

HHRF Research Grant Application

Title of Project: **Basic neurobiological and psychological mechanisms underlying therapeutic effects of Equine Assisted Activities (EAA/T)**

Submission Date: 05/10/2010

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Primary focus area of the investigation: Special education, mental health, horse-
Human-relationship, Equine Assisted Activities

No past HHRF funding applications.

Safety and quality standards for EEA/T:

Personnel directly involved with any associated EAA/T:

Dr. Christiane Schuler, psychology (MA), Ph. D., state certified psychotherapist for children and juveniles, and trauma therapy, has worked with EAA for over ten years, at the Bunter Kreis e.V. Augsburg, Germany, with children, juveniles, and adult with various mental health problems.

Jutta Friedel, therapist for children with developmental disorders, certified in hippotherapy, over 20 years of work experience in EAA

Maria Föste, special education, pedagogue for children with severe emotional and behavioral disorders, certified and several years of practical experience in EAA, Rostock, Germany

Marlen Eisfeld, special education, Ph.D. cand., pedagogue for children with severe emotional and behavioral disorders, several years of practical experience in EAA, Rostock, Germany

Frau Bohl, certified riding therapist and horse trainer, Rostock, Germany

Site standards for EAA/EAT:

The Bunter Kreis Augsburg is certified to keep horses in a hospital environment by the Department of Agriculture of the State of Bavaria, Germany. For the stables on the property of the Children's Hospital and care of the therapy horses, the site received the Bavarian Animal Welfare Award in 2006. Horses are under regular veterinary care, provided with sufficient days

without therapy work, and regularly worked by experienced riders to keep their training standard and for physiotherapeutic reasons.

The Reiterhof Bohl, is a riding-school certified by the FN (Deutsche Reiterliche Vereinigung, Federation Equestre Nationale) and has frequently worked before with children and juveniles with behavior and learning problems.

Collaboration/Consulting:

Other than the named investigators and EAA-therapists, only students from special education and/or psychology will help in the data collection and analysis.

The four PIs form an interdisciplinary and multinational European research group that has worked together before. Each PI has an expertise in his field reaching from psychology and special education with a focus on attachment theory (Beetz, Julius), ethology (Kotrschal), and psychophysiology (Uvnäs-Moberg) and all have conducted research on human-animal interactions and/or animal assisted interventions before. In particular for the field of human-animal research, such as AAT and EAA, this interdisciplinary approach is important and most promising in many respects.

Description of Project:

The basic psychophysiological and psychological mechanisms underlying the psychological effects of equine assisted activities are investigated in two randomized controlled trials. Based on attachment theory and known effects of the hormone oxytocin, the benefit of eight sessions of EAA is compared to conventional therapy with regard to the reduction of stress and the facilitation of trust and connection to others.

Pilot Studies:

Several pilot studies regarding the basic mechanisms investigated in the human-horse relationship in this application have been completed by the members of the research team. Even though the pilot studies focused on human-dog interactions and relationships, the underlying psychophysiological and psychological mechanisms were confirmed, as well as the suitability of the instruments.

Institutional Review Board:

The approval of the IRB of the University of Rostock, Germany, is pending. A decision is expected for June 2010. Projects have to be presented personally to the board and the exact paperwork (consent forms etc.) has to be prepared according to the recommendations of the board. Due to the choice of methods (noninvasive) and previously approved studies with similar samples, approval is expected without changes to the research plan provided here. Since the informal description of the study is in German, it is not attached here (see also XII c).

Start Date of Project: 01/01/2011**End Date of Project: 12/31/2011**

II. Scientific Abstract

Our current proposal is based on the assumption that the curative psychological effects of equine assisted therapy reported so far are based on a shared mechanism. We hypothesize that the interaction between the HPA (hypothalamo-pituitary-adrenal axis) in interaction with the oxytocin system is the central neurobiological mechanism behind these effects. Based on this assumption and the psychological background of attachment theory, cortisol, heart rate, trust, and social interaction and thereby, indirectly also oxytocin-related effects of human-horse interactions will be measured in two controlled intervention studies with twenty insecurely attached children each. Since oxytocin release reduces stress levels and facilitates social interaction and trust in others, both studies will focus on the question whether equine assisted activities can help insecurely attached children and their caregiver or therapist to engage in a more secure and trusting relationship than they had before. In the first study 10 toddlers (age 1-2) who had suffered domestic violence or parental loss will be exposed to eight weekly sessions of EAA or alternatively supervised play interactions together with their (foster) mothers. In the second study we will explore whether insecurely attached children will open up easier to their therapists after EAA in comparison to play therapy.

III. Need/Justification

While the majority of studies on Equine Assisted Activities and Therapy investigated mainly physiological or physiotherapeutic effects, this project focuses on the psychophysiological and psychological effects of human-horse interactions and in particular, on the underlying basic mechanisms. Employing a well established theoretical framework such as attachment theory and its link to the HPA axis and the oxytocin system will not only allow measuring of outcomes but also, a deeper understanding of what makes the assistance of a horse, and of animals in general, so valuable for both physiotherapeutic and psychotherapeutic interventions. The results of our proposed project will provide the base for recommendations on how to specifically utilize the effect of horses in attachment-based interventions for psychological disorders. Our focus is not on a specific disorder, but on a common underlying factor, insecure or disorganized attachment representation. Insecure attachment representations are found in 60- 90% of persons with mental health problems and represent a major risk factor in the development of behavioral and emotional disorders during childhood and adolescence. Therefore, our results will be applicable to a wide variety of clients.

IV. Research Narrative

Basic neurobiological and psychological mechanisms underlying therapeutic effects of Equine Assisted Activities

Research question and hypothesis

A review on the psychological effects of horseback riding, hippotherapy, or therapeutic riding (a PsycInfo and the Psychology and Behavioral Sciences Collection keyword search with the phrases hippotherapy, therapeutic riding, equine assisted therapy, and horseback riding) yielded

thirteen studies meeting the criteria of a minimum of five participants and publication in a peer reviewed journal in English or German. Taken together, the spectrum of psychological effects that have been associated with human-horse interactions indicate that interactions between humans and horses might have the potential to reduce anxiety (Honda & Yamazaki 2006; Gohler & Ohms 1974), stress (including blood pressure and other autonomic functions; Hammer, Nilsgard, Forsberg, Pepa, Skargren & Öberg 2005), pain (Hammer et al. 2005), anger and aggression (Kaiser, Spence, Lavergne & Bosch 2004) and depression (Scheidhacker 1991), may facilitate social communication (Bass, Duchowny, & Llabre 2009; Gohler & Ohms 1974) and trust in others (Yorke, Adams, & Coady 2008), learning (Bass, Duchowny, & Llabre 2009), and may improve mood (Honda & Yamazaki 2006). Since most studies lacked larger samples and in particular, control groups, it remains unclear whether these reported curative effects can be attributed specifically to the assistance by a horse or to the horse-human-relationship.

On this basis, two different research strategies seem reasonable. On the one hand, controlled studies with larger samples would help to interpret the findings of previous research. Assuming that the reported effect patterns are horse-specific, we pose the question whether effects can be attributed to a common underlying mechanism. Towards answering this question, we will present a model that integrates the reported effects, and second, we deduce a hypothesis that is tested on two different samples receiving Equine Assisted Activities (EAA). Our results will allow a deeper understanding of human-horse interactions and their potential positive therapeutic effects.

A common mechanism as a base for the effects reported so far can only be assumed if humans and animals can engage in social relationships. Behavioral and evolutionary biology reports that there are basic and universal physiological structures and mechanisms that underlie social behavior in humans as well as animals. Many structures and functions of behavior, physiology, and brain, which are relevant in a social context, are shared between humans and animals. On this

basis, human and animals, if properly socialized, can establish social relationships and therefore, can affect social behavior and development of humans.

One of the central common principles in the social behavior of humans and non-human mammals is the oxytocin system. Oxytocin is produced in the hypothalamus and acts both as a hormone and a neurotransmitter. In fact, the chemical structure of oxytocin is the same in all mammals and it has been demonstrated to stimulate social trust, and sociopositive interactions in different species. Oxytocin decreases anxiety by acting on the amygdala (Neumann, 2008). It also decreases the activity of the HPA axis by reducing CRH and ACTH release in the hypothalamus and anterior pituitary respectively, and thus reduces and buffers stress (e.g. operationalized via salivary or plasma cortisol; Neumann et al. 2000). Furthermore, it decreases the activity of the sympathetic nervous system, which results in a lower blood pressure, and increases activation in the parasympathetic nervous system (Uvnäs-Moberg, 1998). In humans, intranasal administration of oxytocin is associated with a similar effect spectrum i.e. social interaction and competence is increased and anxiety and stress levels (cortisol) are decreased (Heinrichs et al. 2003; Domes et al. 2007; Guastella et al. 2008; Jonas et al. 2008) and trust in others is enhanced (Kosfeld et al. 2005).

Oxytocin is massively released during labor and in response to suckling, but also in response to less intense sensory stimulation, such as warmth or touch (Uvnäs-Moberg, 1998; Uvnäs-Moberg, 2004). Oxytocin released by skin-to-skin contact increases maternal skills and decreases anxiety and stress levels (Jonas et al. 2008; Handlin et al. 2009; Jonas et al. 2009). Also the infant reacts to skin-to-skin contact with oxytocin release and with oxytocin-related effects (Nissen, Gustavsson et al. 1998; Matthiesen, Ransja-Arvidson et al. 2001; Jonas, Wiklund et al. 2007). Oxytocin is also released in response to warm contact and social support (Heinrichs & Domes, 2008). Altogether, the present evidence suggests that oxytocin has important modulatory effects

on social behavior (less aggression, facilitation and stimulation of social interaction and communication), stress coping (stress reduction), emotional states (less depression, increased trust in others), pain (reduces pain, elevates pain threshold), and the autonomous nervous system. Since most of these effects have been reported in the literature on curative effects of human-horse-relationships we assume that the oxytocin system is the central underlying neurobiological structure. If this is true and if central mechanisms of human-human and human-animal relationships are shared this raises the question, why the oxytocin system should be activated in human-animal relationships while it is not activated in human-human-relationships in certain patients. If the oxytocin system was activated in all human-human-relationships, no therapeutic approaches including animals such as horses were needed.

To answer this question we make a connection between the neurobiologically defined oxytocin system and the psychologically defined attachment and caregiving systems.

In defining attachment between children and their caregivers Bowlby (1988) refers to the ethological concept of "behavioral systems", which, from an evolutionary point of view, are phylogenetically old and have a survival value. Attachment originally referred to a persistent emotional tie between a child and a caregiver, but today, the concept of attachment has been expanded to include also other types of relationships, such as partner relationships. The function of the attachment system is to maintain or establish the proximity between a child and its attachment figure, when the child is stressed or in danger in order to regulate the stress and to protect the offspring. Since the attachment system - as all behavior systems - is flexible, this system does not only adapt to supporting conditions, but also to a negative environment. Exposure of the child to parental neglect, inconsistent behavior or even abuse, will lead to the development of an insecure attachment.

Current data strongly support that the attachment system is connected to the oxytocin system (see Uvnäs-Moberg 2003). Close contact between a caregiver and a child is associated with oxytocin release and the expression of the related effect pattern in both caregiver and child. Anxiety and stress levels are reduced and social interaction is facilitated. We assume that later in the development of a securely attached child oxytocin is released not only in interaction with the mother but also with other attachment figures.

In insecurely attached children the attachment figure does not trigger oxytocin release and consequent calming, stress reduction, and social facilitation. Even though the oxytocin system of these children is not activated in the presence of primary caregivers, we assume that it can still be activated in other situations, such as animal contact.

Also insecurely attached humans should still be open to positive interactions and trusting relationships with animals, which can activate the oxytocin system with its positive effects for an adaptive and healthy development. This might be especially true for the human-horse relationship since it is characterized by close physical contact, e.g. when being carried by a horse (attachment behavior) as well as caring for a horse (caregiving behavior; petting, grooming). Physical contact (touch, body contact) is a classical marker of a secure attachment and caregiving relationship and activates the oxytocin system.

Therefore, in the current research project, we hypothesize that therapeutic human-horse contacts have a positive modulatory effect on stress, trust, and psychological health, in particular in humans with insecure or disorganized attachment patterns, whose oxytocin system - which we propose as the connecting basis for these effects - is normally not activated by close human contact. Direct measurement of oxytocin in plasma would require taking several blood samples which, in particular in children and juveniles, can by itself cause stress. Therefore, the activation

of the oxytocin system is indirectly operationalized via measuring a set of indicators capturing the well investigated effects of oxytocin on stress (cortisol, heart rate), trust, and social behavior.

Empirical support of our hypothesis would provide a theoretical basis for the effects of EAA and prove the enormous therapeutic potential for persons with social and emotional disorders. Human therapists or other health care professionals could slip into the trusting relationship of patient to the horse, utilize the elevated oxytocin in the close and physical contact to the animal, which facilitates trust also in other humans.. The neuro-endocrinological changes further promote approach behavior and minimize aloofness. Under these circumstances the insecurely attached person's attachment system can be confronted with new experiences in human-human relations so that the behavioral system may adapt to conditions supporting psychological development.

Design and Methods

Two separate studies will be conducted to test the main hypothesis.

Study 1: The effect of EAA on mothers and their at-risk toddlers

In this study, we will investigate whether human-horse interactions have a positive effect on difficult mother-child relationships. Twenty high-risk children (1 to 2 years; premature birth children, babies who were marooned, children from homes with domestic violence and neglect, etc.) and their foster mothers from the Child and Adolescent Psychiatry Augsburg, Germany, will be randomly assigned to an intervention or control group (10/10). The mother-child-dyads of the intervention group will participate in 8 weekly sessions of EAA in which mother and child sit on a standing or pacing horse accompanied by a therapist for 45 minutes, focusing on a positive

interaction. Mother-child dyads in the control group will engage in a play interaction that is accompanied by the same therapist. Cortisol, as an indicator of stress and indirectly, of oxytocin will be measured at four times each session, at the beginning, after 15, 30 and 45 minutes. The mothers and the babies will wear a chest belt, and the mother a wrist watch as receiver to monitor heart rate constantly during the sessions. To assess the attachment of the child to the mother before and after the eight weeks of intervention, a standard procedure of attachment research, the Strange Situation procedure will be conducted and videotaped. Also the caregiving behavior of the mother towards the child will be assessed via a standard situation, with the CARE-Index.

Our hypothesis is that children in the EAA group will show more improvement in the mother-child relationship and interaction due to the activation of the oxytocin system by the interaction with the horse, than the control group without animal support. Furthermore, we propose that the EAA sessions will result in reduced stress (as assessed by heart rate and cortisol) in comparison to the play-interaction sessions. Furthermore we propose a link between these psychophysiological effects and a direct client-horse interaction (touch, attachment or caregiving behaviors).

Instruments (for further description of instruments see Appendix)

Mothers:

- Adult Attachment Projective (AAP): Assessment of attachment representation

Mothers and children:

- Salivary cortisol as indicator of stress: measured via salivettes at four times before, during and after the session (minute 0, minute 15, minute 30, minute 45)

- Behavior Observations (NOLDUS Coding) during all 8 sessions; coded for attachment and caregiving behavior, emotion expression, physical contact
- Polar chest belt/watch: assessment of heart rate during the session
- Strange Situation Procedure: 1 week before, 1 week after the intervention; assessment of the child's attachment representation
- CARE-Index: 5-minute play-episode of mother with her child, coded for the mother's sensitivity, hostility, unresponsiveness in accordance with a standard coding system. Also assessment of the child's behavior, such as cooperativeness or passivity.

Study 2: The effect of EAA on children's relationship to the therapist

In this study we will explore if human-horse interactions facilitate the development of a trustful relationship between an insecurely attached child and his or her therapist which allows the child to open up and talk about emotionally stressful situations. Twenty children with insecure or disorganized attachment from a school for behaviorally and emotionally disturbed children in Muenster, Germany, will randomly be assigned to an intervention and control group (10/10). In the intervention group, one child-therapist dyad at a time will engage in a shared activity with a horse (e.g. stroking, riding) for 30 minutes for eight weekly sessions. Subsequently, the therapist and the child will enter a therapy room. At each of the eight sessions the therapist will present a picture which is emotionally challenging for the child (pictures will be taken from projective attachment test, SAT). In order to figure out whether the child is able to open up, the therapist starts a conversation about the picture (about 10 minutes). Children of the control group will participate in a 30-minute one-to-one play therapy with the therapist before the picture task. The complete session (EAA and picture task) will be videotaped.

Our hypothesis is that children in the EAA group will develop more and/or faster trust into the therapist, and improve more with regard to their problem behavior and emotion recognition than the play-therapy group. We also propose that the EAA group will show less stress during therapy sessions (cortisol and heart rate, indirectly indicating the activation of the oxytocin system). Furthermore we propose a link between these psychophysiological effects and direct child-horse interaction (touch, attachment or caregiving behaviors).

Instruments (for description of instruments see Appendix)

- SAT: for preselection of children for an insecure-avoidant or disorganized attachment

During each of the 8 sessions of EAA:

- Cortisol: measured via salivettes at 4 times during the 45-minute session
- Polar chest belt/watch: assessment of heart rate during the session
- Behavior Observations (NOLDUS Coding) during all 8 sessions: child-therapist and child-horse interaction (attachment related behaviors, active eye contact, body contact)

Measures applied before and after the EAA intervention:

- Reading the Mind in the Eyes Test: assessment of emotion recognition in faces (this competence is enhanced via oxytocin, see Guastella, Einfeld, Gray et al 2010)
- CBCL-TRF: Child Behavior Checklist – Teacher Report Form: Standardized Questionnaire for the assessment of problem behavior, to be filled out by the teacher
- “My therapist and I”: 16-item questionnaire assessing the trust in the therapist (also given after session 4)

Analysis

Behavior codings from video will be supervised by Prof. Kotrschal. Cortisol levels will be analyzed by the laboratory at the University of Rostock. The complete data set will be analyzed using SPSS 17.0. Statistical tests will include T-tests and ANOVAs to test for differences in the parameters according to the assignment to control or experimental group and covariates. Also the development of the continuously assessed parameters (cortisol, heart rate, behavior) will be analyzed over the course of the 8 weeks of intervention and will be compared between groups. MANOVAs and GLMs will be used, as appropriate, to assess the influence of sex of child and behavioral markers. Also analyses for repeated measurements will be employed.

V. Proposed timeline

Start of funding: 01/01/2011

01/2011 – 03/2011: Preparation, training of students in data collection,
preselection of participants for insecure/disorganized attachment
representation

04/2011 – 07/2011: Data collection in Augsburg and Münster, for study 1 and 2

08/2011 – 10/2011: Data entry, cortisol analysis, behavior coding

11/2011 – 12/2011: Data analysis and final report

End of funding: 12/31/2011

VIII. Lay Language Article

05/10/2010

Basic neurobiological and psychological mechanisms underlying therapeutic effects of Equine Assisted Activities

Beetz A., Julius H., Kotrschal K., Uvnäs-Moberg K.

The spectrum of curative psychological effects that have been associated with equine assisted activities (EAA) indicates that interactions between humans and horses might have the potential to reduce anxiety, stress, pain, anger, aggression and depression and may facilitate social communication and trust in others. Our current proposal is based on the assumption that these effects of EAA reported so far are based on a shared mechanism. We hypothesize that the interaction between the hypothalamo-pituitary-adrenal axis (HPA, stress axis) in interaction with the oxytocin system is the central neurobiological mechanism behind these effects. Based on this assumption and the psychological background of attachment theory, cortisol, heart rate, trust, and social interaction and thereby indirectly also oxytocin-related effects of human-horse interactions will be measured in two controlled intervention studies with twenty insecurely attached children each. Since oxytocin release reduces anxiety and stress levels and facilitates social interaction and trust in others both studies investigate whether contact to a horse can help insecurely attached children who mistrust or avoid adult caregivers to engage in more secure and trusting relationships with these persons.

In the first study toddlers (age 1-2) who had suffered domestic violence or parental loss will be exposed to eight weekly sessions of either EAA (intervention group) or supervised play interactions (control group), both together with their (foster) mothers. We will investigate whether human-horse interactions will facilitate the development of a secure and trustful relationship better due to oxytocin-related effects of the human-horse interaction. Instruments

from attachment research assessing the quality of the mother-child relationship are applied before and after the eight-week-intervention. Furthermore, psychophysiological reactions, e.g. stress measured via cortisol and heart rate, and interaction between mother, child, horse and therapist are assessed during each session.

In the second study we will explore whether ten insecurely attached children (age 8-10) with behavioral and emotional disorders will open up easier to their therapists directly after EAA than the ten children in the control group who receive play therapy with the same therapist. Interaction of the child with the therapist and the horse is observed and psychophysiological reactions are measured during each of the eight therapy session. Trust to the therapist is measured before and after the intervention.

Confirmation of our hypothesis that the effects of EAA/EAT are based on the oxytocin system and attachment would mean a big step towards a deeper understanding of why and how EAA/EAT might positively affect humans.

XII e) Contact information

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