 unless otherwise stated.

The hypothesis set forth was to examine the effects of EAP on emotion regulation with self-efficacy and self-awareness as potential mediators. The original research design included a comparison between a high dose condition and low dose condition, differentiated by an increased number of EAP sessions (high dose) and the usual number of EAP sessions (low dose). Unfortunately, the number of high dose EAP sessions was significantly lower than expected thus resulting in a limited difference in the number of sessions between these high and low dose conditions. Instead EAP dose was quantified as the variable number of sessions administered to the subject.

Figure 4. Distribution of Number of Sessions.



The mediation models initially proposed were dropped due to the lack of statistically significant relationships between EAP dose (quantified as continuous number of sessions) and changes in either self-efficacy ($r = .03$, $p = .81$, $r_{95\%\ C.I.} = [-.18, .23]$) or self-awareness ($r = .12$, $p = .25$, $r_{95\%\ C.I.} = [-.09, .31]$). These inconclusive results between either hypothesized mediators and the independent variable makes any mediation test moot. Analyses proceeded forward by describing the correlations between hypothesized mediators (self-efficacy and self-awareness) and the various outcomes (HRV, positive and negative affect).

Table C1 shows the means and standard deviations for HRV variables, self-report measures (pretest and posttest), and changes in pre- and post- self-report measures. The correlations among HRV variables are given in Table C2. Of the nine correlations, it can be seen that eight are positive and six are above $r(94) = .20$, $p < .05$. Note that mean HR is the only variable that is negatively correlated with all other variables; as HR increases, there is less time between heartbeats thus less potential for variability. The HRV variables that primarily reflect parasympathetic activity are the log of the root mean square of successive differences in the inter-beat interval (LnRMSSD) and the log of high frequency (LnHF).

The correlations among self-report measures are given in Table C3. Correlations between pre- and post-test measures were positive and statistically significant as follows: self-efficacy, self-awareness, Negative Affect, and Positive Affect. The correlations among self-report and HRV measures are given in Table C4. Note that mean RR (inter-beat interval) is positively correlated and statistically significant for Number of EAP sessions, GSE pretest, and MAAS pretest. In addition, mean HR is negatively correlated and statistically significant for those same variables: Number of EAP sessions, GSE pretest, and MAAS pretest.

The temporal stability of HRV measures can be seen in Table C5. Within subjects ANOVA using a percentile method (Efron & Efron, 1982) on 1,000 bootstrapped samples shows a statistically significant effect on the HRV variable most associated with parasympathetic activity.

Effects of three demand characteristics (Experimenter as Facilitator, Individual EAP Sessions, and Grooming Groups) were analyzed using two-sample t-tests. The two groups are those that had (57 participants) vs. did not have (38 participants) the Experimenter as Facilitator, those that received (10 participants) vs. did not receive (85 participants) Individual EAP Sessions, and those that received (32 participants) vs. did not receive (63 participants) Grooming Groups. There was no evidence of demand characteristics on HRV (Table C6). There was a positive correlation and statistically significant effect of Individual EAP Session on self-efficacy post-test and positive affect post-test (Table C7).

Additionally, there was a positive correlation and statistically significant effect of Experimenter as Facilitator on Number of EAP Sessions and change in self-awareness (Table C8). There was also a positive, statistically significant effect of Individual EAP Sessions on change in self-awareness and positive affect (Table C8). Also seen on Table C8 is a positive correlation and statistically significant effect of Grooming Group on Number of EAP Sessions.

Table C9 describes the changes in scores for the self-report measures. Growth can be seen in participants between baseline and the last EAP session on all dimensions: change in self-efficacy, self-awareness, positive and negative affect.

The correlations between hypothesized mediators and outcome measures are given in Table C10. LnLFHF, which reflects the autonomic state resulting from both sympathetic and parasympathetic influences, was positively correlated and statistically significant for change in self-awareness. In addition, change in negative affect was negatively correlated and statistically significant for both ΔGSE and ΔMAAS. Lastly, change in positive affect was positively correlated and statistically significant for both ΔGSE and ΔMAAS.

In order to investigate any immediate effect of EAP therapy, a composite HRV variable was created and correlated with demand characteristic control variables, initial self-report measures, and the Horse Experience Questionnaire (Table C11). This composite was created using SDNN, LnRMSSD, LnVLF, LnLF, LnHF, and LnTotal. These variables were chosen because of the strong, positive intercorrelations that they share (see Table C3). The variables were standardized and aggregated into a single HRV variable. After aggregation, difference scores (Post Session – Pre Session) were created for each session for each participant. These difference scores were averaged within each participant to yield a single average HRV change score for each participant. Change in HRV was positively correlated and statistically significant for Experimenter as Facilitator.

Table C12 presents HRV changes from baseline to last post-EAP session. Using a dependent, two-tailed t-test, increases in HRV were observed in six of the nine measures of HRV SDNN, LnRMSSD, LnLF, LnHF, LnTotal, and LnLFHF. Of note are the increases in LnRMSSD and LnHF, as these HRV variables are most closely associated with parasympathetic activity, which is related to the ability to emotionally self-regulate. Although the effects sizes are considered small, they represent a possible relationship between EAP and emotion regulation.

Discussion

The purpose of this study was to examine the effects of EAP on emotion regulation with self-efficacy and self-awareness as potential mediators. Results of the analysis showed that the relationship between EAP dose and changes in self-efficacy or self-awareness were inconclusive. The major explanation for these findings is the limited number of EAP sessions for most of the participants. This unexpected result is attributed to the limitations inherent in field research versus laboratory research where many confounding conditions can be controlled. More specifically, the inpatient psychiatric hospital/behavioral health treatment facility where this research was conducted provides an extensive offering of treatment modalities. Some of these modalities were determined essential to patient care thus appointments for these services often had to be scheduled during regular programming, which included EAP groups. This issue became apparent to the primary researcher early in the study and a significant effort was made to prevent further scheduling conflicts during EAP groups in order to support the research. Nonetheless, this issue persisted throughout the duration of the study primarily due to challenges with scheduling.

Although these findings cannot suggest any effects of causality, correlations among the variables indicate several relationships that are worth noting. Most of the self-report variables show a positive correlation with all other variables except for the pre- and post-tests for negative affect, which were negatively correlated such that post-test scores on negative affect decreased from pre-test scores. Additionally, all self-report measures showed a positive and statistically significant change between pre- and post-tests, suggesting that EAP sessions may have contributed to an increase in self-efficacy, self-awareness, and positive affect, and a decrease in negative affect.

Additionally, higher heart rates include less time between heart beats (inter-beat interval), thus less potential for variability. This indicates that an increase in inter-beat intervals has more potential for variability between heart beats, which would in turn increase HRV. Results suggest that a potential increase in the mean inter-beat interval (mn-RR) is associated with an increase in the number of EAP sessions (see Table C4).

A possible rationale for the positive, statistically significant correlation of Individual EAP Sessions on post-test measures of self-efficacy and positive affect might be that individual EAP Sessions provide focused time alone to connect/join with the horse that might elicit increased positive affect and a sense of mastery while engaging in horse-handling activities.

The positive, statistically significant relationship of Experimenter as Facilitator on the number of EAP sessions might be attributed to the fact that more than half the participants had the Experimenter as Facilitator, causing the number of EAP sessions to be statistically significant. This could also apply to the positive, statistically significant relationship between those in Grooming Groups and the number of EAP sessions since these participants had more time with the horses overall. Furthermore, Experimenter as Facilitator and Individual EAP Sessions were associated with a positive change in self-awareness, which could be explained by the encouragement to focus on present moment experience in both these conditions. More specifically, the Experimenter as Facilitator had past training in somatic psychotherapy, which particularly focuses on the moment-to-moment sensorial experience of the participant/client. Individual EAP Sessions allowed participants focused attention on their experience with the horse, without the distraction of other group members.

Changes in HRV scores among the participants showed a positive and statistically significant relationship with Experimenter as Facilitator. This could possibly reflect unintentional researcher bias and/or skill and experience level.

Changes from baseline to post-HRV recording during participants' last EAP session show statistically significant, positive correlations for variables related to the gross measure of HRV and parasympathetic activity of the ANS, suggesting that HRV or emotion regulation increased from baseline to last EAP session.

The correlational findings in this study are consistent with the results of numerous studies on the effects of EAP on measures related to self-efficacy, self-awareness, positive affect, and negative affect (Bachi, 2013; Burgon, 2013; Klontz et al., 2007; Pendry & Roeter, 2013; Schultz et al., 2007; Trotter et al., 2008).

The theories proposed in this study that suggest a relationship between EAP and emotion regulation are based on the principles of autonomic nervous system regulation and the neurobiological and psychological components of attachment theory. More specifically, qualities inherent in horses are believed to be beneficial for humans in terms of learning to regulate nervous system activation, as well as developing corrective attachment transactions. In support of this idea are the correlations among pre- and post-test HRV variables from this study. These trends suggest that EAP increases parasympathetic activity which is associated with a greater ability to self-regulate. These results are consistent with Walters and Baldwin's (2010) findings that the horses may have influenced the humans' HRV to oscillate in a similar frequency to their own HRV. Similarly, findings from Pendry, Smith, and Roeter's (2014) study showed that EAL decreased cortisol levels among children. Cortisol levels and HRV are both physiological measures of psychological well-being and the ability to emotionally regulate (Lupien et al., as cited in Pendry et al., 2014).

The positive and statistically significant relationship of Individual EAP Sessions on post-test measures of positive affect as well as positive changes in self-awareness, might be associated with the time alone to join/connect with the horse. These correlations may suggest the potential for an attachment experience between horse and human. Similarly, Yorke's findings suggest that an attachment relationship with a horse can provide an experience of emotional attunement and expression that can lead to better self-regulation.

Limitations and Implications

The original design of this study sought to compare any differences reflected in the measures among participants in a high dose condition (more EAP sessions) as compared to those in a low dose condition (normal number of EAP sessions). Randomization was part of this original design, as participants were randomly assigned to these conditions. Unfortunately, due to the limitations of field research including those mentioned above, the difference in the number of EAP sessions between these dose conditions was not significant enough to detect changes therefore eliminating the potential for comparison and causality. Instead, the analysis included a test for trend in terms of the number of EAP sessions. However, the issues related to the lack of attendance at EAP sessions also impacted the ability to determine if or how self-efficacy and self-awareness might have mediated the relationship between EAP and emotion regulation.

Another limitation of this study is that it included a non-random sample, as all participants were residents at an inpatient psychiatric hospital/behavioral health treatment facility. Lastly, since it was unavoidable that the primary researcher also needed to facilitate many of the EAP sessions, unintentional experimenter bias may have confounded any of the results.

Future research examining the effects of EAP on emotion regulation will benefit from use of a control or comparison condition. Furthermore, adding another physiological measure such as cortisol levels along with HRV will likely substantiate the neurobiological underpinnings such as nervous system regulation, of EAP's effects on the ability to self-regulate. Since some populations including those with specific psychopathological conditions might benefit from EAP, it would be valuable to conduct future studies with individuals facing certain problems. Lastly, the inclusion of follow-up data in prospective research studies would help determine if any changes in emotion regulation related to EAP are stable over time.

Overall, the current study suggests that physiological and self-report measures related to the effects of EAP are correlated with an increase in HRV/emotion regulation, self-efficacy, self-awareness, positive affect, and a decrease in negative affect among residents at an inpatient psychiatric hospital/behavioral health treatment facility facing addictions, mood disorders, and trauma.

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Appendices

Appendix A

Description of Equine Activities

Equine Meditation

Prior to going into round pen, lead brief meditation with residents sitting in chairs, with focus on their breath, sensations in their body, and any other sensory experiences such as sounds such as sounds, smells and kinesthetic sense. Tell them they are going to be given 15 or 20 minutes to go into the pen and be with the horses in silence, bringing attention to their moment-to-moment experience with all their senses. After time is up, bring residents back to chairs and ask them to either draw an image or write about their experience. Process questions: What was it like to be in silence with the horses? What was it like to be in silence with your group members? What stood out for you the most about your experience? Was anything surprising to you?

Catching and Haltering

Hand halter and lead rope to residents or leave it hanging on fence and tell them to catch and halter the horse to the best of their ability, without any further instructions. If residents ask for help, encourage them to do the best they can or ask them what they would like you to do. Praise if they ask for help. If they are trying to get you to do it for them, tell them to find their own way to do it. Process questions: How did it work for you? How did it work for the horse? What didn't work? What was your reaction or feeling to the horse's responses to you?

Leading

There are limitless ways of leading. Use to start or end a session either with or without the halter and lead rope. Ask resident to lead the horse anywhere in the pen they want while the rest of the group watches the interactions between their group member and the horse. Process questions: How does the resident hold the lead rope? Is this the kind of leading style the resident likes? Why? Who is leading whom? Where is the resident's focus while they are leading? What is the process of building the relationship with the horse?

Grooming

Tie horses to fence with 1-2 residents at each horse grooming. This gives residents time to connect with the horse. Notice how they approach the horse. Process questions: Who does the horse remind you of? Notice how you're feeling.

Ground Tie

After residents have caught and haltered the horse, explain that sometimes there are no places to tie the horse and tell them to ground tie, which means to lay the lead rope down on the ground, and the horse stays as if he is tied. The exercise is to ground tie the horse and then walk around or away from it as many times as they want without the horse walking off. Bring the horse back if he does walk off and start again. Process questions: Where was the horse's focus? Where was the residents' focus? Who does the horse remind you of? What does success look like? How did you respond when the horse moved? Who was training whom? How did your group members affect you?

Backing Up

Ask residents, one at a time, to hold onto the end of the lead rope with one hand, stand about an arms distance in front of the horse, and ask the horse to back up. Do not demonstrate this. If the patient asks how to do it, help them explore verbal and non-verbal communication and ask what they think would work. Process questions: What worked in terms of getting the horse to back up? What was it like for you? Is this consistent with the way you typically communicate (assertive, aggressive, passive, polite, mean, etc.)? How did the horse respond? How did you respond when the horse didn't do what you wanted?

Story

Ask residents to observe the herd for several minutes. Possible process questions/activities can include: Which horse is most like you? Which ones are most like your family members? Which ones get along and which ones don't? Which ones are beautiful or not and why? Draw a picture of the story you think the horses are telling. In round pen without horses initially, have them build a "home" or "safe place". Bring them outside the pen and the horses into the pen, and discuss how the horses respond to what they built.

Keyhole

Create a pathway that opens up to a circle (somewhat like a keyhole) in the middle of the round pen. Ask one resident to lead the horse with their eyes closed, through the keyhole and back out while their group members stand on the outside of various points of the keyhole giving that person directions using only 3 words. Residents are asked to brainstorm and come up with the 3 words that they can use to communicate to person leading the horse. If they use other words, they are to sit out until the next round. Neither the horse or person leading the horse can step outside the keyhole – if they do, they start over. Process questions: What worked? What didn't work? How did the 3 words work? How did the horse respond?

Rail

Staff sets up the rail in the middle of the arena. The goal is for residents to get one of the horses to go over the rail. Rules**:** NO touching the horses, NO using halters or lead ropes, NO bribing or simulating bribing (pretending to have treats), NO using anything outside the arena, NO verbally talking (can make noises). The group has 2 minutes to make a plan**.** Process questions: How did the group communicate non-verbally? Verbally? How did they handle difficulties? How did they work together? What helped them succeed? Were they focused more on the rules (what they couldn't do compared to what they could do)? What might the rail represent to them?

Pathway

Ask residents to identify a group goal they all share and agree upon. Then ask them to build a pathway made of various objects (balls, buckets, cones, ropes) that lead to their goal. Ask them to lead the horse through the pathway to their goal. Rules: NO touching the horse, NO verbally talking (they can make noises), NO bribing or simulating bribing, or NO using the halter or lead line. Process questions: How is communication between group members going? How does the horse respond/feel throughout the activity? What was challenging? What went well? What did this mirror in your life?

Brain

Ask 3 or 4 residents to participate and stand next to each other with their arms linked. Explain that the one or two middle residents are the brain and the group member on the outer right side is the right arm while the group member on the outer left side is the left arm. Their task is to catch and halter the horse. Rules: The brain can only think, talk and give directions. The hands cannot think or talk, or do anything at all unless told by the brain. The right side of the brain communicates to the left hand and the left side of the brain communicates to the right hand. Process questions: What happened in the process? How did the residents feel in their roles? How was the communication from the brain? When were things rough? When were they smooth? How did the horse respond?

<u>Appendix B</u>

<u>Description of Measures</u>

Horsemanship and EAP Experience Questionnaire.

Participants will answer 2 items (one about their horsemanship experience and the other about any previous EAP experience) using a 5-point Likert scale with ranges: (1) - *no past experience*; (2) - *a handful of experiences*; (3) – *many experiences*; (4) – *several years of experience*; (5) – *a lifetime of experience*.

Heart rate variability.

HRV is a non-invasive measure that is able to estimate the interactions of parasympathetic and sympathetic control of the heart, which is associated with a person's ability to emotionally self-regulate. Whereas sympathetic nerves accelerate heart rate, parasympathetic nerves slow it down. These two branches of the ANS are continually interacting in response to changes in external and internal conditions. High HRV is indicative of increased parasympathetic activity, which results in "more pronounced acceleration and deceleration and more variable intervals between heart beats" (Segerstrom & Nes, 2007, p. 275), reflecting flexible responses to external and internal stimuli. Alternatively, low HRV suggests less parasympathetic input and therefore less flexibility in terms of regulating sympathetic activity. Thus, HRV is an indicator of physiological resilience to stress, behavioral flexibility, and emotion regulation.

Positive and Negative Affect Schedule (PANAS)

The PANAS consists of 20 words that describe feelings or emotions. The respondent indicates the extent to which they feel this way using a Likert scale ranging from, 1 - *Very Slightly/Not at All* to 5 – *Extremely*. A study examining the psychometric properties of the

PANAS (Watson, Clark, & Tellegen, 1988) administered a mood questionnaire with PANAS terms randomly distributed throughout to students, nonstudents, and clinical samples. Ratings from seven different timeframes were obtained such as, “right now,” “today,” “during the past few days,” and so on. Results showed “a significant level of stability in every timeframe” (Watson et al., 1988, p. 1065), suggesting high test-retest reliability. It also indicates the link between mood states and level of general affect. Comparable results were found for student, nonstudent, and clinical samples, suggesting generalizability of the PANAS. The internal consistency reliabilities (coefficient alpha) are high for both positive affect (PA) and negative affect (NA), ranging from .86 to .90 and .84 to .87, respectively (Watson et al., 1988). The PANAS also has excellent convergent and discriminant validity (Watson et al., 1988).

Mindfulness Attention Awareness Scale (MAAS).

The MAAS consists of 15 statements about everyday experiences rated on a scale of 1-6 (1 – *Almost Always* to 6 – *Almost Never*), based on how frequently or infrequently the respondent currently experiences them. Brown and Ryan (2003) examined the psychometric properties of the MAAS using a student sample (N = 327) and general adult sample (239). Both samples showed high internal consistency – students, alpha = .82, and general adult sample, alpha = .87. The authors also examined the test-retest reliability and agreement of the MAAS with 60 students and found the intraclass correlation of .81 ($p < .0001$). In addition, test-retest score agreement was found in mean scale scores between Time 1 (3.78) and Time 2 (3.77; Brown & Ryan, 2003).

Generalized Self-Efficacy Scale (GSE).

The GSE is 10-item measure of self-efficacy (Schwarzer & Jerusalem, 1995). The respondent rates each statement on a scale ranging from 1 – *Not at All True* to 4 – *Exactly True*.

A study was conducted to examine the psychometric properties of the GSE among a large sample (*N* = 19,120) of participants from 25 different countries (Scholz, Dona, Sud, & Schwarzer, 2002). Item analyses for each language showed satisfactory correlations. Results indicated high internal consistency for the total sample at alpha = .86, with the highest found for Japanese, alpha = .91, and lowest for the Indians, alpha = .75 (Sholz et al., 2002). The GSE was also found to be unidimensional, which was supported by confirmatory factor analysis. "The following coefficients demonstrate the global goodness of fit: GFI = .98, AGFI = .97, NFI = .97, RMR = .03, and RMSEA = .05" (Sholz et al., 2002, p. 247).

Appendix C
Tables

Table C1

Means and Standard Deviations for Heart Rate Variability Measures, Pre- and Post- Self-Report Measures, and Changes in Pre- and Post- Self-Report Measures

Variable	n	M	SD
mn_RR	95	786.45	104.15
mn_HR	95	78.63	1.45
SDNN	95	50.01	19.48
lnRMSSD	95	3.73	.42
LnVLF	95	6.14	.81
LnLF	95	6.03	1.05
LnHF	95	6.00	.96
LnTotal	95	7.28	.88
LnLFHF	95	.03	.56
Number of EAP Sessions	95	2.59	1.55
EAP1	95	2.57	1.03
GSE1	95	28.85	4.74
MAAS1	95	3.33	.80
NEG1	95	28.54	9.33
POS1	95	29.11	8.18
EAP2	95	1.26	.55
GSE2	95	31.69	4.36
MAAS2	95	3.76	.94
NEG2	95	19.98	8.34
POS2	95	36.23	7.47
ΔGSE	95	2.84	5.09
ΔMAAS	95	.42	.97
ΔNEG	95	-8.56	9.99
ΔPOS	95	7.13	7.89

Notes. Mn_RR=mean inter-beat interval; mn_HR=mean heart rate; SDNN=standard deviation of inter-beat interval; lnRMSSD=log of root mean square of successive differences; LnVLF=log of very low frequency; LnLF=log of low frequency; LnHF=log of high frequency; LnTOTAL=log of total frequency; LnLFHF=log of ratio between low and high frequency; Number of EAP Sessions=number of equine-assisted psychotherapy sessions; EAP1= first question on Horse Experience Questionnaire; GSE1=Generalized Self-Efficacy Scale, pre-test; MAAS1=Minfulness Attention Awareness Scale, pre-test; NEG1=negative affect endorsements on PANAS, pre-test; POS1=positive affect endorsements on PANAS, pre-test; EAP2=second question on the Horse Experience Questionnaire; GSE2=Generalized Self-Efficacy Scale, post-test; MAAS2=Mindfulness Attention Awareness Scale, post-test; NEG2=negative affect endorsements on PANAS, post-test; POS2=positive affect endorsements on PANAS, post-test; ΔGSE=change in GSE scores; ΔMAAS=change in MAAS scores; ΔNEG=change in negative affect scores on PANAS; ΔPOS=change in positive affect scores on PANAS.

Table C2

Pearson Bivariate Correlations Among Heart Rate Variability Measures

	I	II	III	IV	V	VI	VII	VIII	IX
I. mn_RR	1.00								
II. mn_HR	**-.98**	1.00							
III. SDNN	**.28**	**-.28**	1.00						
IV. LnRMSSD	.08	-.08	**.81**	1.00					
V. LnVLF	**.44**	**-.47**	**.86**	**.58**	1.00				
VI. LnLF	**.31**	**-.34**	**.91**	**.68**	**.85**	1.00			
VII. LnHF	**.28**	**-.30**	**.88**	**.80**	**.79**	**.85**	1.00		
VIII. LnTotal	**.38**	**-.41**	**.94**	**.73**	**.93**	**.96**	**.93**	1.00	
IX. LnLFHF	.11	-.11	**.20**	-.09	**.26**	**.43**	-.11	.23	1.00

Notes. Correlations in bold are statistically significant and $p < .05$. Mn_RR=mean inter-beat interval; mn_HR=mean heart rate; SDNN=standard deviation of inter-beat interval; lnRMSSD=log of root mean square of successive differences; LnVLF=log of very low frequency; LnLF=log of low frequency; LnHF=log of high frequency; LnTOTAL=log of total frequency; LnLFHF=log of ratio between low and high frequency

Table C3

Pearson Bivariate Correlations Among Self-Report Measures (Pre- and Post-test)

	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV
X. Number of Sessions	1.00														
XI. EAP 1	-.13	1.00													
XII. GSE1	.10	.03	1.00												
XIII. MAAS1	-.10	.0016	**.24**	1.00											
XIV. NEG1	-.04	.02	**-.32**	**-.39**	1.00										
XV. POS1	.10	.03	**.27**	.17	-.18	1.00									
XVI. EAP 2	-.02	**.32**	.11	-.06	.0030	.08	1.00								
XVII. GSE2	.14	-.20	**.38**	.01	-.07	**.41**	-.07	1.00							
XVIII. MAAS2	.04	-.06	**.31**	**.37**	**-.23**	.20	-.11	**.50**	1.00						
XIX. NEG2	-.08	.12	**-.28**	**-.23**	**.36**	**-.33**	.18	**-.40**	**-.38**	1.00					
XX. POS2	**.27**	-.19	.15	-.10	.11	**.50**	-.03	**.60**	**.29**	**-.30**	1.00				

Notes. Correlations in bold are statistically significant and $p < .05$. Number of EAP Sessions=number of equine-assisted psychotherapy sessions; EAP1= first question on Horse Experience Questionnaire; GSE1=Generalized Self-Efficacy Scale, pre-test; MAAS1=Minfulness Attention Awareness Scale, pre-test; NEG1=negative affect endorsements on PANAS, pre-test; POS1=positive affect endorsements on PANAS, pre-test; EAP2=second question on the Horse Experience Questionnaire; GSE2=Generalized Self-Efficacy Scale, post-test; MAAS2=Mindfulness Attention Awareness Scale, post-test; NEG2=negative affect endorsements on PANAS, post-test; POS2=positive affect endorsements on PANAS, post-test

Table C4

Pearson Bivariate Correlations Among Self-Report and Heart Rate Variability Measures

	mn_RR	mn_HR	SDNN	LnRMSSD	LnVLF	LnLF	LnHF	LnTotal	LnLFHF
Number of Sessions	**.22**	**-.21**	.07	.05	.07	.09	.10	.10	.0031
EAP 1	-.02	.02	.02	.05	.01	-.09	-.04	-.05	-.11
GSE1	**.22**	**-.21**	-.01	.02	.04	.04	.02	.04	.05
MAAS1	**.22**	**-.22**	-.09	-.06	-.01	-.08	-.04	-.04	-.09
NEG1	-.03	.07	.15	.10	.10	.10	.03	.08	.13
POS1	.16	-.14	.04	.04	.08	.04	-.05	.03	.15
EAP 2	-.01	.03	.08	.10	.06	.0012	.03	.03	-.04
GSE2	.15	-.16	.12	.08	.19	.18	.07	.17	**.22**
MAAS2	-.02	-.01	-.14	-.07	-.03	-.07	-.16	-.08	.14
NEG2	-.14	.17	.05	.05	.0027	.0011	.03	.01	-.06
POS2	.15	-.15	.17	.15	**.23**	.16	.10	.17	.13
Δ GSE	-.08	.06	.11	.05	.13	.12	.05	.11	.15
Δ MAAS	-.20	.17	-.05	-.03	-.02	.0020	-.12	-.05	**.21**
Δ NEG	-.09	.07	-.10	-.05	-.09	-.09	.0016	-.07	-.17
Δ POS	-.03	.0016	.13	.11	.14	.11	.15	.13	-.04

Notes. Correlations in bold are statistically significant and $p < .05$. Mn_RR=mean inter-beat interval; mn_HR=mean heart rate; SDNN=standard deviation of inter-beat interval; lnRMSSD=log of root mean square of successive differences; LnVLF=log of very low frequency; LnLF=log of low frequency; LnHF=log of high frequency; LnTOTAL=log of total frequency; LnLFHF=log of ratio between low and high frequency; Number of EAP Sessions=number of equine-assisted psychotherapy sessions; EAP1= first question on Horse Experience Questionnaire; GSE1=Generalized Self-Efficacy Scale, pre-test; MAAS1=Minfulness Attention Awareness Scale, pre-test; NEG1=negative affect endorsements on PANAS, pre-test; POS1=positive affect endorsements on PANAS, pre-test; EAP2=second question on the Horse Experience Questionnaire; GSE2=Generalized Self-Efficacy Scale, post-test; MAAS2=Mindfulness Attention Awareness Scale, post-test; NEG2=negative affect endorsements on PANAS, post-test; POS2=positive affect endorsements on PANAS, post-test; ΔGSE=change in GSE scores; ΔMAAS=change in MAAS scores; ΔNEG=change in negative affect scores on PANAS; ΔPOS=change in positive affect scores on PANAS.

Table C5

Temporal Stability of Heart Rate Variability Measures Using Within Subjects ANOVA

Variable	df1, df2	F-ratio	p-value	r-squared	
				R^2	$R^2_{95\%\ C.I.}$
mnRR	1, 94	2.21	.14	.02	(.00,.12)
mnHR	1, 94	1.39	.24	.02	(.00,.09)
SDNN	1, 94	3.89	.05	.04	(.00,.12)
LnRMSSD	1, 94	**6.74**	**.01**	**.07**	**(.01,.18)**
LnVLF	1, 94	.28	.60	.00	(.00,.04)
LnLF	1, 94	1.26	.26	.01	(.00,.07)
LnHF	1, 94	3.11	.08	.03	(.00,.12)
LnTotal	1, 94	1.43	.24	.01	(.00,.06)
LnLFHF	1, 94	1.02	.32	.02	(.00,.12)

Notes: Confidence intervals determined using percentile method (Efron & Efron, 1982) on 1000 bootstrapped samples. Within subjects ANOVA F-tests in bold are statistically significant at $p < .05$. Mn_RR=mean inter-beat interval; mn_HR=mean heart rate; SDNN=standard deviation of inter-beat interval; lnRMSSD=log of root mean square of successive differences; LnVLF=log of very low frequency; LnLF=log of low frequency; LnHF=log of high frequency; LnTOTAL=log of total frequency; LnLFHF=log of ratio between low and high frequency

Table C6

Demand Characteristics on Heart Rate Variability Using Two-Sample T-Tests

	Variable	t-statistic	df	p	Cohen's d	95% CI
Experimenter as Facilitator	mnRR	.59	93	.55	.12	(-.29, .53)
	mnHR	-.54	93	.59	-.11	(-.52, .30)
	SDNN	1.11	93	.27	.23	(-.18, .64)
	LnRMSSD	.49	93	.63	.10	(-.31, .51)
	LnVLF	.97	93	.34	.20	(-.21, .61)
	LnLF	1.18	93	.24	.24	(-.17, .65)
	LnHF	.70	93	.48	.14	(-.26, .55)
	LnTotal	1.01	93	.32	.21	(-.20, .62)
	LnLFHF	.99	93	.32	.20	(-.20, .61)
Individual EAP	mnRR	-.30	17.46*	.76	-.06	(-.47,.34)
	mnHR	-.16	17.86*	.87	-.03	(-.44,.37)
	SDNN	.69	93	.49	.23	(-.18,.64)
	LnRMSSD	.79	93	.43	.26	(-.15,.67)
	LnVLF	.44	93	.66	.15	(-.26,.55)
	LnLF	.73	93	.47	.24	(-.16,.65)
	LnHF	.71	93	.48	.24	(-.17,.65)
	LnTotal	.56	93	.58	.19	(-.22,.59)
	LnLFHF	.16	93	.87	.05	(-.35,.46)
Grooming Group	mnRR	-.88	93	.38	-.19	(-.59,.22)
	mnHR	.87	93	.39	.18	(-.23,.59)
	SDNN	.75	93	.46	.16	(-.25,.57)
	LnRMSSD	.74	93	.46	.16	(-.25,.56)
	LnVLF	.11	93	.91	.02	(-.38,.43)
	LnLF	.60	93	.55	.13	(-.28,.53)
	LnHF	.23	93	.82	.05	(-.36,.46)
	LnTotal	.34	93	.74	.07	(-.34,.48)
	LnLFHF	.76	93	.45	.16	(-.25,.57)

Notes: All t-tests are two-sample two-tailed tests. Asterisks (*) indicate degrees of freedom corrected for inequality of variances. T-statistics in bold are statistically significant at $p < .05$. CI=confidence interval. Mn_RR=mean inter-beat interval; mn_HR=mean heart rate; SDNN=standard deviation of inter-beat interval; lnRMSSD=log of root mean square of successive differences; LnVLF=log of very low frequency; LnLF=log of low frequency; LnHF=log of high frequency; LnTOTAL=log of total frequency; LnLFHF=log of ratio between low and high frequency

Table C7

Demand Characteristics on Self-Report Measures Using Two-Sample T-Tests

	Variable	t-statistic	df	p	Cohen's d	95% CI
Experimenter as Facilitator	GSE1	-.66	93	.51	-.14	(-.54,.27)
	MAAS1	-.92	93	.36	-.19	(-.60,.22)
	POS1	.34	93	.74	.07	(-.34,.48)
	NEG1	.97	93	.33	.20	(-.21,.61)
	GSE2	1.37	93	.17	.28	(-.13,.69)
	MAAS2	1.48	93	.14	.31	(-.10,.71)
	POS2	1.33	93	.19	.27	(-.14,.68)
	NEG2	.30	93	.77	.06	(-.35,.47)
Individual EAP	GSE1	.67	93	.51	.22	(-.19,.63)
	MAAS1	-1.41	93	.16	-.47	(-.88,-.06)
	POS1	-.04	93	.97	-.01	(-.42,.39)
	NEG1	.02	93	.98	.01	(-.40,.41)
	GSE2	**2.36**	**93**	**.02**	**.79**	**(.37,1.21)**
	MAAS2	1.86	93	.07	.62	(.21,1.04)
	POS2	**2.42**	**93**	**.02**	**.81**	**(.39,1.23)**
	NEG2	.01	93	.99	.00	(-.40,.41)
Grooming Group	GSE1	.51	93	.61	.11	(-.30,.51)
	MAAS1	-1.23	93	.22	-.26	(-.67,.15)
	POS1	.26	93	.80	.05	(-.35,.46)
	NEG1	.27	93	.79	.06	(-.35,.46)
	GSE2	1.77	93	.08	.37	(-.04,.78)
	MAAS2	-.59	93	.55	-.12	(-.53,.28)
	POS2	.66	93	.51	.14	(-.27,.55)
	NEG2	-.81	93	.42	-.17	(-.58,.24)

Notes: All t-tests are two-sample two-tailed tests. Asterisks (*) indicate degrees of freedom corrected for inequality of variances. T-statistics in bold are statistically significant at $p < .05$. CI=confidence interval. GSE1=Generalized Self-Efficacy Scale, pre-test; MAAS1=Minfulness Attention Awareness Scale, pre-test; NEG1=negative affect endorsements on PANAS, pre-test; POS1=positive affect endorsements on PANAS, pre-test; GSE2=Generalized Self-Efficacy Scale, post-test; MAAS2=Mindfulness Attention Awareness Scale, post-test; NEG2=negative affect endorsements on PANAS, post-test; POS2=positive affect endorsements on PANAS, post-test

Table C8

Demand Characteristics on Change Scores, EAP Experience, and Number of Sessions Using Two-Sample T-Tests

	Variable	t-statistic	df	p	Cohen's d	95% CI
Experimenter as Facilitator	NSessions	**2.08**	**93**	**.04**	**.43**	**(.02,.84)**
	ΔGSE	1.81	93	.07	.37	(-.04,.78)
	ΔMAAS	**2.27**	**91.58***	**.03**	**.46**	**(.04,.87)**
	ΔPOS	.90	86.33*	.38	.19	(-.22,.59)
	ΔNEG	-.66	91.68*	.51	-.14	(-.54,.27)
	EAP1	-1.48	75.84*	.14	-.31	(-.72,.09)
	EAP2	-1.01	93	.32	-.21	(-.62,.20)
Individual EAP	NSessions	.45	93	.65	.15	(-.26,.56)
	ΔGSE	1.36	93	.18	.45	(.04,.87)
	ΔMAAS	**3.03**	**93**	**<.01**	**1.01**	**(.58,1.45)**
	ΔPOS	**2.33**	**93**	**.02**	**.78**	**(.36,1.20)**
	ΔNEG	-.01	93	.99	.00	(-.41,.40)
	EAP1	.43	93	.67	.14	(-.27,.55)
	EAP2	.85	9.52*	.42	.48	(.07,.90)
Grooming Group	NSessions	**2.10**	**93**	**.04**	**.44**	**(.03,.85)**
	ΔGSE	.97	61.39*	.34	.22	(-.19,.62)
	ΔMAAS	.43	93	.67	.09	(-.32,.50)
	ΔPOS	.35	93	.72	.07	(-.33,.48)
	ΔNEG	-.93	93	.35	-.20	(-.60,.21)
	EAP1	-.01	93	.99	-.00	(-.41,.41)
	EAP2	-.66	93	.51	-.14	(-.55,.27)

Notes: All t-tests are two-sample two-tailed tests. Asterisks (*) indicate degrees of freedom corrected for inequality of variances. T-statistics in bold are statistically significant at $p < .05$. CI=confidence interval. Number of EAP Sessions=number of equine-assisted psychotherapy sessions; ΔGSE=change in GSE scores; ΔMAAS=change in MAAS scores; ΔNEG=change in negative affect scores on PANAS; ΔPOS=change in positive affect scores on PANAS. EAP1= first question on Horse Experience Questionnaire; EAP2=second question on the Horse Experience Questionnaire

Table C9

T-Tests for Change Scores

Difference Scores	t-statistic	Cohen's d	95% CI
ΔGSE	5.45	.56	(.32,.80)
ΔMAAS	4.22	.43	(.20,.67)
ΔNEG	-8.35	-.86	(-1.11,-.60)
ΔPOS	8.81	.90	(.66,1.14)

Notes: All t-tests are two-sample, two-tailed tests. Degrees of freedom is 93 for all tests. All t-statistics are statistically significant at $p < .0001$. CI=confidence interval. ΔGSE=change in GSE scores; ΔMAAS=change in MAAS scores; ΔNEG=change in negative affect scores on PANAS; ΔPOS=change in positive affect scores on PANAS.

Table C10

Pearson Bivariate Correlations Between Hypothesized Mediators and Outcomes (Heart Rate Variability and Changes in Positive and Negative Affect)

Variable	Δ GSE			Δ MAAS		
	r	p-value	$r_{95\%\ C.I.}$	r	p-value	$r_{95\%\ C.I.}$
mnRR	-.08	.45	(-.28, .12)	-.2	.05	(-.38, .00)
mnHR	.06	.56	(-.14, .26)	.16	.11	(-.04, .35)
SDNN	.11	.28	(-.09, .31)	-.05	.60	(-.25, .15)
LnRMSSD	.05	.63	(-.15, .25)	-.02	.81	(-.23, .18)
LnVLF	.13	.22	(-.08, .32	-.02	.86	(-.22, .18
LnLF	.12	.25	(-.08, .31)	.00	.98	(-.20, .20)
LnHF	.05	.65	(-.16, .25)	-.12	.24	(-.32, .08)
LnTotal	.11	.31	(-.10, .30)	-.05	.66	(-.24, .16)
LnLFHF	.14	.16	(-.06, .34)	**.21**	**.04**	**(.01, .40)**
Δ Negative Affect	**-.29**	**.00**	**(-.46, -.09)**	**-.24**	**.02**	**(-.42, -.04)**
Δ Positive Affect	**.25**	**.01**	**(.05, .43)**	**.29**	**.00**	**(.09, .46)**

Notes. Correlations in bold are statistically significant and p < .05. Mn_RR=mean inter-beat interval; mn_HR=mean heart rate; SDNN=standard deviation of inter-beat interval; lnRMSSD=log of root mean square of successive differences; LnVLF=log of very low frequency; LnLF=log of low frequency; LnHF=log of high frequency; LnTOTAL=log of total frequency; LnLFHF=log of ratio between low and high frequency; ΔGSE=change in GSE scores; ΔMAAS=change in MAAS scores; ΔNEG=change in negative affect scores on PANAS; ΔPOS=change in positive affect scores on PANAS.

Table C11

Pearson Bivariate Correlations of Situational Treatment Factors on Changes in Heart Rate Variability

Variable	Δ HRV		
	r	p-value	$r_{95\%\ C.I.}$
Individual EAP	0.05	0.66	(-.16, .25)
Groom Group	0.04	0.67	(-.16, .25)
Experimenter as Facilitator	**0.26**	**0.01**	**(.06, .44)**
EAP1	0.03	0.75	(-.17, .23)
EAP2	0.04	0.74	(-.17, .24)
GSE1	-0.04	0.68	(-.24, .16)
MAAS1	-0.08	0.46	(-.28, .13)
NEG1	0.18	0.08	(-.02, .37)
POS1	-0.03	0.78	(-.23, .17)

Notes. Correlations in bold are statistically significant and $p < .05$. ΔHRV=Composite heart rate variability measure; EAP1= first question on Horse Experience Questionnaire; GSE1=Generalized Self-Efficacy Scale, pre-test; MAAS1=Minfulness Attention Awareness Scale, pre-test; NEG1=negative affect endorsements on PANAS, pre-test; POS1=positive affect endorsements on PANAS, pre-test; EAP2=second question on the Horse Experience Questionnaire

Table C12

Baseline to Last Post- EAP Session for Heart Rate Variability Measures Using Dependent, Two-Tailed T-Tests

Variable	t-statistic	df	p	Cohen's d	95% CI
mnRR	-.64	93	.53	-.07	(-.29,.16)
mnHR	.43	93	.67	.05	(-.17,.27)
SDNN	**3.25**	**93**	**<.01**	**.33**	**(.12,.55)**
LnRMSSD	**4.44**	**93**	**<.01**	**.46**	**(.19,.72)**
LnVLF	1.08	93	.28	.11	(-.11,.32)
LnLF	**2.11**	**93**	**.04**	**.22**	**(.01,.42)**
LnHF	**3.77**	**93**	**<.01**	**.39**	**(.15,.62)**
LnTotal	**2.54**	**93**	**.01**	**.26**	**(.05,.47)**
LnLFHF	**-2.53**	**93**	**.01**	**-.26**	**(-.51,-.02)**

Notes. Correlations in bold are statistically significant and p < .05. Mn_RR=mean inter-beat interval; mn_HR=mean heart rate; SDNN=standard deviation of inter-beat interval; lnRMSSD=log of root mean square of successive differences; LnVLF=log of very low frequency; LnLF=log of low frequency; LnHF=log of high frequency; LnTOTAL=log of total frequency; LnLFHF=log of ratio between low and high frequency