Animal-Assisted Psychotherapy: A Meta Analytic Review

by

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Abstract

Limited research exists examining animal-assisted psychotherapy, which is surprising given its current popularity. I conducted three meta-analyses to examine the efficacy of animal-assisted psychotherapy (AAPT) to address this research gap. The first study examined the effect of AAPT on mental disorders (Study 1). The second study examined the effect of AAPT on internalizing disorders (Study 2). The third study examined the effect of AAPT on individuals who had experienced a trauma (Study 3). I also conducted a systematic review for Study 2. The results of Study 1 found a large effect for pre-versus post intervention comparisons for all disorders, attention deficit hyperactivity disorder, reading disability, and trauma/PTSD. I found a moderate effect for the pre-versus post-comparison for autism. Additionally, I found a large effect for treatment versus control comparisons for anxiety disorders, and a moderate effect for the treatment versus control comparison for all disorders, reading disability, autism measures, and trauma/PTSD. The systematic review in Study 2 (internalizing disorders) found that the majority of studies reported no statistical difference between their experimental group and their control group (treatment versus treatment-as-usual). The meta-analytic results indicated a significant large effect. In study 3 (trauma) I found a large effect size for the pre-versus post-comparison analysis and a moderate effect size for the treatment versus control comparison analysis. Overwhelmingly, the majority of the moderator analyses were non-significant. Moderators that emerged as significant across studies were 'place of study,' 'percentage of women' (in the total sample and in the treatment group), and 'provider of the intervention.' The results of this dissertation tentatively support the use animal-assisted psychotherapy programs to reduce mental disorder symptoms. I used a measure (Grading of Recommendations, Assessment, Development and Evaluation – GRADE) to assess the quality of the studies included in this

dissertation, and is included in the general discussion chapter. The results of the GRADE Analyses for Study 1, however, indicated a score of very low quality on the assessment. Therefore, only tentative conclusions about the efficacy of animal-assisted psychotherapy can be drawn. Overwhelmingly, very little primary research exists on animal-assisted psychotherapy, despite its popularity. Grant funders should call for research in this area to address both the lack of research generally, and the lack of high-quality research in this area.

Keywords: animal-assisted psychotherapy, mental disorder, treatment, meta-analysis, internalizing disorders, depression, anxiety, trauma, post-traumatic stress disorder, PTSD

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1. Germain, S. M., Wilkie, K. D., Milbournesfgdg, V. M. K., & Theule, J. (2018) Animal-assisted Psychotherapy and Trauma: A Meta-analysis, *Anthrozoös, 31*(2), 141-164, DOI: 10.1080/08927936.2018.1434044

   The above publication appears in this doctoral thesis as Chapter 4. The above work can be reproduced with information regarding access, as I am the primary author. As primary author, I was responsible for idea conception, literature searches, planned and executed analyses, interpreting findings, writing the first draft and editing subsequent drafts.

Chapter 1: Introduction

There is a longstanding history between humans and other animals, where humans have purposefully used and cared for animals in several domains. Not only have these relationships been utilitarian (i.e., work animals, herd protection, homestead protection) but, over time, these relationships also included a focus on status and companionship. For example, archeologists have found fossils of dogs and wolves in the caves of humans in Belgium from Paleolithic times suggesting domestication (Germonpre, et al, 2009) in Ancient Greece, temple dogs, who resided in the temple, were kept for the purposes of healing (Avalos, 1995). Looking at the span of human civilization, animals have always had an important presence.

With regards to psychotherapy [in her book, *Handbook on Animal Assisted Therapy: Theoretical Foundations and Guidelines for Practice]* Fine (2000) details the first recorded use of animals for a psychotherapeutic purpose. He reports that William Tuke ran a courtyard of small animals with which patients of the York Retreat Mental Institution (which opened in 1796) were encouraged to interact (Fine, 2000). In recent years, animal-assisted psychotherapy has developed. Anderson (2005) noted that domestic pets "naturally perform in a therapeutic manner with their owners" (p. 12), suggesting that domestic pets are ideal to use in therapy. Levinson (1984), considered to be the father of modern animal-assisted psychotherapy, theorized that animals could be incorporated therapeutically in four ways. They are 1) as a psychotherapeutic adjunct, 2) as the therapeutic agent, 3) as a catalytic agent for change, and 4) as a way for the patient to connect with nature. Levinson (1969) coined the term "pet therapy" to describe the incorporation of animals for therapeutic purposes.

The terminology for animals in therapy is quite broad and unstandardized. Through the years, the term Pet Therapy evolved into the term "animal-facilitated therapy" (Urbanski & Lazenby, 2012). Howell-Newman and Goldman (1993) define animal-facilitated therapy as "the

therapeutic use of the human-animal bond to improve a patient's physical and emotional health" (p.77). Urbanski and Lazenby (2012) further denote that animal-facilitated therapy encompasses two different types of interventions, animal-assisted therapy and animal-assisted activities.

Pet Partners (formerly known as The Delta Society) is an organization dedicated to research, training, and the development of community programs centered on the use of animals in helping people (Pet Partners, 2015). They define animal-assisted therapy (AAT) as:

> "… a goal-directed intervention in which an animal that meets specific criteria is an integral part of the treatment process. AAT is directed and/or delivered by a health/human service professional with specialized expertise, and within the scope of practice of his/her profession. AAT is designed to promote improvement in human physical, social, emotional, and/or cognitive functioning [cognitive functioning refers to thinking and intellectual skills]. AAT is provided in a variety of settings and may be group or individual in nature. This process is documented and evaluated" (Pet Partners, 2015, Animal-Assisted Therapy section, para. 1).

Animal-assisted activities, on the other hand, involve a less rigid or casual type of intervention (Urbanski & Lazenby, 2012). Animal-assisted activities differ from animal-assisted therapy in several ways (Pet Partners, 2015). First, the animals in animal-assisted activities tend to be a casual interactional partner, whereas in animal-assisted therapy the animals are a significant part of the treatment. Second, animal-assisted activity lacks specific treatment goals. Third, animal-assisted activity is characterized by a utilization of the same activity with many people, in comparison to Animal-assisted therapy which targets individual or group treatment for each person. Fourth, animal-assisted activity typically requires less documentation regarding case notes as compared to animal-assisted therapy, where detailed notes of client progress are

recorded after each session. Finally, animal-assisted activity visits may have varying content and exposure intervals of various times. In contrast, animal-assisted therapy has set content and time intervals scheduled for the needs of the patient (Pet Partners, 2015).

In recent years, there have been additional attempts to further standardize the terminology for animals in therapy. The Equine Assisted Growth and Learning Association (EAGALA, 2012) proposed a separate term of equine-assisted psychotherapy, where a particular or specific mental health goal is to be set for the intervention (EAGALA, 2012). For this dissertation, I am interested in examining animal-assisted psychotherapy. Similar to equine-assisted psychotherapy, for the purposes of this project I have defined animal-assisted psychotherapy as holding all the tenets of an animal-assisted therapy (a goal-directed intervention in which an animal that meets specific criteria is an integral part of the treatment process, directed and/or delivered by a health/human service professional with specialized expertise, designed to promote improvement in human physical, social, emotional, and/or cognitive functioning [cognitive functioning refers to thinking and intellectual skills], provided in a variety of settings and may be group or individual in nature, and documented and evaluated; Pet Parters, 2015) with the two additional caveats, that 1) the goal-directed intervention specifically targets psychotherapeutic treatment goals (e.g., decreasing maladaptive symptoms), and 2) that the animal be utilized as part of a psychotherapeutic intervention (e.g., the animal must be incorporated as a critical part of an intervention targeting symptom reduction). For example, an individual intervention run by a psychologist that incorporates teaching a dog how to sit with the goal of decreasing a participant's depression would be considered to be an animal-assisted therapy but not an animal assisted psychotherapy as 'teaching to sit' is not a psychotherapeutic intervention. An individual intervention run by a psychologist that teaches mindfulness by incorporating a dog by petting its fur with the goal of decreasing anxiety would be considered an animal-assisted psychotherapy.

PHILOSOPHICAL FRAMEWORKS FOR ANIMAL-ASSISTED PSYCHOTHERAPY

Three major theoretical perspectives have emerged to explain the effectiveness of animal-assisted psychotherapy – biophilia, cognitive behavioural, and attachment. Each theory will be discussed in turn, illustrating the theory itself and how animal-assisted psychotherapy fits within the theoretical framework.

Biophilia Theory and Animal-Assisted Psychotherapy

The biophilia theoretical perspective was developed by Wilson (1984) to describe why humans want to be near other living things. In his theory, he states that humans have a propensity to approach other living organisms and to approach nature itself (Wilson, 1984). The premise of this theory is that through evolution people have developed a preference for an affiliation to nature – or that an approach to nature helped the human species survive and therefore humans are genetically 'prewired' to approach, and indeed like, nature. Wilson argues that the biophilia tendency functions as a primed-mind centered on the enhancement of survival. Wilson is careful to caution that his theory only posits that some things are learned more efficiently than others ("biased learning"), but do not constitute an "instinct" (p. 106). Wilson further hypothesized that humans approach certain animals because they have the ability to fill a "superficial role of surrogate kin" through "human-like rituals" (p. 126).

Melson (2000) suggests that the biophilia theory provides the best theoretical framework for understanding why animal-assisted therapy is so effective. She bases her postulation on three criteria – animals are familiar to humans, animals signal security and safety, and animals have been shown to develop and promote emotional development that closely mimics human development. In other words, familiar safe animals form a reciprocal interactional system where animals decode human emotion and then have the capability to teach humans that same ability.

Animals have been familiar to the human species for generations. Once animals became domesticated, Bradshaw and Paul (2010) concluded that pet-keeping developed into a "fundamental and ancient attribute of our species" (p. 111). Melson (2000) argued that animals have developed into significant categories of early developmental learning, reflecting the importance of nature (and thus the importance of animals) in the development of people. In other words, children have a propensity to learn about animals earlier than they learn about other schema. Quinn, Eimas, and Rosenkrantz (1993) examined the age at which children formed exclusive categorical representations for animals and found these schemas formed at approximately 3-4 months of age. Eimas, Quinn, and Cowan (1994) note that the schemas formed by children of this age are similar, if not identical, to those made by older children and adults, meaning that this process of identification occurs early and remains fairly permanent.

Not only does the information remain categorical in essence, such as a dog is different from a tree, but physiological and emotional information also becomes encoded during these early stages. Historically, Melson argued that animals became "sentinels [for danger]" (2000, p. 376). In other words, when familiar animals are calm, humans become calm. Humans will mimic the effect of the animals that are present around them. Myers (1996) found that children would mirror the affect displayed by the animal with which they were interacting. When children interacted with an excited dog, they became rambunctious and wild. Conversely, when the children interacted with lethargic ferrets, the children became lethargic as well. Moreover, Melson (2000) argued that if children associate security with animals, they should and will seek animals in times of negative affect. The research in this area appears to support this position. Rost and Hartmann (1994) conducted a study examining factors associated with pet ownership as well as the relational context of owning a pet. They found that for children, 80% endorsed "very

important or important" that the pet "listens to me" (p. 247). Pets were also found to have an emotionally stabilizing effect on children. Seventy-nine percent of children "prefer[red] the company of their pet when they [were] sad" (Rost & Hartmann, 1994, p. 247).

Research has found that animals do not just signal situational affect, but also have the ability to decode and respond appropriately to human affect. Research has shown that some animals have the ability to decode human behaviour (Melson, 2000). Soproni, Miklosi, Topal, and Csanyi (2001) conducted a study examining the canine species' ability to decode human non-verbal behaviour. They utilized a two-way food choice task. The human participant produced four types of directional non-verbal cues (pointing and gazing, head nodding in the correct direction, head turning in the correct direction, and glancing in the correct direction). It was found that the canine species was very adept at decoding human non-verbal behaviour. Soproni et al. (2001) compared their results to a study by Povinelli, Bierschwale, and Cech (1999) who examined children and chimpanzees. Soproni et al. (2001) found that the dogs' ability to decode non-verbal behaviour mirrored the pattern displayed by human children and was far superior to the ability of chimpanzees.

If companion animals (specifically dogs in this instance) can adeptly decode human non-verbal behaviour, it is theoretically possible that animals may affect human emotional development. Indeed, this appears to be the case for companion-type animals. Research shows that animals affect socio-emotional development in humans (Melson, 2000). Vizek-Vidovic, Vlahovic-Stetic, and Bratko (1999) examined if pet ownership affected socio-emotional development in school children. They found that children who owned a dog were rated as being more empathetic and more prosocial than children who had no pet. Additionally, they found that children who were highly attached to their pets rated higher on scales of empathy and prosocial

behaviour than children less attached to their pets (Vizek-Vidovic et al., 1999). Maruyama (2011) conducted similar research and found that children who had stronger attachments to their pets showed greater perspective-taking ability.

While Wilson (1984) developed the biophilia theoretical perspective to explain why humans approach nature, it was Melson (2000) who showed that utilizing a biophilia perspective is highly applicable to understanding how animal-assisted psychotherapy conceptually works. Humans have had a close history with animals resulting in animals being signals for familiarity, security, and safety. Companion animals, additionally, have been shown to have the ability to decode human behaviour and affect socio-emotional development in humans.

Cognitive Behavioural Theory and Animal-Assisted Psychotherapy

Cognitive-behavioural theory was developed through an integration of the theories of behaviourism and cognitive psychology. Behaviourism emerged from the study of physiology (Davison, 1997; Rachlin, 1976). It was incorporated into psychology by Watson and Skinner who promoted a study of behaviour that was based on directly observable phenomenon, as opposed to constructs that could not be measured, such as Freud's concept of an ego (Davison, 1997; Skinner 1953). Skinner iterated that strictly mental constructs have no place in the study of psychology as they do nothing to explain the question of 'why' (Davison, 1997; Skinner 1953). As time progressed, behaviourism began to be heavily critiqued for its failure to consider cognitive processes (Bandura, 1977; Davison, 1997; Rachlin, 1976). Researchers began to consider how internal events or processes could be determinants of behaviour (Davison, 1997). While extremists were found on each side of the behavioural-cognitive battlefront, a group of researchers began to combine behavioural principles with internal processes, giving rise to the Cognitive-Behavioural Paradigm (Davison, 1997).

Cognitive-behavioural theory postulates that an individual continually interacts with their environment. How a person interacts with their environment involves a reciprocal feedback system, which plays an integrative role using the individual's cognitions and behaviours (Geist, 2011; Griess, 2011). In other words, individuals are constantly in a back-and-forth relationship between events, causes for events, and reactions to those causes. This feedback system is incredibly adaptive because it allows for both the modification of behaviour based on new stimuli and the modification of the cognitive interpretation of the stimuli. In other words, perception of stimuli is fluid and may change based on experience. The danger of this system lies in the attributions (or the theorized causes of events) that can be made. When this reciprocal cycle repeats with consistent attributions for causes of events, these attributions are developed into automatic thoughts. For example, an individual walks into a kitchen, touches a stove, and burns their hand. They make the attribution that "the stove was on and that is why I was burned". If the individual has this thought every time they touch a hot stove, the hot stove and danger become connected together in an automatic or reflexive thought. This is different from behaviourism (which only considers the effect of the environment on an individual's behaviour) as the individual's thoughts, or attributions, are central here. These thoughts are in essence reality to the individual and therefore highly resistant to change (Geist, 2011). Where the problem lies and where psychological problems are likely to develop is in what Beck (1976) describes as faulty learning and unrealistic thinking. Thinking back to the example of the hot stove and being burned, what if the attribution of the individual was not "the stove is on and that is why I was burned" but instead "a cup broke and that's the reason I was burned"? That individual may then develop a phobia of cups.

Patterson (1986) further developed this theory by illustrating that emotional responses may also contribute to the cognitive perception of stimuli. Quite often cognitive attributions create negative affect. The negative affect then produces a heightened state of arousal, thereby activating the sympathetic nervous system (or the fight or flight system), which prevents cognitive efficiency (Davidson, 1998). In other words, attributions can produce negative emotions which then make it harder to pragmatically evaluate whether one's attributions are correct or distorted. When researchers promote disordered attributional thinking in a laboratory setting, individuals will in fact produce additional negative thoughts over positive ones (Sobotka, Davidson, & Senulis, 1992). Other researchers have found similar findings (Coan, Allen, & Harmon-Jones, 2001; Hugdahl et al., 2007). In very simplistic terms, by simply adding high emotional arousal it is harder to create positive attributions and it is much easier to maintain maladaptive attributions (Avram, Baltes, Miclea, & Miu, 2010).

What does this mean for the development and persistence of psychopathology? An individual interacts in a reciprocal feedback system with their environment. They create attributions (or automatic thoughts) for repeated experiences with stimuli. Negative attributions, which are created out of faulty learning (or unrealistic thinking), may be further maintained by a difference in emotional arousal. This arousal then promotes a reduced ability to process the information coming from that reciprocal feedback system. In other words, psychopathology is created and maintained through cognitions and behaviours. One way, then, to reduce psychopathology symptoms would be to reduce the emotional arousal to allow for an increased ability to process information within the reciprocal feedback system.

Using a variety of measures, animals have been found to modulate the negative emotions found in this developmental trajectory. Specifically, research in this area has focused on

examining the physiological aspects of emotional arousal, such as changes in blood pressure, in the sympathetic nervous system activation, in cardiovascular measures, and in cortisol responses (Allen, Blascovich, Tomaka, & Kelsey, 1991; Anderson, 2005; Friedmann, Katcher, Thomas, Lynch, & Messent, 1983; Viau et al., 2010; Willis, 1997). Friedmann et al. (1983) conducted one of the first controlled studies looking at the effect of animals on blood pressure, in children reading aloud. Previous research had associated blood pressure with stress level (when stress level increases, blood pressure increases); therefore, they utilized blood pressure as a physiological measure of stress levels in children. They found that children who read aloud with a dog in the room experienced significantly lower blood pressure rates. Additionally, they found that if a dog was brought in before the initial reading began, the children's blood pressure rates were significantly lower than if the experimenter brought the dog in half way through the experiment.

Studies have shown that the presence of animals deactivates the sympathetic nervous system allowing for normalized frontal lobe activation (Willis, 1997). In other words, the presence of animals decreases high emotional arousal. Anderson (2005) argued that these effects could be produced by the simple presence of the domestic animal itself. Allen et al. (1991) conducted a repeated measures study design where baseline autonomic responses were measured while the participants completed a standard psychological challenge of mental arithmetic alone. Two weeks later, the participants completed a similar task at home in the presence of: a) their pet dog, b) a close human friend, or c) alone. Participants also filled out questionnaires examining attitudes towards pets and pet ownership. Allen et al. (1991) found that the participants who completed the task in the presence of their pet dogs had significantly lower physiological

reactivity than those in any other condition. They theorized that the presence of the pet dog decreased autonomic nervous system activation.

Viau et al. (2010) examined the effect of animal interaction on cortisol levels in children diagnosed with Asperger's Syndrome and Pervasive Developmental Disorder-Not Otherwise Specified. They conducted an ABA experimental design in an attempt to prove a causal link between domestic animal interaction and a decrease in salivary cortisol levels. They found children's cortisol awakening response (morning cortisol levels) was 58% initially, which decreased to 10% after the introduction of the therapy dog. The cortisol awakening response then increased after the removal of the therapy dog, increasing to 48% (Viau et al., 2010).

The above body of research suggests that animal-assisted therapy produces a decrease in physiological arousal. Beale (2005) suggested that the cognitive-behavioural theory provides the best theoretical framework for understanding why animal-assisted psychotherapies are so effective. She states that the domestic animal in therapy provides a way to help modulate the physiological arousal (negative emotional arousal) that the client may experience during the treatment. The client is then able to cognitively make use of the therapy content, including cognitive strategies and cognitive restructuring.

Attachment Theory and Animal-Assisted Psychotherapy

Attachment theory was first postulated by Bowlby (1951), who stated that during a child's development, the primary caregiver provides a regulatory function attending to the child's needs and in doing so provides a framework for how relationships function (1951). In essence, what Bowlby (1951) concluded was that good mental health was largely due to the relationship that an infant had with its primary caregiver. Bowlby (1973, 1980) later said that mental representations of self and others are developed through social interactions with

significant caregivers early in life. These mental representations become fairly stable after the first few years of life (Bretherton, 1992). In essence, attachment theory posits that when children are responded to appropriately they develop an internal working model of security, which promotes self-esteem, positive relationships, emotional regulation strategies, and good mental health (Zilcha-Mano, Mukulincer, & Shaver, 2011). In contrast, when children are not responded to appropriately, they lack these characteristics and are more likely to have issues with adaptive functioning – which is labeled insecure attachment (Zilcha-Mano, Mukulincer, & Shaver, 2011). While Bowlby originated the Attachment Hypothesis, it was Ainsworth who began to systematically examine the quality of mother-infant relationships (Bretherton, 1992). Ainsworth developed an experimental design called the Strange Situation (Bretherton, 1992), in which a mother and infant enter an experimental room alone. A stranger then joins the pair and plays with the infant. While the play is occurring, the mother then leaves the room returning a few minutes later. After a period of being reunited, the mother and stranger both leave the room and the baby is left alone. Finally, the stranger returns to the room and then the mother returns a few minutes later. What Ainsworth found particularly interesting was the infants' behaviour upon the return of the mother (Bretherton, 1992). Three distinct infant responses led Ainsworth to categorize three types of attachment patterns: Secure-attached, ambivalent-attached, and avoidant-attached infants (Bretherton, 1992). A secure-attached infant will be upset when the primary caregiver departs, but happy upon their return (Bretherton, 1992). An ambivalently-attached infant will cry upon the primary caregiver's return and will be unable to be soothed by the caregiver (Bretherton, 1992). An avoidant-attached infant will typically ignore the primary caregiver upon reentry even if the child had looked for the caregiver when they had gone (Bretherton, 1992). Later Bowlby (1969, 1973) developed four components that could be used to

characterize attachment-security. These four components are: proximity-seeking (a desire to be around the primary caregiver when there is alarm), safe haven (the primary caregiver can be returned to for reassurance), secure base (the primary caregiver functions as a base for exploration), and separation distress (when separated from the primary caregiver; Bowlby, 1969, 1973).

While attachments initially form in childhood, they can be modified by later relational experiences (Zilcha-Mano, Mukulincer, & Shaver, 2011). Researchers have shown that recent relational experiences, can in fact, dramatically affect attachment style (Baldwin, Keelan, Fehr, Enns, & Koh Rangarajoo, 1996; Mikulincer & Shaver, 2001). This type of research has been done by Shaver and Hazan (1988) who concluded that adult attachment patterns for romantic relationships could be radically different from parent-child attachment patterns.

Zilcha-Mano et al. (2011) have argued that interactions with animals mirror interactions with humans. Levinson (1997) noted that animals provide a medium for children to generalize affection to human relationships. This kind of research asks the question - does the animal-human bond mimic human-human attachment? There are two sides to the relationship that should be considered. The first concerns whether the animal has the capability to attach to a human in the same way that human-human attachment develops. Topal, Miklosi, Csanyi, and Doka (1998) examined the attachment relationship that the canine species exhibits towards the human species. They used a modified version of the Strange Situation to examine the owner-dog relationship. Topal et al. (1998) found that dogs, in fact, used their owner as a secure base for exploration. Owners also served as a safe haven for the dogs. Finally, the dogs experienced separation distress when the owners left the room. The authors concluded that dogs can indeed be categorized along the secure-insecure continuum of the Strange Situation Paradigm. Similar

research and conclusions have been found by Prato-Previde, Custance, Spiezio, and Sabatini (2003) and Palmer and Custance (2008).

The second issue concerns whether a human can attach to an animal in the same way that a human attaches to a human. Zilcha-Mano et al. (2011) attempted to quantify human-pet bonding by measuring two dimensions of attachment – anxiety and avoidance. They did this through the development of the Pet Attachment Questionnaire. The metric was tested to be reliable and valid (construct, predictive, concurrent, discriminant validities were all demonstrated). While they found correspondence between participants' human-pet relationship orientations and their human-human relationship orientations, the Pet Attachment Questionnaire was unable to differentiate the specific type of insecurity. The pet attachment anxiety was associated with both interpersonal attachment anxiety and interpersonal avoidance, while pet attachment avoidance was only associated with interpersonal attachment anxiety. This particular finding does support the idea that the human-pet bond is similar, but not equal, to that of human-human bonding (Zilcha-Mano et al., 2011). Since this relationship is similar, animals may function as objects of attachment.

Bachi (2013) suggested that animals may provide assistance in the five objectives that therapists provide in attachment-based therapies. These tasks are a) providing a secure base, b) assisting the client in their personal exploration, c) helping the client examine the relationship between the client and therapist, d) considering how past events are affecting emotional functioning in the present, and e) enabling the client to recognize that how the client sees themselves and others now is a reflection of past events. Jasperson (2010) developed an animal-assisted group therapy program for the Utah State Prison for Women, specifically incorporating a dog as a secure base for therapy. The program focused on developing social skills, coping skills,

and self-awareness. A certified therapy dog was present during group therapy and was trained to interact affectionately with all members of the group. Additionally, the group facilitator used the dog as the model for illustrating session content. Each session ended with the group members attempting to teach the dog a new trick. Jasperson (2010) noted that the dog was not utilized to promote an attachment classification change, but for the dog to act as a secure base for the group members to reduce anxiety and to increase treatment acceptability. At the conclusion of the program, participants were found to have reductions in anxiety and depressive symptoms, increased prosocial behaviours, reductions in social isolation, and increased motivation and participation in individual therapy session (Jasperson, 2010). Geist (2011) conducted a similar study utilizing animal-assisted therapy in an emotional support program in schools. This program focused on stabilizing children so they could effectively learn (Geist, 2011). The dogs in this therapy worked to calm the children down and help to regulate their emotional state. In other words, when an insecurely attached child had continual activation of the sympathetic nervous system, the dog modeled and acted as a secure base.

Anderson (2005) furthered this line of research by suggesting that animals act as a common relational bond between the therapist and the client to build a therapeutic alliance. Reichert (1998) found that incorporating domestic animals in her work with sexually abused children allowed a “bridge” to be made between her and the children (p. 184). Mallon (1994) stated that therapy dogs provide an outlet for physical connection which may not be able to be met by the therapeutic relationship. Furthermore, depending on the emotional injury, Levinson (1997) noted that animals, specifically dogs, provide a completely non-judgmental, unconditionally accepted platform that a human therapist may be unable to create in initial therapy sessions. Beale (2005)

cautioned that the animal-client relationship should not take the place of the therapist-client relationship, but that the animal-client relationship helps foster the therapist-client relationship.

Levinson's (1969) work (see page 13 for more information) provides a summative argument for the use of attachment theory as a theoretical framework for animal-assisted therapy. He argued very strongly for animal-assisted psychotherapy working within an attachment theory framework, positing that animals provide a relationship that mimics human-human relationships, but are typically more simple, predictable, and consistent than human-human relationships (Zilcha-Mano et al., 2011). He argued that animals are natural objects of attachment. Additionally, Levinson (1962) indicated that domestic animals could be incorporated to develop the relationship between the therapist and client more quickly and therefore increase the effectiveness of treatment. In other words, animals may function as a transitional object in psychotherapy allowing for greater ease in communicating feelings and emotions as compared to direct communication with another human.

Summary

Historically, animals have had an important presence within human society. In recent years, the development of animal-assisted psychotherapy has emerged and has been growing in popularity. Three distinct theoretical frameworks posit a rationale as to why animal-assisted psychotherapy is effective. Biophilia theory states that humans have a natural tendency to approach animals. It is in our history as humans, illustrated by our cognitive learning patterns and our patterns of emotions around animals. Cognitive-behavioural therapy posits that animal-assisted psychotherapy mediates how the environment, cognitions, and behaviours interact with each other. The therapy animal may also function as a model for clients. Finally, attachment

theory theorizes that animals have an innate ability to mimic the human attachment relationship in a simple, predictable way. The therapy animal may function as a transitional object.

Each theory has a unique viewpoint as to why animal-assisted psychotherapy is effective. However, when one examines these three theories closely, consistent patterns of change begin to emerge. Each theory reports changes in emotional arousal resulting in changes in cognitions and behaviours that accompany animal-assisted psychotherapy interventions. It is important to note that these theories are currently developed on a small body of research. This research typically focused on the incorporation of domesticated animals. Newer research may produce changes in these theories.

RESEARCH ON ANIMAL-ASSISTED PSYCHOTHERAPY

While the field of animal-assisted psychotherapy is still relatively new, researchers around the globe have been studying the efficacy of animal-assisted psychotherapy interventions. The research specifically examining animal-assisted psychotherapy (as defined by method content rather than program name) is quite broad in scope and examines multiple mental disorders. Menna, Santaniello, Gerardi, Di Maggio, and Milan (2016) conducted a study examining the effect of animal-assisted therapy in elderly patients affected by Alzheimer's disease. They conducted weekly sessions over a six-month period. They utilized three groups – one where animal-assisted therapy was based upon a reality orientation therapy protocol, a standard reality orientation therapy protocol, and a no stimulation group. Both the animal assisted therapy and the reality orientation training groups showed a statistically significant improvement, whereas the control group showed no significant changes. The authors noted that the animal-assisted therapy group had a slightly greater improvement in symptoms. They concluded that animal-

assisted therapy interventions based on the formal reality orientation therapy protocol were effective at reducing symptoms.

There have been several studies that have examined the effect of animal-assisted psychotherapy on attention deficit hyperactivity disorder. One such study by Oh et al. (2018) examined the effect of psycho-exercise incorporating horses for children with attention deficit hyperactivity disorder. They utilized a twice-weekly study design where participants either had programming with a horse or pharmacotherapy. Oh et al. (2018) concluded that both groups showed marked improvements in attention deficit hyperactivity disorder symptoms, however no significant differences between groups were detected regarding treatment outcome (with the exception of one subscale).

Interventions targeting reading disabilities have also been conducted. Rector (2016) examined the Bringing Animals Relief and Kindness (B.A.R.K.S.) program to see if it was effective in increasing reading achievement. She utilizing a mixed-methods approach and found that the program did not show a statistically significant impact when students' academic growth and off-task behaviors were compared in the pre- and post-assessment. Qualitative results did indicate a positive result.

Individuals with anxiety have also been a target of animal-assisted psychotherapy. One such study conducted by Henry (2014) examined the efficacy of animal-assisted psychotherapy in reducing anxiety and depression symptoms in university students. She utilized a randomized control trial design, and had two groups. One had animal-assisted therapy with a modified mindfulness-based stress reduction program while the other was simply a mindfulness-based stress reduction program. The intervention was comprised of six sessions of 50 minutes of individual therapy. Henry (2014) found that participants in both groups experienced fewer

anxiety and depressive symptoms, and decreased psychological distress. She also found that there was no significant difference between the control and experimental groups.

Studies have also been conducted examining the effect of animal-assisted psychotherapy on autism spectrum disorder. Becker, Rogers, and Burrows (2017) conducted a study examining the effectiveness of an animal-assisted social skills training group for individuals with autism. They utilized a traditional social skills group and comparted it to a social skills group with therapy dogs. Intervention was weekly for a period of three months. Becker et al. (2017) found that participants in the groups with dogs were rated as significantly less symptomatic than participants in the traditional social skills group.

Finally, studies have been conducted examining the effectiveness of animal-assisted psychotherapy for individuals with trauma or post-traumatic stress disorder (PTSD). Burton, Qeadan, and Burge (2019) conducted a study examining the effectiveness of equine-assisted psychotherapy on veterans who had post-traumatic stress disorder. They found that participants had a significant reduction in their Post-Traumatic Stress Disorder Checklist-Military Version (PCL-M) score.

While the research is broad and examines several different disorders, there are additional challenges that exist in the literature base on animal-assisted psychotherapy. As noted above, these studies describe animal-assisted psychotherapy in their methodology, not in their chosen term. For example, Menna et al. (2016) termed their intervention “animal-assisted therapy,” whereas Oh et al. (2018) termed theirs “psycho-exercise.” This inherently makes this area difficult to study, given that animal-assisted therapy is not a standardized treatment. Additionally, given that it is not a standardized treatment, there is variability between the

different studies. Further, given the lack of standardization and the nascent nature of this research, poor methodological quality is also apparent.

It is also important to note that despite the animal-assisted psychotherapy research area being limited, research has been conducted examining the welfare of the animals incorporated in the animal-assisted therapy. One such study examined the impact of a multiprofessional animal-assisted intervention (MIT) on the dogs incorporated in the treatment (Glenk, Kothgassner, Stetina, Palme, Kepplinger, & Baran, 2014). The sample consisted of five adult dogs, and the researchers utilized behavioural obsercvations (work-related activity, beahviour, and response to human action) to assess animal stress. Glenk, et al. (2014) concluded that the dogs incorporated in the intervention were not stressed by repeated participation in in-patient substance abuse therapy sessions.

PREVIOUS REVIEWS ON ANIMAL-ASSISTED PSYCHOTHERAPY

To date, there has only been one meta-analysis published examining the effect of animal –assisted psychotherapy (refer to Chapter 4 animal-assisted psychotherapy and trauma). There have been no systematic reviews or meta-analyses examining animal-assisted psychotherapy and mental disorders as a whole.

Several meta-analyses have been completed in an attempt to ascertain whether or not animal-assisted therapy (not animal-assisted psychotherapy) is an effective treatment in different domains. Souter and Miller (2007) conducted one such analysis on the effect of animal-assisted therapy for the treatment of depression. They examined five studies and found that animal-assisted therapy had a medium effect $d = 0.61$ (using Cohen's criteria for effect size interpretation; Cohen, 1988) on improving levels of depression (Souter & Miller, 2007). In similar research, Nimer and Lundahl (2007) examined the effects of animal-assisted therapy on a

variety of disorders. They also found that animal-assisted therapy had an overall medium effect, examining 49 studies, which included populations of: autism-spectrum symptoms (d = 0.72), medical difficulties (d = 0.51), behavioural problems (d = 0.59), and emotional well-being (d = 0.39) (Nimer & Lundahl, 2007). Finally, Chitic, Rusu, and Szamoskozi (2012) examined four studies and found that animal-assisted therapy had a large effect on communication and social skills. They did not examine any particular disorder, only examined interventions targeting communication and social skills. They reported an overall global effect size of d = 0.79. Taken together, these meta-analyses appear to suggest that animal-assisted therapy is an effective treatment for certain disorders and symptoms. One could surmise that animal-assisted psychotherapy might also be an effective treatment for mental disorders (such as major depressive disorder or schizophrenia) and symptoms.

Systematic reviews have come to similar conclusions. Kamioka et al. (2014) appraised the effect of animal-assisted therapy (not animal-assisted psychotherapy) on a wide range of disorders. They specifically examined 11 randomized control trials from 1990-October 2012. They concluded that animal-assisted therapy was effective in treating mental and behavioural disorders. Maujean, Pepping, and Kendall (2015) conducted similar research examining randomized control trials of animal-assisted-therapy on psychosocial outcomes from 2008-2013. They concluded, based on eight studies, that animal-assisted therapy was beneficial for a wide range of populations. Again, these conclusions have not been yet been examined for animal-assisted psychotherapy. As noted above, animal-assisted psychotherapy essentially differs from animal-assisted therapy in that animal-assisted psychotherapy has the animal itself playing an essential role in the therapy itself, and targets specific mental disorder symptoms. These constitute the most recently published broad meta-analyses and systematic reviews for animal-

assisted therapy. More recent specific reviews have been published. Germain, Wilkie, Milbourne, and Theule (2018) to date have published the only meta-analysis examining animal-assisted psychotherapy and its effects on trauma (refer to Chapter 4 of this dissertation). A broad meta-analysis is required to synthesize the research that has been created since 2015.

META-ANALYSIS

It may be hard to fully understand whether animal-assisted psychotherapy is effective when looking at an inconsistent literature base. Lundahl and Yaffe (2007) state that "meta-analysis is rapidly becoming the gold-standard for conducting integrative literature reviews" (p. 1). Meta-analysis allows researchers to address issues that cannot be addressed in traditional research, such as summative results on a particular psychotherapy and if certain characteristics promote an increase in efficacy (Lundahl & Yaffe, 2007). Similar to traditional research, meta-analyses attempt to answer predetermined research questions by gathering research on published and unpublished works (Lundahl & Yaffe, 2007). Walker, Herandez, and Kattan (2008) describe the seven objectives achieved by a meta-analysis: First, a meta-analysis summarizes and integrates results from multiple studies. Second, a meta-analysis has the ability to examine differences present in each individual study. Third, a meta-analysis is able to utilize studies that have small sample sizes and "analyze end points that require larger sample sizes" (p. 432). Fourth, a meta-analysis allows for improved precision in estimating effect sizes. Fifth, a meta-analysis enables one to assess for effects in a subset of study characteristics. Sixth, a meta-analysis allows for the potential conclusion that further studies may be necessary for a valid conclusion. Seventh, a meta-analysis may generate new hypotheses for a particular phenomenon (Walker et al., 2008).

Meta-analyses are not without their limitations. Eysenck (1994) cautions that regressions may be assumed to be linear when a curvilinear relationship may, in fact, be accurate. Additionally, when a curvilinear relationship is present, estimates of effect size are meaningless (Eysenck, 1994). Lee (2019) also noted that meta-analyses run the risk of potentially attributing single conclusions to varied problems. In other words, echoed by Feuer (1999), meta-analysis may distort true conclusions. Eysenck also notes that meta-analyses should only be utilized with research that has homogenous data and cautioned against comparing apples to oranges (1994). Additionally, Esterhuizen and Thabane (2016) note that including poorly designed studies will result in invalid results.

THE PRESENT STUDY

The objective of this study was to examine the effectiveness of animal-assisted psychotherapy in the treatment of mental disorders, defined as any diagnosis from the Diagnostic and Statistical Manual of Mental Disorders, from the current or previous versions (American Psychiatric Association, 1980, 1994, 2000, 2013). I did this utilizing meta-analytic procedures. This research involved completing a series of meta-analyses utilizing a systematic search and retrieval of published and unpublished research. Moderator analyses were conducted to see under which circumstances, if any, animal-assisted psychotherapy works most effectively. The currently available literature is inconsistent with respect to the effects of animal-assisted psychotherapy. The results of my research addresses this issue by providing summary data on the effectiveness of animal-assisted psychotherapy in treating mental disorders. By running moderator analyses, this project provides an explanation for why there are inconsistencies in the current literature.

This dissertation is consists of a general introduction, three separate meta-analyses, and a general discussion. Each meta-analysis examines animal-assisted psychotherapy and its intervention effect on different populations. These analyses allowed for a critical evaluation of the effect of animal-assisted psychotherapy.

Chapter Two describes the effect of animal-assisted psychotherapy on all mental disorders. In this study I evaluated the effect of the intervention on all mental disorders by conducting a number of meta-analyses. Additionally, I investigated the potential moderators of the intervention effects.

Chapter Three describes the effect of animal-assisted psychotherapy on internalizing disorders. Given the prevalence of internalizing disorders, I was interested in examining the specific effect of animal-assisted psychotherapy on this population. In this study, I evaluated the effect of the intervention on internalizing disorders by conducting both a systematic review and meta-analysis. Further, I investigated the potential moderators of the intervention effect.

Chapter Four describes the effect of animal-assisted psychotherapy on trauma and post-traumatic stress disorder. Given the small body of research that is available for animal-assisted psychotherapy, there is a significant portion allocated to the study of trauma/post-traumatic stress disorder. As such, I was interested in examining the specific effect of animal-assisted psychotherapy on this population. In this study, I evaluated the effect of the intervention on trauma/post-traumatic stress disorder by conducting a meta-analysis, and investigating the potential moderators. This component of the dissertation is published in the journal of Anthrozoos (Germain, Wilkie, Milbourne, & Theule, 2018).

Chapter Five presents a general discussion focusing on broader theory and implications of these studies that comprise this dissertation. Additionally, a Grading of Recommendations,

Assessment, Development and Evaluation (GRADE) quality analysis was completed for the studies included in Chapter 2. It was completed as a quality measure for studies included in this dissertation.

As noted above, several meta-analyses have been completed in an attempt to ascertain whether or not animal-assisted therapy is an effective treatment for certain disorders and symptoms. Only one meta-analysis has been done for animal-assisted psychotherapy, and it examined trauma and post-traumatic stress disorder (refer to Chapter 4 of this dissertation). Regarding the meta-analyses for animal-assisted therapy, differing effect sizes have been found. These results beg the question: Would animal-assisted psychotherapy show the same trend, perhaps being better at treating certain symptoms? Souter and Miller (2007) found a medium effect for the treatment of depression, Nimer and Lundahl (2007) found a medium effect for the treatment of autism, and Chitic, Rusu, and Szamoskozi (2012) found a large effect for the improvement of communication and social skills. Perhaps these differences are due to study characteristics, such as differences in search strategies. There is also a question of whether these meta-analyses examining animal-assisted therapy are comparable to the research on animal-assisted psychotherapy. A large meta-analysis run on all animal-assisted psychotherapy is needed to answer this question.

POTENTIAL MODERATORS OF EFFICACY

In the current study, several potential moderator variables were investigated to learn whether they impacted the efficacy of animal-assisted psychotherapy. The first category of moderator variables that I investigated were bibiliographic variables. I investigated date of publication to ascertain whether animal-assisted psychotherapy has changed in efficacy over time. In order to assess for possible publication bias, I investigated publication type (published

versus unpublished). I additionally examined continent of study to assess potential cultural relativity. Sample characteristics were also investigated. Studies have been conducted with different animal species, which may also account for the differences in effect size data; therefore, species utilized was investigated. Sample characteristics, such as percent sample attrition, proportion of female and male participants, and age of participants, were also investigated to see if these factors impacted the efficacy of animal-assisted psychotherapy. Another category of moderator variables investigated were methodological variables. I examined the theoretical orientation utilized by each study to see if there was an associated effect. Additionally, I examined if utilizing a randomized control trial, measuring treatment fidelity, or utilizing a manual impacted the efficacy of animal-assisted psychotherapy. While provider of the intervention was examined, data was not always available to assess the handler of the animal. The final category of moderator variables that were investigated were intervention characteristics. These characteristics included variables such as: the focus of intervention, the number of weeks therapy lasted, the number of sessions, and the total number of hours of therapy completed.

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Chapter 2: Animal-Assisted Psychotherapy: A Meta-Analysis

Abstract

In this meta-analysis, I examine the efficacy of animal-assisted psychotherapy on mental disorders. Twenty-eight studies quantitatively assessed the treatment effects following involvement in animal-assisted psychotherapy. I used a random effects model to aggregate each study into an overall effect size. I found a large effect for pre-versus post intervention comparisons for all disorders, attention deficit hyperactivity disorder, reading disability, and trauma/PTSD. I found a moderate effect for the pre-versus post-comparison for autism. I found a large effect for treatment versus control comparisons for anxiety disorders, and a moderate effect for the treatment versus control comparison for all disorders, reading disability, autism measures, and trauma/PTSD. The majority of the moderator analyses were non-significant. There were four moderators that were significant in three of the four sub meta-analyses. Studies that were conducted in Hong Kong, Italy, and Australia were associated with a larger effect ('Place of study'). Overall, when the 'percentage of women in the total sample,' increased, as well as when the 'age in the total sample' increased, there was an associated larger effect. Finally, when 'treatment fidelity' was measured, there was an associated larger effect. Several other moderators were found to moderate the effect of the intervention in single meta-analyses. The results potentially suggest that animal-assisted psychotherapy is an efficacious treatment for mental disorders, however significant limitations temper this conclusion.

Keywords: animal-assisted psychotherapy, mental disorder, treatment, meta-analysis

Mental Disorders affect how individuals think about themselves, how they interact and relate to others, and how they interpret the world around them (Canadian Mental Health Association [CMHA], 2017). They are characterized by disturbances in emotions, thoughts, and/or behaviours and are categorized based on shared symptomology (CMHA, 2017).

Mental health disorders are problematic for individuals and society for several reasons. Young (2015) suggests that when mental health disorders are left untreated, worsening mental health problems and physical health problems are more likely to occur. At a larger societal level, individuals with mental health disorders are more likely to have difficulties with job stability, and in extreme cases, homelessness and incarceration (Young, 2015).

There are many therapies that have been developed which successfully reduce symptoms associated with mental disorders. These broad categories include psychotherapy (e.g., cognitive behavioural therapy, behavioural therapy, psychodynamic therapy) and pharmacological therapy (Kring, Johnson, Davison, & Neale, 2016). Recently animal-assisted psychotherapy has been developed as a treatment for mental disorders. Since Levinson (1962) first noted the effect of animals on children participating in psychological intervention, differing combinations of animals and therapy have been developed. Some of these interventions include: animal therapy, animal interaction, animal interventions, animal-assisted activities, animal-assisted therapy, and animal-assisted psychotherapy. Even though adding an animal into therapy has been done for the past 50 years, there is still a remarkable lack of standardization in this field. Terms such as "therapy," "activity," and "intervention" are often used interchangeably to describe varying therapies and varying animal involvement. Organizations, such as EAGALA and Pet Partners, have worked over the past few decades to develop standardization for animal program practices (EAGALA, 2012; Pet Partners, 2015). Animal-assisted therapy is a goal-directed intervention

targeting improvements in human functioning (Pet Partners, 2015). Equine-assisted psychotherapy specifically targets a psychotherapeutic treatment goal (EAGALA, 2012). It is difficult to compare interventions for anxiety reduction where one study has participants teach a dog to sit and another teaches mindfulness through petting an animal. Therefore, for the purposes of this paper, I will be examining animal-assisted psychotherapy for the treatment of mental disorders. I defined animal-assisted psychotherapy as holding all the tenets of an animal-assisted therapy (a goal-directed intervention targeting improvement in human physical/social/emotional/ cognitive functioning, directed and/or delivered by a health/human service professional with specialized expertise – Pet Partners, 2015) with the two additional caveats that 1) the goal-directed intervention specifically targets psychotherapeutic treatment goals (e.g., decreasing maladaptive symptoms), and 2) that the animal be utilized as part of a psychotherapeutic intervention (e.g., the animal must be used as a critical part of an intervention targeting symptom reduction).

The research specifically examining animal-assisted psychotherapy (as defined by method content rather than program name) is quite broad in scope and examines multiple mental disorders. Contralbrigo et al. (2017) conducted a pilot study examining the efficacy of a dog-assisted therapy program on drug-addicted male inmates. They found that participants improved their social skills, reducing craving, anxiety and depression symptoms compared to the control group. A study by Villalta-Gil et al. (2009) examined the effect of a therapy dog on positive and negative symptoms of schizophrenia. They conducted a randomized, controlled study with blind assessment. They wanted to examine the effect of a therapy dog on patients with chronic schizophrenia. Villalta-Gil et al. (2009) utilized two treatment groups, one group received an intervention assisted by a therapy dog, and the other received the same intervention but without a

therapy dog. Overall, the treatment as usual group and the animal-assisted therapy group both showed significant improvements in positive symptoms and in the total Positive and Negative Syndrome Scale. The animal-assisted therapy group additionally showed improvements in areas related to social contact and in the severity of negative symptoms.

There have been several studies that have examined the effect of animal-assisted psychotherapy on attention deficit hyperactivity disorder. Jang et al. (2015) examined the effect of equine-assisted therapy in the treatment of children with attention deficit hyperactivity disorder. They were the first to demonstrate that equine-assisted therapy is an effective treatment for improving core attention deficit hyperactivity disorder symptoms. Yoo et al. (2016) also examined the effect of a psycho-exercise program incorporating horses for children with attention deficit hyperactivity disorder. They found clear symptom improvement.

Additionally, there have been studies that have examined the effect of animal-assisted psychotherapy on children with reading disability. Le Roux et al. (2014) evaluated the effects of an animal-assisted reading program on the reading rate, accuracy, and comprehension of grade 3 students. They concluded that their reading program had an impact on some of the reading skills of the students who read to a dog. Another study on animal-assisted psychotherapy was conducted by Smith (2010). They conducted a pilot study aimed at determining the impact of animal-directed reading instruction on reading performance, in a sample of 26 homeschooled students in grade 3. They found that animal-directed oral reading instruction significantly impacted student reading rate.

Some studies examining animal-assisted psychotherapy have focused on individuals with anxiety. Alfonso et al. (2015) explored the efficacy of animal-assisted psychotherapy to decrease symptoms of social anxiety for adult women. They found that participants in the treatment group

had significantly greater reduction in social anxiety scores from pre- to post-intervention than those in the no-treatment control group.

Studies have also been conducted examining the effect of animal-assisted psychotherapy on autism spectrum disorder. Bass, Duchowny, and Llabre (2009) examined the effect of incorporating horses on social functioning in children with autism. Their program focused on using horses and horse activities as a prompt for verbal (or signed) communication. They found that their participants exhibited greater sensory seeking, sensory sensitivity, and social motivation, and less inattention, distractibility, and sedentary behaviors following the intervention. Fung and Leung (2014) studied the effect of animal-assisted play therapy on social interaction in children with autism. They concluded that verbal social behavior increased significantly in the experimental group. Redefer and Goodman (1989) examined children with autism and the effect that behavioural intervention with a dog had on symptoms. They found that incorporating a dog as a component in therapy had a strong impact on behaviour. Welsh (2009) examined the effect of animal-assisted therapy (AAT) on joint attention in children with autism spectrum disorder. Their results indicated no significant difference between the presence of a domesticated dog and that of a toy dog to prompt joint attention from young children diagnosed with an autism spectrum disorder.

The disorder group with the most research examining the efficacy of animal-assisted psychotherapy is post-traumatic stress disorder (PTSD) and other trauma disorders. Mueller and McCullough (2017) studied equine-facilitated psychotherapy for individuals with post-traumatic stress disorder. They found that there was a significant decrease in post-traumatic stress symptoms following the intervention for both the treatment and treatment as usual group, but the treatment group did not decrease significantly more than the treatment as usual group. Wharton,

Whitworth, Macauley, and Malone (2019) tested the efficacy and feasibility of equine-facilitated cognitive processing therapy (EF-CPT), a manualized adaptation of the cognitive processing therapy model for veterans with PTSD. They found a significant reduction in post-traumatic stress disorder symptoms compared to pre-treatment scores.

To date, there has been one meta-analysis published on animal-assisted psychotherapy. Germain, Wilkie, Milbourne, and Theule (2018) found a moderate effect for animal-assisted psychotherapy for trauma disorders and symptoms (see Chapter 4). They also found a moderate effect for trauma symptoms alone, as well as depression, and anxiety symptoms. There have been no systematic reviews or meta-analyses examining animal-assisted psychotherapy and mental disorders as a whole. One of the broadest meta-analyses conducted in this area focused on animal-assisted therapy, not psychotherapy. Nimer and Lundhal (2007) examined 49 articles on animal-assisted therapy, and found a moderate effect on four outcome areas including: autism spectrum symptoms, medical difficulties, behavioural problems, and emotional well-being. More specific meta-analyses have been conducted for animal-assisted therapy (not animal-assisted psychotherapy). Chitic, Rusu, and Szamoskozi (2012) found a large effect for animal-assisted therapy on communication and social skills. Their study included four articles. Virues-Ortega, Pastor-Barriuso, Castellote Poblacion, and de Pedro-Cuesta (2010) examined the effect of animal-assisted therapy on elderly populations and patients with psychiatric disorders. They included 21 studies in their analysis and found a large effect for improving social function. They additionally found a moderate effect for reducing depression, anxiety, and behavioural disturbances.

Systematic reviews have come to similar conclusions. Kamioka et al. (2014) reviewed 11 randomized control trials of animal-assisted therapy (not animal-assisted psychotherapy). They

found that animal-assisted therapy was effective in treating mental and behavioural disorders, including depression, schizophrenia, and addictions. Similar research was conducted by Maujean, Pepping, and Kendall (2015) who reviewed randomized control trials of animal-assisted therapy on psychosocial outcomes. They based their review on eight articles and found that animal-assisted therapy was beneficial for a wide range of populations. The overwhelming conclusions from these review articles are that animal-assisted therapy is an effective treatment. However, this conclusion has not been yet been investigated for animal-assisted psychotherapy. Animal-assisted psychotherapy fundamentally differs from animal-assisted therapy. In animal-assisted psychotherapy, the animal plays an integral role in the therapy itself targeting specific mental disorder symptoms. Therefore, a comprehensive investigation is required to determine whether animal-assisted psychotherapy is indeed an efficacious treatment for mental disorders. Further, it is essential to obtain an understanding of what factors, if any, are associated with better treatment outcomes.

Factors, or variables, oftentimes associated with treatment outcomes occur in four broad categories. The first category of variables are bibliographic variables. Bibliographic variables have been found in other studies to moderate the effect of interventions. One such example is whether a study is published or unpublished. A well-known phenomenon known as publication bias exists, where studies with small samples and non-significant findings are less likely to be published (Decullier, 2005). Determining whether or not this phenomenon exists within the animal-assisted psychotherapy literature is important. The second category of variables oftentimes associated with treatment outcomes are sample characteristics. Other studies have shown that interventions can be affected by who participates. An example of a sample characteristic is percentage of women in the sample. Studies have shown that there are gender

differences related to intervention outcome (Grubbs et al., 2015; Rojiani, Santoyo, Rahrig, Roth, & Britton, 2017). An assessment of gender on animal-assisted psychotherapy outcomes would therefore be relevant. The third category, methodological characteristics, has also been shown in studies to influence the effect size of interventions. If the study is a randomized control trial is one such characteristic. Research conducted on randomized control trials suggests that they will produce smaller effect sizes in comparison to quasi-experimental designs (Cheung & Slavin, 2016). The final category is characteristics of the intervention. These factors also have been shown to affect the efficacy of interventions. An example is how long the intervention runs. Bakker, Cai, English, Kaiser, Mesa and Van Dooren (2019) have suggested that larger effect sizes are potentially expected in intervention that are longer or more intense as they present subjects with greater learning opportunities. They caution that there may be a ceiling effect as longer-run studies present difficulties in controlling conditions. Given these reasons, potential moderators of the treatment effect are essential to consider to inform our understanding of animal-assisted psychotherapy.

The objective of this study is to examine the efficacy of animal-assisted psychotherapy in the treatment of mental disorders by utilizing meta-analytic procedure. As the literature base indicates considerable flexibility regarding terminology within the field of animal-assisted therapy, studies were required to adhere to the definition of an animal-assisted psychotherapy as reviewed above. They did not need to specifically use the term ‘animal-assisted psychotherapy’ in their methodology to be included.

RESEARCH QUESTIONS

The proposed study will address the following research questions:

1. Is animal-assisted psychotherapy efficacious for the treatment of mental disorders?

2. What factors (bibliographic variables, sample characteristics, methodological characteristics, characteristics of the intervention), if any, affect the effect size of animal-assisted psychotherapy for mental disorders?

METHOD

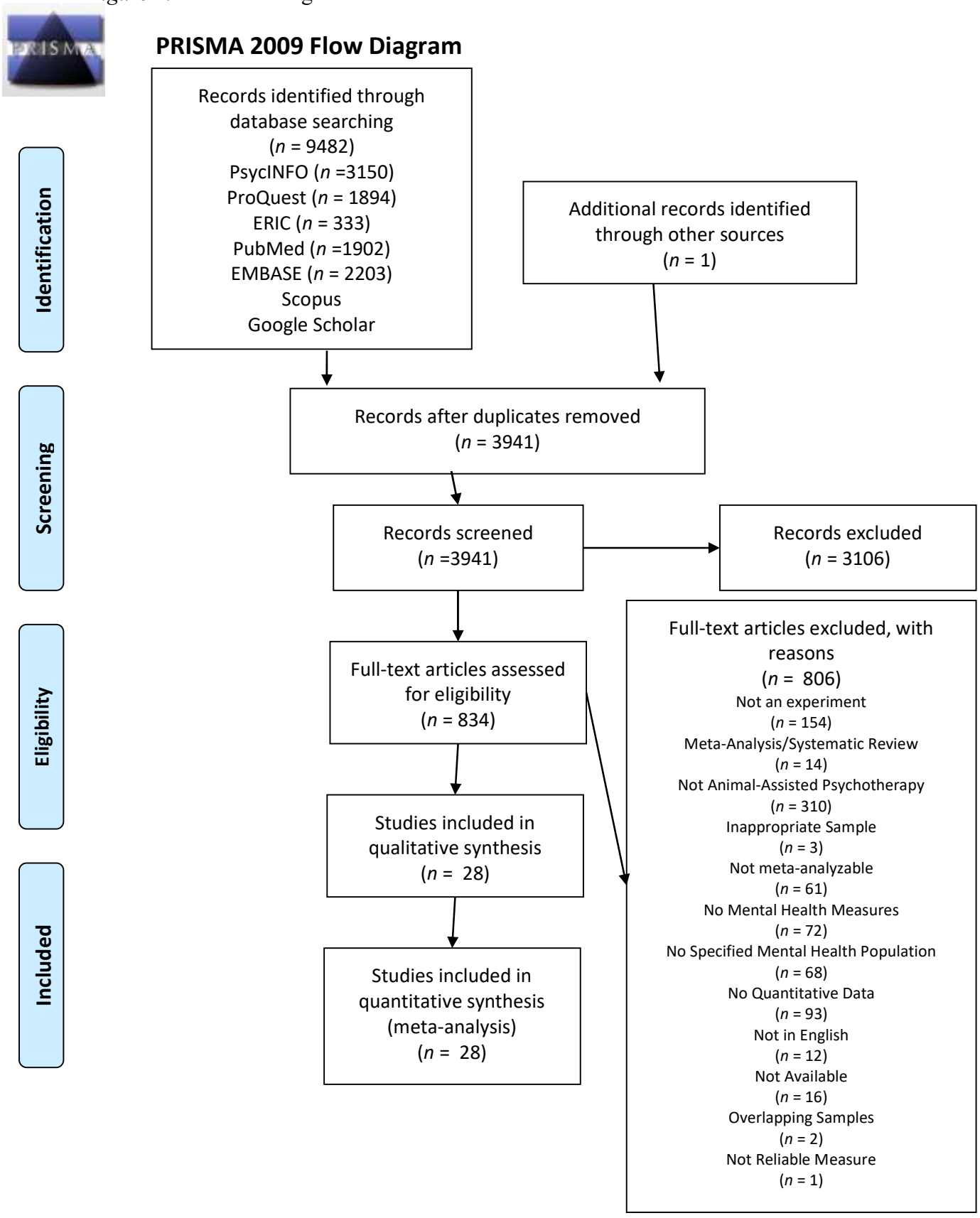
Research design

A random effects model was used in this study with efficacy as the main outcome variable. The random effects model assumes that there is a varying true effect size from study to study (Borenstein, Hedges, Higgins, & Rothstein, 2015). This differs from a fixed-effect model where the assumption is that the effect is equal across studies (Borenstein et al., 2015). As the studies included in this meta-analysis utilized differing populations, disorders, and programs, it is reasonable to assume that each study has a differing effect size as situational factors likely impacted the effect size. An additional benefit of using a random effects model is the ability to examine the situational factors, or moderators, to see how they influence the true effect size.

Procedure

Data extraction. A systematic review process was used for this meta-analysis to ensure consistency and transparency (Liberati et al., 2009). The Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines were used for study identification, screening, and eligibility determination (see Figure 1- Moher, Liberati, Tetzlaff, & Altman, 2009). I located studies primarily by systematically searching the following databases: PsycINFO, ERIC, ProQuest Dissertations & Theses, Scopus, PUBMED, EMBASE, and Google Scholar. To find all relevant studies, I searched the following keywords in combination in each database: interspecies, animal, animals, pet, pets, human and animal, dog, dogs, canine, canines, equine, equines, horse, horses, dolphin, dolphins, mammal, mammals; and therapy, therapies,

Figure 1. PRISMA Diagram.



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

psychotherapy, psychotherapies, intervention, interventions, facilitated, assisted, activity, activities, interaction, interactions, program, programs, programming, counselling, and counseling. Descriptors were additionally utilized to search each database when available.

First, I entered the search terms into each database, and a list of potential studies was generated. I screened each title based on the clearly outlined exclusion criteria (see Appendix B). If the study's title was clearly not relevant to the proposed study, it was excluded. Second, I screened the abstract of studies whose titles were potentially related to animal-assisted psychotherapy and any mental disorder concern using the inclusion and exclusion criteria. Articles clearly unrelated to animal-assisted psychotherapy and mental disorders were excluded. Third, I conducted a full manuscript review for the remaining studies. Studies that successfully passed through each phase of the screening process were included in the meta-analysis. As studies included in the meta-analysis must have independence from one another in order for the meta-analysis to be statistically valid, a detection strategy developed by Wood (2008) was utilized to assess if two publications had overlapping samples (see Appendix C). If two studies were found to use the same data, the study with the most comprehensive information (i.e., the study with the greatest amount of usable data) was included. Two studies were found to have overlapping samples. Henry and Crowley (2015) was excluded as it was a publication from Henry's (2014) dissertation, which was more comprehensive and included. McCullough, Risley-Curtiss, and Rorke (2015) was a publication from McCullough's (2011) dissertation. Therefore, McCullough (2011) was included as it had more comprehensive information, and McCullough et al. (2015) was excluded.

The next phase of searching involved screening the references of each eligible study to find studies not located in the database searches (termed "backwards searching"). I conducted additional searching through citation indices (available through Google Scholar). This further allowed myself to identify any additional eligible studies citing an eligible study that had not been previously located (termed "forwards searching"). Previous reviews by Nimer and Lundahl (2007) and by Maujean, Pepping, and Kendall (2015) were examined to identify any study not found elsewhere. The final phase of searching involved hand-searching a journal that publishes a large quantity of animal-assisted psychotherapy articles (i.e., *Anthrozoos).* Reporting, as required by PRISMA, included documentation of the number of studies excluded and a supplemental rationale for each study excluded at the full manuscript review level (Moher et al., 2009 – See Figure 1).

Eligibility. The eligibility criteria (Appendix B) utilized during the search process included the information below. Studies must have been quantitative reports with samples of at least three participants. Given the nascent state of this literature base, I wanted to be as inclusive as possible in selecting studies. Samples of at least three participants allowed for the exclusion of single subject designs, while retaining any studies amenable to standard meta-analytic procedures. Studies must have been published in English. Eligible studies must have had an animal-assisted psychotherapy component outlined in their methods section, which specifically targeted any mental disorder or measured symptoms. Quantitative data amenable to meta-analysis was required.

Pre- versus post-comparison designs and treatment versus control designs are two study designs which allow for meta-analytic examination. Studies that examine a single group and compare change in participants from pre- to post-intervention are called pre- versus post-

comparison designs. This is also known as a within-subjects design. Treatment versus control comparisons can examine either (a) two groups and compare each group's post-intervention scores or (b) compare two groups and compare each group's pre- versus post-intervention scores or mean change scores. This is known as a between-subjects design. It is important to note that the control comparison may have differing conditions. First, the control group may represent a true control group where no intervention takes place, often called a waitlist control. Second, the control group may represent an alternative intervention group, often described as treatment-as-usual. In considering internal validity, the conclusions drawn from a treatment versus control experimental design are more likely to represent the true effect of the intervention. Pre- versus post-comparison designs have greater threats to validity (Gravetter & Forzano 2012). While under ideal circumstances this meta-analysis would examine treatment versus control comparisons alone, due to the small body of literature available, all study designs amenable to meta-analysis were included. Participants of eligible studies must have had mental disorder symptoms. Eligible studies must have had a treatment goal to reduce mental disorder symptoms. Eligible studies must also have had outcome measures which were standardized and aimed to assess mental disorder symptoms. Due to the varied sample of studies included in the meta-analysis, no preferential measures were required for inclusion.

Coding and reliability. Study information was extracted after eligibility was determined. This was done using a coding manual to ensure consistency (Appendix D). Relevant demographic, bibliographic information, and outcome data were extracted from each study. Quantitative data was limited to pre- and post-intervention only to maintain consistency throughout coding. For example, if outcome data was reported for multiple time points, only the first measurement (defined as pre-intervention) and last (excluding follow-up) measurement

(defined as post-intervention) were recorded. The primary investigator coded each study initially, while a research assistant double-coded each included study. This was done to assess interrater reliability. The research assistant had an Honours degree in psychology and is proficient in meta-analytic procedures. Extracted data was then formatted for data analysis.

Data analysis

Data were analyzed using The Comprehensive Meta-Analysis Version 3.0 program. This computer software program is specifically designed to calculate an effect size from each of the individual studies and weight them to provide a summary effect (Borenstein et al., 2015). This computer software program also allows studies to provide more than one measure of data, such as a measure of depression and a measure of anxiety. When studies provided multiple outcome measures, the data from these measures were aggregated to avoid dependence in the analysis (Borenstein, Hedges, Higgins, & Rothstein, 2009).

Overall effect size. As noted above, The Comprehensive Meta-Analysis Version 3.0 program was utilized to convert each study's outcome scores into a single effect size or standardized mean difference utilizing Hedge's *g*. This calculation was done for each study to allow for the calculation of the overall mean effect size to answer the question of whether or not animal-assisted psychotherapy was efficacious in the treatment of mental disorders. Hedge's *g* provides a more accurate effect size for when intra-study sample sizes are small as it corrects for positive bias (Borenstein et al., 2009). Given that the research body is relatively new, most studies published have a small number of participants. As a result, Hedge's *g* was chosen as an effect size estimate over the more popular Cohen's *d*. The magnitude of the resulting effect sizes were interpreted as follows: approximately 0.20 is interpreted as small; approximately 0.50 is interpreted as medium; larger than 0.80 is interpreted as large (Lipsey & Wilson, 2001).

Weighted mean effect size calculations were calculated for all symptoms reported, and separate analyses were calculated for studies that reported on attention deficit hyperactivity disorder, reading disorders, anxiety disorders, autism disorder, and trauma/PTSD disorders.

Heterogeneity. Heterogeneity assesses dissimilarity between studies included in a meta-analysis (Borenstein et al., 2009). It is represented by Q_T and measures the degree to which each study's effect size varies within the distribution of effect sizes (Borenstein, et al., 2009). In this study, both the Q_T statistic and the I^2 statistic were used to assess heterogeneity. The Q_T statistic assesses if unaccounted variance exists within the studies included in the meta-analysis. That is, the Q_T statistic identifies if study characteristics associated with individual studies are moderating the effect of animal-assisted psychotherapy, in addition to the assumption of random error. The I^2 statistic specifically measures the proportion of variance that is attributed to real differences or attributed to the characteristics inherent to the included studies. As noted above, this meta-analysis used a random effects model. This was done as the studies included in the analysis were presumed not to share a common effect size. A forest plot was created to visually inspect the dispersion of effect sizes and identify any observable outliers, which were defined as studies with a standardized residual greater than 1.96 (Field, 2013).

Moderator analyses. Moderator analyses were conducted to assess which, if any, study or participant variables were associated with changes in overall efficacy of animal-assisted psychotherapy. Moderator analyses were performed using meta-regression. The individual study was used as the unit of analysis. Only variables that had data from four or more studies were analyzed, as the software will not analyze fewer than four data points. Graphs were also examined to assess the presence of a curvilinear relationship and to assess for outliers.

Publication bias. Historically, journals have been more likely to publish studies which reported statistically significant results. This is referred to as publication bias. Canestaro (2017) stated that publication bias is a significant problem given that "nearly half of all studies that collect data never reach publication" (p. 2). To reduce publication bias, this paper included both unpublished and published studies. In order to achieve this, specific databases were searched (e.g., ERIC) as they include unpublished research such as conference proceedings as well as unpublished master's theses/dissertations.

To formally assess for the presence of publication bias, funnel plots were created and visually examined. When a scatterplot is made of each study's effect size against study size or study standard error, a funnel plot is created (Higgins & Green, 2011). Rothstein, Sutton, and Borenstein (2005) have suggested that funnel plots should play a role in the assessment of the presence of publication bias. They do this by allowing the researcher to identify patterns associated with bias (Rothstein et al, 2005). In a funnel plot distribution, the effect size distribution will symmetrically resemble an inverted funnel. The larger studies will be clustered at the apex. The apex of the funnel plot represents the summative effect size. The smaller studies should be dispersed around the base in a symmetrical pattern. If publication bias does exist, the funnel plot will be asymmetrical (Higgins & Green, 2011). In particular, the smaller studies will cluster on the right side of the funnel distribution rather than being equally distributed on both sides of the funnel pattern. Moderator analyses were also conducted to assess for publication bias.

RESULTS

Search Results

The searches yielded 9482 articles from seven databases (PsycINFO, ProQuest Dissertations & Theses, ERIC, PubMed, EMBASE, Scopus, and Google Scholar) – refer to Figure 1 for specific numbers associated with each database. There was one article identified through additional sources. Once duplicates were removed, 3941 articles were screened by title and abstract. Of these, 834 articles were screened by full text analysis. Twenty-eight of these studies met the inclusion criteria. Studies were included up to April 2019. See Figure 1.

Characteristics of Included Studies

Twenty-one published and seven unpublished studies met the inclusion criteria for the meta-analysis (See Table 1). Studies were published between 1989 and 2019. Participants' age across studies ranged between 3 and 85 years of age, with 17 of the studies focusing on child and adolescent populations and 11 examining adult populations. Gender varied throughout the studies, ranging from 0% to 100% female participants. Regarding clinical population of participants, one study examined each of schizophrenia, Alzheimer's disease (dementia), and substance abuse disorder. Three studies each examined attention deficit hyperactivity disorder, anxiety disorders, and reading disability. Five studies examined autism spectrum disorder and 11 studies examined trauma and PTSD symptoms. The majority of studies included in this meta-analysis had zero percent attrition (13 studies). The remaining studies had rates between 3.23% and 52%. Theoretical orientation utilized in each study varied considerably. An experiential approach was used in seven of the 29 studies. Six studies utilized a behavioural theoretical orientation. Three studies utilized a cognitive-behavioural therapy theoretical orientation. Mindfulness, attachment, play therapy, eye movement desensitization movement (EMDR-

Table 1. Characteristics of included studies

Study	Publication Type	Place of Study	*n*	Age Range (Years)	Identified Concern	Data Analysis	Theoretical orientation	Animal	Interventionist	Duration of Program	Form	Attrition (%)	% Female Total
Alfonso et al, 2015	Journal Article	United States	11	Not Avail.	Anxiety	Both[1]	CBT[2]	Horse	Psychologist	6 Weeks	Group	8.33	100
Balluerka, 2015	Journal Article	Spain	63	12-17	Trauma/ PTSD[3]	Pre/Post[4]	Attachment	Horse and Dog	Multiple[5]	12 Weeks	Combo[6]	5.97	38.31
Bass, Duchowny, & Llabre, 2009	Journal Article	United States	34	4-10	Autism	Both	Behavioural	Horse	Multiple	12 Weeks	Group	0	10.53
Becker, Rogers, & Burrows, 2017	Journal Article	United States	31	8-14	Autism	Both	Behavioural	Dog	Multiple	12 Weeks	Group	3.23	9.68
Burton, Qeadan, & Burge, 2019	Journal Article	United States	20	31-63	Trauma/ PTSD	Both	Experiential	Dog	Occupational Therapist	6 Weeks	Group	4.76	20
Contalbrigo et al, 2017	Journal Article	Italy	22	Not Avail.	Substance Abuse Disorder	Both	Experiential	Dog	Multiple	20 Weeks	Group	31.8	0
Dietz, 2012	Journal Article	United States	153	7-17	Trauma/ PTSD	Both	CBT and Stories	Dog	Multiple	12 Sessions	Group	0	93.46
Earles, 2015	Journal Article	United States	16	33-62	Trauma/ PTSD	Pre/Post	Mindfulness	Horse	Psychiatrist	6 weeks	Group	0	75.00
Fung & Leung, 2014	Journal Article	Hong Kong	10	7-10	Autism	Both	Play Therapy	Dog	Therapist NS	7 weeks	Individual	0	20
Henry, 2014	Dissertation	United States	21	18-54	Anxiety	Tx/Cont[7]	Mindfulness	Dog	Psychologist	6-9 weeks	Individual	19.23	71.43
Jang et al., 2015	Journal Article	Korea	20	6-13	ADHD	Pre/Post	Behavioural	Horse	Therapist NS	12 Weeks	Unspecified	9.09	5
Kemp et al., 2014	Journal Article	Australia	30	8-17	Trauma/ PTSD	Pre/Post	Experiential	Horse	Counsellor	9-10 Weeks	Group	0	100.00

Kruger, 2012	Dissertation	United States	15	7-17	Trauma/ PTSD	Pre/Post	Bilateral Stimulation	Horse	Multiple	6 Months	Combo	0	26.67
Le Roux, Swartz, & Swart, 2014	Journal Article	Africa	102	7-13	Reading Disability	Tx/Cont	Behavioural	Dog	Volunteers Trained by Author	10 Weeks	Individual	7.54	Not Avail.
McCullough, 2011	Dissertation	United States	11	10-18	Trauma/ PTSD	Pre/Post	Experiential	Horse	Multiple	6-8 Weeks	Group	8.33	45.45
Menna et al., 2016	Journal Article	Italy	30	62-85	Alzheimer's Disease	Both	Reality Orientation	Dog	Multiple	6 Months	Group	0	76.67
Mueller & McCullough, 2017	Journal Article	United States	54	Not Avail.	Trauma/ PTSD	Both	Experiential	Horse	Psychologist	12 Weeks	Group	20.58	16.67
Oh et al., 2018	Journal Article	Korea	34	Not Avail.	ADHD	Both	Psycho-exercise	Horse	Multiple	12 weeks	Group	5.88	8.82
Rector, 2016	Dissertation	United States	18	Not Avail.	Reading Disability	Both	Reading Strategies Training	Dog	Animal Volunteer	12 Weeks	Individual	5.56	Not Avail.
Redefer & Goodman, 1989	Journal Article	United States	12	5-10	Autism	Pre/Post	Behavioural	Dog	Psychologist	18 Sessions	Individual	0	25
Signal, 2013	Journal Article	Australia	14	19-50	Trauma/ PTSD	Pre/Post	Experiential	Horse	Counselors	9-10 Weeks	Group	0	100.00
Smith, 2010	Dissertation	United States	26	Not Avail.	Reading Disability	Both	Whole Word Reading	Dog	Dog Handler	6 Weeks	Individual	0	Not Avail.
Villalta-Gil et al., 2009	Journal Article	Spain	21	Not Avail.	Schizophrenia	Both	CBIPT[5]	Dog	Psychologist	25 Sessions	Group	0	Not Avail.
Welsh, 2009	Dissertation	United States	24	3-8	Autism	Pre/Post	Behavioural	Dog	Multiple	1 Session	Individual	0	12.5
Wharton et al., 2019	Journal Article	United States	26	Not Avail.	Trauma/ PTSD	Pre/Post	CBT	Horse	Psychologist	12 Weeks	Individual	7	22.23
Whittlesey-Jerome, 2014	Journal Article	United States	13	28-64	Trauma/ PTSD	Tx/Cont	Experiential	Horse	Multiple	8 Weeks	Group	7.14	100.00

Yoo et al., 2016	Journal Article	Korea	10	Not Avail.	ADHD	Pre/Post	Psycho-education	Horse	Multiple	12 Weeks	Unclear	52	10
Zents, 2017	Dissertation	United States	10	10-15	Anxiety	Tx/Cont	CBT	Dog	Multiple	9 Weeks	Group	0	30

[1] Note: Both = Data available with pre- versus post-intervention data and treatment versus control data
[2] CBT = Cognitive Behaviour Therapy
[3] PTSD = Post traumatic stress disorder
[4] Pre/Post – Data available with pre- versus post-intervention data
[5] Multiple = Multiple intervention providers
[6] Combo = Combination of individual and group therapy
[7]Tx/Cont = Data available with treatment versus control data

bilateral stimulation), reality orientation, psycho-exercise, psycho-education, reading strategies training, whole word reading, reading comprehension, cognitive-behavioural integrated psychological treatment, and a combination of cognitive-behavioural and social learning (by the use of social stories) were used by the remaining studies.

The majority of studies utilized a group format (16 of the 28). Two additional studies utilized a group format with segments of one-to-one animal assisted psychotherapy, while eight studies utilized an individual approach. In two studies it was unclear if they used a group or individual format. Duration and frequency of intervention varied. Average duration in each study varied from 1 session to 20 weeks including one outlier study that ran its program for a maximum of 6 months (26 weeks). The majority of interventions ran weekly or biweekly from 20 minutes to two and a half hours. Most interventions were run by multiple practitioners, though some were run solely by a psychologist, an occupational therapist, a psychiatrist, a non-specified therapist, a counsellor, volunteers, animal volunteers, or a dog handler.

Reliability. Interrater reliability was calculated for each variable in the coding system. Agreement was 100%.

Main Results

Ten meta-analyses were conducted examining the effect of animal-assisted psychotherapy on six different mental disorder categories. Pre-versus post-comparison and treatment versus control comparison analyses will be presented separately for overall findings, as well as for each mental disorder category. Pre- versus-post-comparison estimates are typically larger, as they employ a within-subjects design. A within-subjects design is more vulnerable to factors including maturation, placebo effects, and/or factors such as spontaneous remission which affect the pre-versus post-comparison (Gravetter & Forzano, 2012). Linden (2013)

additionally highlights the issue of regression to the mean. He notes that in a control group, subjects who score high on pre-test measures are more likely to score low on post-test measures. For studies that examine individuals with significant mental health symptoms, there is the potential that subjects have reduced symptoms simply due to a factor of time. An inter-correlation of .70 was assumed for pre-versus post-comparison analysis (Rosenthal, 1991).

All Symptom Measures. Twenty-five effect sizes (from 24 studies) were included in the pre- versus post-comparison analysis (Alfonso et al., 2015; Balluerka et al., 2015; Bass et al., 2009; Becker et al., 2017; Burton et al., 2019; Contralbrigo et al., 2017; Dietz et al., 2012; Earles et al., 2015; Fung & Leung, 2014; Jang et al., 2015; Kemp et al., 2014; Kruger, 2012; McCullough, 2011; Menna et al., 2016; Mueller & McCullough, 2017; Oh et al., 2018; Rector, 2017; Redefer & Goodman, 1989; Signal et al., 2013; Smith, 2010; Villalta-Gil et al., 2009; Welsh, 2009 [Group 1]; Welsh, 2009 [Group 2]; Wharton et al., 2019; Yoo et al., 2016). The results indicated a large effect size ($g = 0.91$, $p < .001$; Refer to Appendix A Figure 1 for individual effect size statistics. Refer to Appendix A Table 1 for main effect statistics).

Seventeen effect sizes were included in the treatment versus control comparison analysis (Alfonso et al., 2015; Bass et al., 2009; Becker et al., 2017; Burton et al., 2019; Contralbrigo et al., 2017; Dietz et al., 2012; Fung & Leung, 2014; Henry, 2014; Le Roux et al., 2014; Menna et al., 2016; Mueller & McCullough, 2017; Oh et al., 2018; Rector, 2017; Smith, 2010; Villalta-Gil et al., 2009; Whittlesey-Jerome, 2014; Zents, 2017). Two effect sizes were quantified by measuring the difference of post-test scores between the treatment group and control group (Dietz et al., 2012; Le Roux et al., 2014). Fourteen effect sizes were quantified by comparing the mean change of the treatment group with the mean change of the control group (Alfonso et al., 2015; Bass et al., 2009; Becker et al., 2017; Burton et al., 2019; Contralbrigo et al., 2017; Fung

& Leung, 2014; Menna et al., 2016; Mueller & McCullough, 2017; Oh et al., 2018; Rector, 2017; Smith, 2010; Villalta-Gil et al., 2009; Whittlesey-Jerome, 2014; Zents, 2017). The results indicated a large effect size ($g = 0.75$, $p < .001$; Refer to Appendix A Table 1 for main effect statistics. Refer to Appendix A Figure 2 for individual effect size statistics).

Attention Deficit Hyperactivity Disorder Measures. Three studies reported on attention deficit hyperactivity disorder measures and their individual effect sizes were included in the pre- versus post-comparison analysis (Jang et al., 2015; Oh et al., 2018; Yoo et al. 2016). I calculated each effect size by measuring the difference of pre-intervention data to post-intervention data. The results indicated a large effect size ($g = 0.86$, $p < .001$; Refer to Appendix A Table 1 for main effect statistics. Refer to Appendix A Figure 3 for individual effect size statistics).

Reading Disability Measures. Three studies reported on reading disability measures. Two studies and their individual effect sizes were included in the pre- versus post-comparison analysis (Rector, 2016; Smith, 2010). Both effect sizes were calculated by measuring the difference of pre-intervention data to post-intervention data. The results indicated a large effect size ($g = 1.26$, $p = .001$; Refer to Appendix A Table 1 for main effect statistics. Refer to Appendix A Figure 4 for individual effect size statistics).

Three studies and their individual effect sizes were included in the treatment versus control comparison analysis (Le Roux et al., 2014; Rector, 2016; Smith, 2010). One effect size was quantified by measuring the difference of post-test scores between the treatment group and control group (Le Roux et al., 2014). Two effect sizes were quantified by comparing the mean change of the treatment group with the mean change of the control group (Rector, 2017; Smith, 2010). The results indicated a moderate effect size ($g = 0.62$, $p < .001$; Refer to Appendix A

Table 1 for main effect statistics. Refer to Appendix A Figure 5 for individual effect size statistics).

Anxiety Measures. Three studies reported on anxiety measures. These studies and their individual effect sizes were included in the treatment versus control comparison analysis (Alfonso et al. 2015; Henry, 2014; Zents, 2017). All three effect sizes were calculated by measuring the difference of treatment data to control data. The results indicated a large effect size ($g = 0.83$, $p = .03$; Refer to Appendix A Table 1 for main effect statistics. Refer to Appendix A Figure 6 for individual effect size statistics).

Autism Spectrum Disorder Measures. Five studies reported on autism spectrum disorder measures. Six effect sizes (from five studies) were included in the pre- versus post-comparison analysis (Bass et al. 2009; Becker et al. 2017; Fung & Leung, 2014; Redefer & Goodman, 1989; Welsh, 2009 [Group 1]; Welsh, 2009 [Group 2]). Each effect size was calculated by measuring the difference of pre-intervention data to post-intervention data. The results indicated a moderate effect size ($g = 0.58$, $p < .001$; Refer to Appendix A Table 1 for main effect statistics. Refer to Appendix A Figure 7 for individual effect size statistics).

Three studies and their individual effect sizes were included in the treatment versus control comparison analysis (Bass et al. 2009; Becker 2017; Fung & Leung, 2014). All three effect sizes were calculated by measuring the difference of treatment data to control data. The results indicated a moderate effect size ($g = 0.73$, $p < .001$; Refer to Appendix A Table 1 for main effect statistics. Refer to Appendix A Figure 8 for individual effect size statistics).

Trauma/Post-Traumatic Stress Disorder Measures. The trauma/Post-Traumatic Stress Disorder sub-meta-analysis was completed in this chapter as there were three additional studies were found post-publication of Chapter 4. Given that there were only eight studies in Chapter 4,

three additional studies constituted a significant increase in the literature base. Eleven studies reported on trauma/post-traumatic stress disorder measures. Ten studies and their effect sizes were included in the pre- versus post-comparison analysis (Ballureka et al. 2015; Burton et al., 2019; Dietz et al., 2012; Earles et al., 2015; Kemp et al., 2014; Kruger, 2012; McCullough, 2011; Mueller & McCullough, 2017; Signal et al., 2013; Wharton et al., 2019). Each effect size was calculated by measuring the difference of pre-intervention data to post-intervention data. The results indicated a large effect size ($g = 0.92$, $p < .001$). Refer to Appendix A Table 1 for main effect statistics. Refer to Appendix A Figure 9 for individual effect size statistics.

Four studies and their effect sizes were included in the treatment versus control comparison analysis. Three effect sizes were calculated by measuring the difference of treatment data to control data (Burton et al., 2019; Mueller & McCullough, 2017; Whittlesey-Jerome, 2014). One effect size was calculated by measuring the difference of post-test scores between the treatment group and control group (Dietz et al., 2012). The results indicated a moderate effect size ($g = 0.44$, $p < .001$; Refer to Appendix A Table 1 for main effect statistics. Refer to Appendix A Figure 10 for individual effect size statistics).

Heterogeneity

Heterogeneity, represented by Q_T, is a measure that represents the degree to which each study's effect size varies within the distribution of effect sizes (Borenstein, et at. 2009). In other words, the Q_T statistic is a measure of the differences among studies. This allows a researcher to determine whether or not the studies included in the meta-analysis have unaccounted variance. This statistic allows the researcher to determine whether individual characteristics inherent in each study are moderating the effect in addition to the assumption of random error. The I^2

statistic measures the proportion of variance that is due real differences or due to characteristics inherent to each study.

All Symptom Measures. After testing for heterogeneity among the studies that utilized a pre- versus post-comparison, the results suggest that the pre- versus post-comparisons studies are heterogeneous ($Q = 265.20$, $p < .001$). $I^2 = 90.95\%$, suggesting that almost all of the variance is potentially explained by study characteristics. As noted above, this meta-analysis utilized a random effects model. This was done as it was presumed that the studies included in the analysis did not share a common effect size, or in other words, meaning the true effect size will vary from study to study. A forest plot was created to visually inspect the dispersion of effect sizes and identify any observable outliers which were defined as studies with a standardized residual greater than 1.96 (see Appendix A Figure 1). Among the pre- versus post-comparison effect sizes, four studies were identified as outliers (Fung et al. 2014; Menna et al., 2016; Redefer & Goodman, 1989; Wharton et al., 2019).

Similarly, heterogeneity for the treatment versus control group comparison was statistically significant ($Q = 75.87$, $p < .001$). $I^2 = 78.91\%$, suggesting that almost all of the variance is potentially explained by study characteristics. Among the treatment versus control comparison effect sizes, two studies were identified as outliers in the forest plot (see Appendix A Figure 2 - Fung et al. 2014; Menna et al., 2016).

Attention Deficit Hyperactivity Disorder Measures. After testing for heterogeneity among the studies that utilized attention deficit hyperactivity disorder measures, the results suggest that the pre- versus post-comparisons studies were not statistically significantly heterogeneous ($Q = 2.58$, $p = .28$). The lack of significant findings does not necessarily confirm a lack of heterogeneity. It is important to note there were far fewer effect sizes included in this

analysis ($k = 3$). The power of the Q_T statistic is low when there is a small number of studies included in the analysis (Higgins, et al., 2003). This indicates that when k is small, the Q_T statistic should be interpreted cautiously. When there is no heterogeneity present, the use of a random effects model is statistically equivalent to the use of a fixed effect model. Therefore, the use of a random effects model in this analysis was ideal. The I^2 statistic is much less vulnerable to low power. The I^2 statistic = 22.50%, suggesting that slightly under a quarter of the variance is potentially explained by study characteristics. The forest plot was not examined as there were only three studies included in this analysis.

Reading Disability Measures. After testing for heterogeneity among the studies that utilized reading disability measures, the results suggest that the pre- versus post-comparisons studies are heterogeneous ($Q = 5.80$, $p = .02$). The I^2 statistic = 82.77%, suggesting that almost all of the variance is potentially explained by study characteristics. The forest plot was not examined as there were only three studies included in this analysis.

After testing for heterogeneity among the studies that utilized reading disability measures, the results suggest that the treatment versus control comparisons studies were not statistically significantly heterogeneous ($Q = 0.18$, $p = .92$). As noted above, the Q statistic is particularly vulnerable to detection of homogeneity in small sample sizes, and using the I^2 statistic provides a much more robust interpretation. The I^2 statistic was < 0.001% suggesting that none of the variance was due to study characteristics. The forest plot was not examined as there were only two studies included in this analysis.

Anxiety Measures. After testing for heterogeneity among the studies that utilized anxiety measures, the results suggest that the treatment versus control comparisons studies were not statistically significant heterogeneous ($Q = 4.28$, $p = .12$). The I^2 statistic = 53.31%, suggesting

that over half of the variance is potentially explained by study characteristics. The forest plot was not examined as there were only three studies included in this analysis.

Autism Spectrum Disorder Measures. After testing for heterogeneity among the studies that utilized Autism Spectrum Disorder measures, the results suggest that the pre- versus post-comparisons studies are statistically significantly heterogeneous ($Q = 33.24$, $p < .001$). The I^2 statistic = 84.96%, suggesting that almost all of the variance is potentially explained by study characteristics. Among the pre- versus post-comparison effect sizes, two studies were identified as outliers by the forest plot (see Appendix A Figure 7 – Fung & Leung, 2014; Redefer & Goodman, 1989)

After testing for heterogeneity among the studies that utilized Autism Spectrum Disorder measures, the results suggest that the treatment versus control comparisons studies were not statistically significant heterogeneous ($Q = 2.42$, $p = .30$). The I^2 statistic = 17.24%, suggesting that very little of the variance is potentially explained by study characteristics. The forest plot was not examined as there were only three studies included in this analysis.

Trauma/Post-Traumatic Stress Disorder Measures. After testing for heterogeneity among the pre-versus post intervention comparison studies that utilized trauma/Post-traumatic Stress Disorder measures, the results suggested moderator variables may partially be responsible for the distribution of effect sizes ($Q = 80.79$, $p < .001$). This suggests that the pre- versus post-comparisons studies are statistically significantly heterogeneous. The I^2 statistic = 88.86%, suggesting that almost all of the variance is potentially explained by study characteristics. Among the pre- versus post-comparison effect sizes, two studies were identified as outliers in the forest plot (see Appendix A Figure 9 - Kemp et al., 2014; Wharton et al., 2019).

After testing for heterogeneity among the treatment versus control comparison studies that utilized trauma/Post-traumatic Stress Disorder measures, the results suggest that the treatment versus control comparisons studies were not statistically significant heterogeneous ($Q = 2.15$, $p = .54$). The I^2 statistic < 0.001%, suggesting that none of the variance is potentially explained by study characteristics. Among the treatment versus control comparison effect sizes, no studies were identified as outliers in the forest plot (see Appendix A Figure 10).

Moderator Analyses

Moderator analyses were only conducted for variables that had four or more studies that provided data on that variable.

All Symptom Measures. There were 25 moderator analyses conducted in total for the pre- versus post-comparison analysis. See Appendix A Table 2 for the statistics for all of the moderator analyses and Appendix A Table 3 for the studies that were included in each moderator analysis.

The graph of each moderator analysis was visually examined to determine the presence of outliers and to assess if a curvilinear relationship provided a better explanation for the data. No graphs indicated a curvilinear relationship. There were 11 moderator analyses were statistically significant.

Bibliographic Variables. Studies conducted in Hong Kong were associated with a larger effect (Appendix A Figure 11 and Appendix A Table 4).

Sample Characteristics. Studies that examined Alzheimer's Disease, and reading disabilities were associated with a larger effect (Appendix A Figure 12 and Appendix A Table 5). When there was a greater percentage of women in the total sample and in the treatment group there was an associated larger effect (Appendix A Figure 13 and Appendix A Figure 14).

Further, when the mean age increased in the total sample there was an associated larger effect (Appendix A Figure 15).

Methodological Characteristics. Studies that were conducted utilizing a Reality Orientation or Play Therapy theoretical orientation were associated with a larger effect (Appendix A Figure 16 and Appendix A Table 6). For interventions that conducted treatment fidelity checks (Appendix A Figure 17 and Appendix A Table 7) or when the treatment was manualized, this was associated with a larger effect (Appendix A Figure 18 and Appendix A Table 8).

Characteristics of the Intervention. When interventions were provided three times weekly (tri-weekly), the effect of the intervention was greater than when it was provided biweekly, weekly or once (Appendix A Figure 19 and Appendix A Table 9). When the duration of each session decreased, there was an associated greater effect (Appendix A Figure 20). Further, when participants did not participate in additional therapy, the effect of the intervention was greater (Appendix A Figure 21 and Appendix A Table 10).

There were 25 moderator analyses conducted in total for the treatment versus control comparison analysis. See Appendix A Table 11 for the statistics for all of the moderator analyses and Appendix A Table 12 for the studies that were included in each moderator analysis. The graph of each moderator analysis was visually examined to determine the presence of outliers and to assess if a curvilinear relationship provided a better explanation for the data. No graphs indicated a curvilinear relationship. There were 7 moderator analyses that were statistically significant.

Bibliographic Variables. Studies conducted in Italy and Hong Kong were associated with a larger effect (Appendix A Figure 22 and Appendix A Table 13).

Sample Characteristics. The study that examined Alzheimer's disease was associated with a larger effect (Appendix A Figure 23and Appendix A Table 14). Additionally, as the mean age increased in the total sample/treatment goup/comparison group the effect increased (Appendix A Figure 24, Appendix A Figure 25, Appendix A Figure 26).

Methodological Characteristics. Studies that utilized humanistic and reality orientation theoretical orientations were associated with a larger effect (Appendix A Figure 27 and Appendix A Table 15).

Characteristics of the Intervention. The study that lasted 6 months was associated with a greater effect (Appendix A Figure 28).

Attention Deficit/Hyperactivity Disorder Measures. No moderators were conducted for the pre-versus post-comparison analysis as only three studies were included in the main analysis.

Reading Disorder Measures. No moderators were conducted for the pre-versus post-comparison analysis as only three studies were included in the main analysis. Further, no moderators were conducted for the treatment versus control comparison analysis as only two studies were included in the main analysis.

Anxiety Measures. No moderators were conducted for the treatment versus control comparison analysis as only three studies were included in the main analysis.

Autism Measures. There were 23 moderator analyses conducted in total for the pre-versus post-comparison analysis for autism measures. See Appendix A Table 16 for the statistics for all of the moderator analyses and Appendix A Table 17 for the studies that were included in each moderator analysis. The graph of each moderator analysis was visually examined to determine the presence of outliers and to assess if a curvilinear relationship provided a better

explanation for the data. No graphs indicated a curvilinear relationship. There were 7 moderator analyses that were statistically significant.

Bibliographic Variables. Studies published earlier were associated with a larger effect (Appendix A Figure 29).

Sample Characteristics. When there was greater percentage of women in the total sample there was an associated larger effect (Appendix A Figure 30).

Methodological Characteristics. For interventions that conducted treatment fidelity checks (Appendix A Figure 31 and Appendix A Table 18) or when the treatment was manualized (Appendix A Figure 32 and Appendix A Table 19), this was associated with a larger effect.

Characteristics of the Intervention. When the total contact for participants decreased, it was associated with a greater effect (Appendix A Figure 33). When the provider of the intervention was a therapist, the effect of the intervention was greater (Appendix A Figure 34 and Appendix A Table 20). Further, when that provider's education level was a Master's degree, it was associated with a larger effect (Appendix A Figure 35 and Appendix A Table 21).

No moderators were conducted for the treatment versus control analysis as only three studies were included in the main analysis.

Trauma/Post-Traumatic Stress Disorder Measures. There were 23 moderator analyses conducted in total for the pre- versus post-comparison analysis. See Appendix A Table 22 for the statistics for all of the moderator analyses and Appendix A Table 23 for the studies that were included in each moderator analysis. The graph of each moderator analysis was visually examined to determine the presence of outliers and to assess if a curvilinear relationship provided a better explanation for the data. There were six moderator analyses that were statistically significant.

Bibliographic Variables. Studies conducted in Australia were associated with a larger effect (Appendix A Figure 36 and Appendix A Table 24).

Sample Characteristics. When there was a greater percentage of women in the total sample there was an associated larger effect (Appendix A Figure 37). Finally, as age increased in the total sample, there was an associated larger effect (Appendix A Figure 38).

Methodological Characteristics. When treatment fidelity was measured, the effect was larger (Appendix A Figure 39 and Appendix A Table 25).

Characteristics of the Intervention. Interventions that were provided in an individual format were found to be more efficacious than interventions that were provided in both group and combination format (Appendix A Figure 40 and Appendix A Table 26). Finally, providers that had education other than a Masters, PhD, or unspecified were associated with interventions that had a greater effect (Appendix A Figure 41 and Appendix A Table 27).

There were eight moderator analyses conducted in total for the treatment versus control comparison analysis. See Appendix A Table 28 for the statistics for all of the moderator analyses. All four studies included in the primary analysis were included in each moderator analysis. None of the moderator analyses were statistically significant.

Publication Bias

Funnel plots were created to visually detect the presence of publication bias among the sample of studies (see Figures 2-6). By reviewing the funnel plots generated by the data for the pre-versus post-comparison analysis all measures, publication bias does seem to be evident (Figure 2). The moderator analyses contradicted this finding, noting no significant differences between published and unpublished studies. Publication bias does not seem to be present in the funnel plots for the treatment versus control comparison analysis all measures (Figure 3), the

pre-versus post-comparison analysis autism measures (Figure 4), the pre-versus post-comparison analysis trauma/PTSD measures (Figure 5), nor the treatment versus control comparison analysis trauma/PTSD measures (Figure 6). The moderator analyses for each comparison analysis echo the finding that publication bias was not present.

Figure 2. Pre-versus post-comparison effect size funnel plot – all measures.

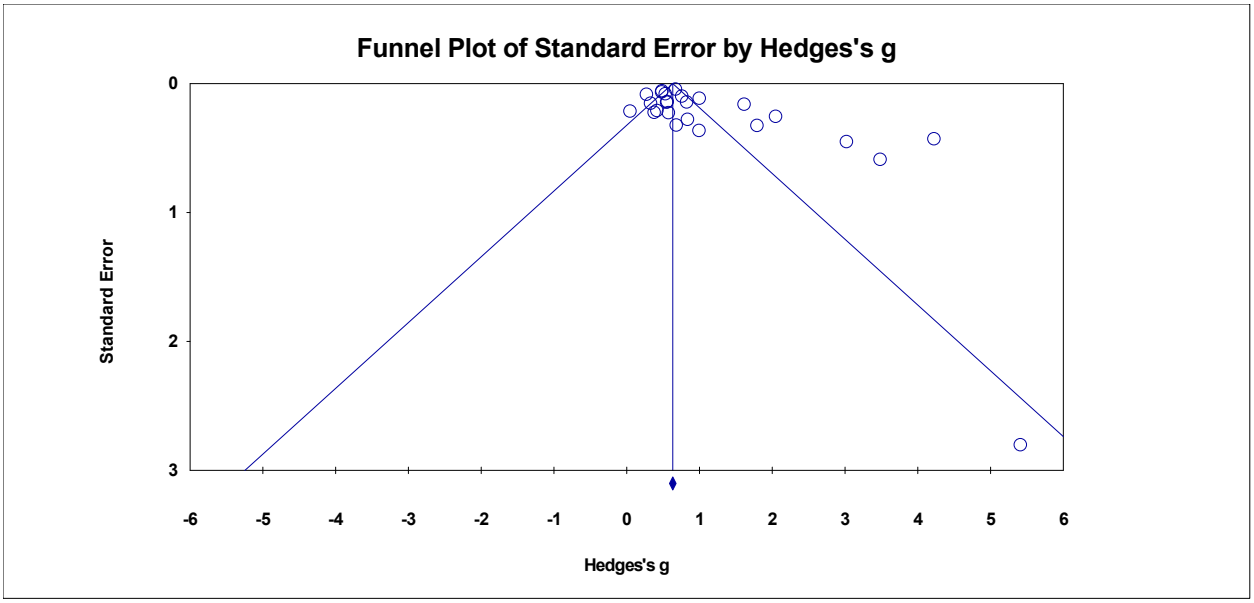


Figure 3. Treatment versus control effect size funnel plot – for all measures.

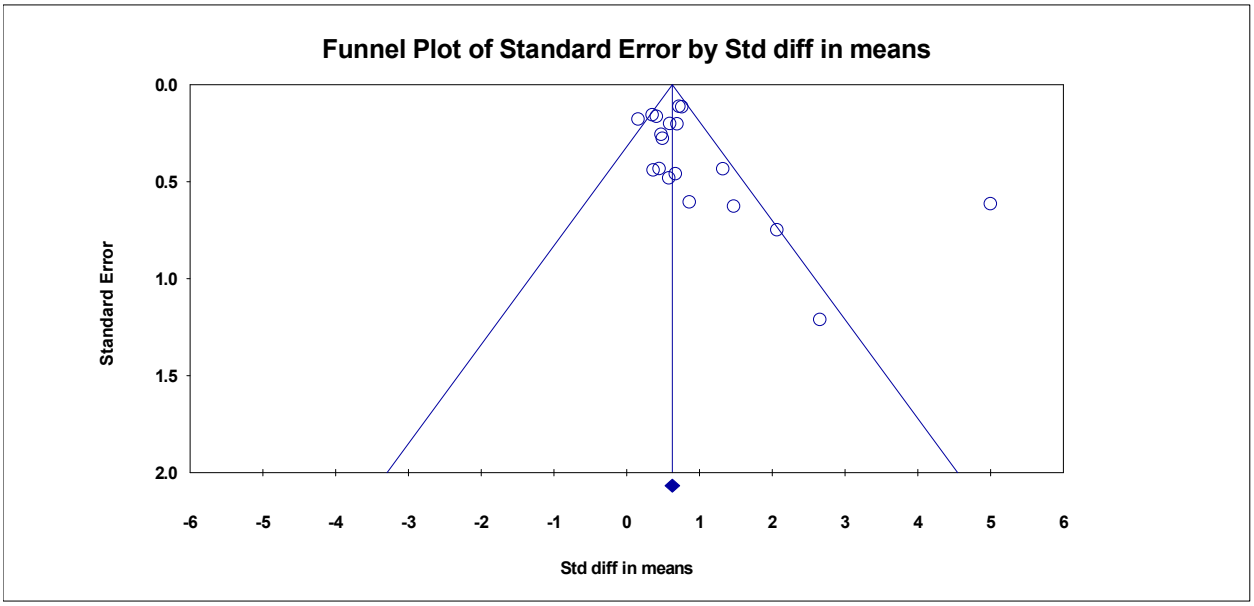


Figure 4. Pre-versus post-comparison effect size funnel plot – autism measures.

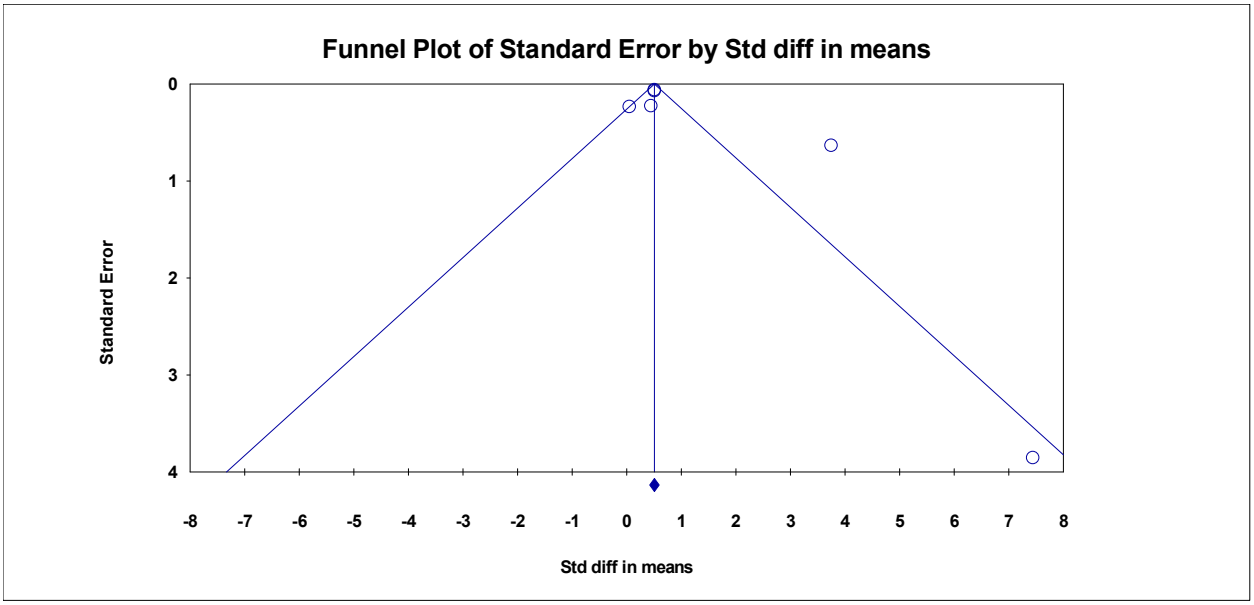


Figure 5. Pre-versus post-comparison effect size funnel plot – trauma/PTSD measures.

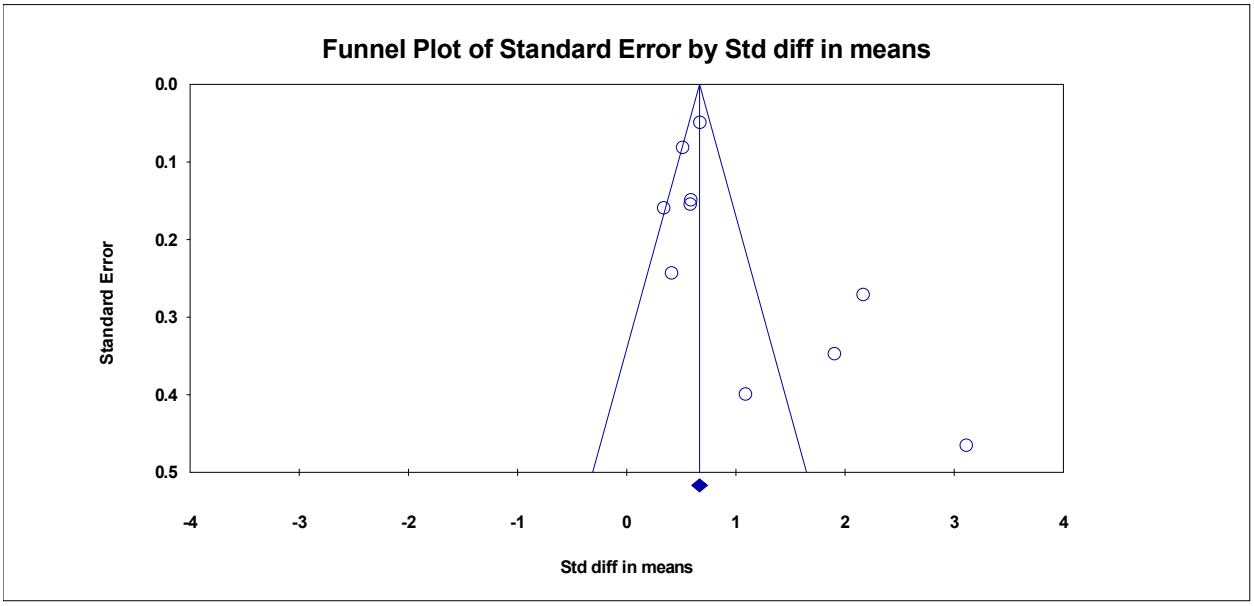
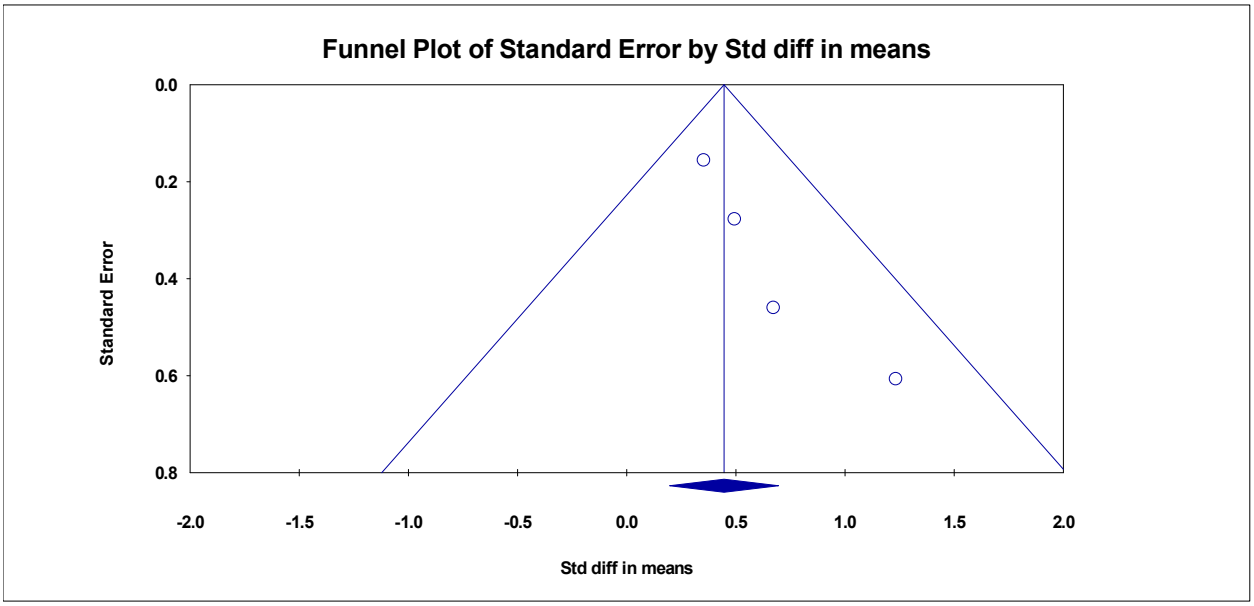


Figure 6. Treatment versus control comparison effect size funnel plot – trauma/PTSD measures.



Due to the limited number of studies included in the primary analysis, funnel plots and moderator analyses were unable to be produced for: pre-versus post-control comparison attention deficit hyperactivity disorder measures**,** pre-versus post-comparison analysis reading disorder measures**,** treatment versus control comparison reading disorder measures, treatment versus control comparison anxiety measures, or treatment versus control comparison autism measures.

DISCUSSION

Overall, this study found that animal-assisted psychotherapy programs are efficacious in decreasing mental health disorder symptoms, finding a moderate to large effect for both pre-versus post-comparison and treatment versus control comparison data. Additionally, I found a large effect for pre-versus post intervention comparisons for attention deficit hyperactivity disorder, reading disability, autism, and trauma/PTSD. I further found a large effect for treatment versus control comparisons for reading disability, and autism measures. A moderate effect was found for the treatment versus control comparison for trauma/PTSD. These results are consistent

with the animal-assisted therapy literature base. Nimer and Lundahl (2007) found that animal assisted therapies had a moderate effect on decreasing mental health symptoms. A systematic review of randomized control trials by Maujean, Pepping, and Kendall (2015) found that animal-assisted interventions were beneficial for wide range of individuals. The inter-rater agreement was 100%.

The majority of the moderator analyses were non-significant. This is likely due to low power in the analyses as a result of a small number of included studies. That said, there were several moderators that were statistically significant. With regards to bibliographic characteristics there were two moderators that were statistically significant. 'Place of study' was statistically significant in three out of the five comparison analyses (pre-versus post-comparison all measures, treatment versus control comparison all measures, and pre-versus post-comparison trauma/PTSD measures). With regards to the comparisons for all measures, the study conducted by Fung and Leung (2014) in Hong Kong was associated with the largest effect. With regards to the comparisons for trauma/PTSD, studies conducted in Australia were associated with the largest effects (Kemp et al., 2014; Signal et al., 2013). However, it is important to note that both the study by Kemp et al. (2014) and by Signal et al. (2013) utilized the same facility and therapy protocol with the same researchers. This suggests that perhaps there was a unique element of their program that potentially augmented their results. Additionally, the characteristic 'study year' (pre-versus post intervention comparison for Autism measures) found that studies published later were associated with a larger effect.

There were two general sample characteristics that were found to be associated with a larger intervention effect – percentage of women and age. 'Percentage of women in the total sample' was statistically significant in three of the five comparison analyses (pre-versus post-

comparison all measures, pre-versus post- comparison autism measures, pre-versus post-comparison trauma/PTSD measures). As the percentage of women in the total sample increased, there was an associated larger effect. This moderator was also associated with the studies conducted by Fung and Leung (2014), Kemp et al. (2014), and Signal et al. (2013). Additionally, in the pre-versus post intervention comparison for all measures, when the 'percent female in treatment group' increased, there was an associated larger effect. It may be that women respond to treatment more than men do. Age played a significant factor in the moderator analyses as well. As 'age in the total sample' increased there was an associated larger effect in three of the five comparison analyses (pre-versus post-comparison all measures, treatment versus control comparison all measures, pre-versus post-comparison trauma/PTSD measures). This moderator was associated with the studies conducted by Signal et al. (2014) and Wharton et al. (2019). It is possible that older populations are more responsive to treatment than younger populations. Further, in the treatment versus control intervention comparison for all measures, as both 'mean age of the treatment sample' and 'mean age of the comparison sample' increased, there was an associated larger effect. Menna et al. (2016) appeared to significantly pull the significance of the moderator analysis as their calculated effect was very large (4.23) and the mean age of their participants ranged from 75.0-75.95 years of age.

Several methodological characteristics were found to moderate the intervention effect. When 'treatment fidelity' was measured it was found to be a statistically significant moderator in three of the five comparison analyses (pre-versus post-comparison all measures, pre-versus post-comparison autism measures, and pre-versus post-comparison trauma/PTSD measures). When the treatment was manualized, there was an associated larger effect (pre-versus post-comparison analysis for all measures and pre-versus post-comparison analysis for autism). In other words,

treatments that assess if the treatment is being provided in a standardized manner and treatments that are standardized have larger effects than treatments that do not. 'Type of disorder', and 'theoretical orientation' moderated the effect of the intervention (pre-versus post-comparison all measures and treatment versus control comparison all measures). The study by Menna et al. (2016) was associated with the larger effects in each of these moderator analyses. The Menna et al. study examined Alzheimer's disease (and the results of the mean Mini Mental State Examination), and used a reality orientation theoretical orientation. As noted above, there are several characteristics that are associated with the study by Menna et al. (2016). It is likely that it is their protocol that produced a large effect (and resulted in these moderator analyses being significant). When participants did not participate in other therapy ('other therapy' - pre-versus post intervention comparison for all measures), this was associated with larger effects. It is possible that the other therapies were targeting other symptoms versus the target of the animal-assisted psychotherapy, which would place a dual focus on the individual to improve global symptoms versus symptoms of a single disorder. Additionally, when treatments had lower total contact or in other words, when the treatment course was shorter ('total contact for participants' - pre-versus post intervention comparison for Autism measures), there was an associated larger effect. It is important to note that the studies that had a shorter treatment course were the studies that reported large individual effect size calculations – Redefer and Goodman (1989) with a Hedge's $g = 3.486$ and an intervention course of six hours and Fung and Leung (2014) with a Hedge's $g = 5.414$ and and intervention course of 6.67 hours. It is likely that there is something unique about these two interventions which promoted such a large effect size. Fung and Leung (2014) additionally ran an intervention that was run by a therapist as opposed to a psychologist, or other ('provider of intervention' - pre-versus post intervention comparison for autism

measures). As such, interventions that were run by a therapist as opposed to a psychologist, or other were associated with larger effects. Furthermore, the 'education of the provider' was also associated with a larger effect when the education was a master's degree versus a smaller effect with other types of education, such as a PhD, or other training (pre-versus post-comparison autism measures and the pre-versus post-comparison trauma/PTSD measures). It is important to note that while the animal handler is a focus at times in the animal-assisted therapy literature, due to the lack of available data, this variable (moderator) was not analyzed.

Finally, there were several characteristics of the intervention that moderated the intervention effects. When interventions were provided three times weekly (tri-weekly) the effect of the intervention was greater versus bi-weekly, weekly, or one session only, and shorter sessions were associated with larger effects (pre-versus post intervention comparison for all measures). Further, the duration of intervention moderator was statistically significant and found that longer interventions were associated with larger effects (treatment versus control intervention comparison for all measures). Interventions provided more frequently, over a longer period of time have a greater effect than interventions that are provided less frequently over a shorter course. It is possible that the frequent therapy contact allows for greater knowledge transmission and therapeutic effect, as would a longer course of therapy. Lastly, 'style of intervention' was a significant moderator, where interventions that were provided in a group format, were found to be associated with a larger effect (pre-versus post intervention comparison for trauma/PTSD measures). Group therapy benefits have been widely documented (Yalom & Leszcz, 2005).

This meta-analysis found that whether or not a study was published ('type of publication') did not moderate the effect. Type of 'recruitment' did not appear to moderate the

effect, nor did a study's attrition rate ('attrition'). Additionally, conducting therapy outdoors versus indoors ('environment') did not moderate the effect. Further, it appears that incorporating different species did not moderate the effect. Finally, utilizing a randomized control trial study design ('RCT?'), or utilizing a random sample versus a convenience sample ('sample characteristic') did not moderate the effect of the intervention.

These findings together potentially suggest that animal-assisted psychotherapy programs could recruit from anywhere, conduct the study indoors or outdoors, with either dogs or horses without any reduction in efficacy. Additionally, randomized control trials did not diminish the effect of animal-assisted psychotherapy, as would be expected. This has powerful implications regarding cost of intervention. It suggests that if cost is a factor, a less costly animal could be utilized in a less costly location. However, as noted above, the results of this meta-analysis must be taken tentatively given the small body of research.

Limitations

This study presented a number of limitations. First, there were a limited number of studies included. One factor that led to the limited number of studies was the inclusion criterion. Specifically, the criterion that studies must utilize a psychotherapeutic intervention, as opposed to any activity that an animal might be a part of, such as grooming the animal. In this study, over 800 studies were assessed and 302 were excluded as they did not utilize animals within a psychotherapeutic intervention. We know that animals in therapy are beneficial. Research regarding physiology, emotional states, and well-being, all support this (Friedmann, Katcher, Thomas, Lynch, & Messent, 1983; Zilcha-Mano, Mukulincer, & Shaver, 2011). However, it is important to continue to explore and identify what aspects of therapy are essential for therapeutic benefit. If animals utilized within a psychotherapeutic context are equally as effective as animals

simply within the same room, financial resources (such as training costs) could be allocated elsewhere. An additional 72 studies were excluded as they did not report on mental health measures (e.g., only reporting on wellbeing statistics, self-esteem), and 65 studies were excluded as they did not report on a specific mental disorder population.

A second factor that led to the limited number of studies was the overwhelming lack of quantitative research available. Ninety-three studies were excluded as they only presented qualitative data. Ninety studies conducted literary reviews on animal-assisted therapy. Program proposals/descriptions/guidelines (n = 29), systematic reviews/meta-analyses (n = 14), and studies with two or fewer subjects (n = 42) also fell into this category. In total, 178 studies were excluded for not including quantitative data amenable to meta-analysis. It appears that there is more literature reviewing animal-assisted interventions than there is primary research.

A third issue that is apparent in animal-assisted psychotherapy research is the lack of reporting standards. A small number of studies (n = 7) were excluded from analysis as they did not provide quantitative data amenable to be utilized by meta-analysis. The Journal Article Reporting Standards (JARS) was created by the American Psychological Association as a method to standardize information provided in journal articles (American Psychological Association, 2019 November). They suggest reporting effect size data to allow for secondary analysis. Had these articles included such statistics, they would have been eligible to be included in this meta-analysis.

There were several limitations with regards to the moderator analyses. The majority of moderator analyses run for the differing analyses ran with all studies included. However, there were several moderator analyses that were unable to be run due to lack of available data. For example, some moderators could not be calculated due to collinearity. Additionally, some

moderator analyses could not be conducted due to the lack of studies included in: the pre-versus post-comparison analysis attention deficit hyperactivity disorder measures ($k = 3$); the pre-versus post-comparison analysis reading disorder measures ($k = 2$), the treatment versus control comparison analysis reading disorder measures ($k = 3$), the treatment versus control comparison analysis anxiety disorder measures ($k = 3$), and the treatment versus control comparison analysis autism disorder measures ($k = 3$). Therefore, I am unable to conclude whether or not any characteristics moderate the effect for the above analyses, and therefore am limited in the general conclusions I can draw regarding the efficacy of animal-assisted therapy.

Another issue concerning the moderator analyses concerns Type I and Type II error. Type I error is when a researcher concludes there is an effect when in fact there is no effect. Type II error is when a researcher concludes that there is not an effect when there is in fact an effect. Type I and Type II error are inversely related, as Type I error decreases, Type II error increases. Due to the sheer number of moderator analyses that were run, there is a heightened potential that Type I error is present. There exist statistical corrections, such as the Bonferroni correction, which aim to reduce the potential of Type 1 error. However, these were not utilized given the small number of studies included in this meta-analysis. Furthermore, these corrections are not commonly used in meta-analysis. Specific *p*-values have been provided in the appropriate tables, however, for interested readers. A small number of studies already reduces power to detect an effect. An increase in Type II error would further reduce the power in this study and was thus opted against.

A final liminitation with regards to the moderator analyses concerns the traditional definition of male and female. All studies included in this meta-analysis included a male/female dichotomy. As such, the conclusions of this research are limited to such.

A final liminitation with regards to the moderator analyses concerns the traditional definition of male and female. All studies included in this meta-analysis included a male/female dichotomy. As such, the conclusions of this research are limited to such.

Implications

This meta-analysis has several practical implications. It suggests that animal-assisted psychotherapy reduces mental disorder symptoms. It additionally suggests that animal-assisted psychotherapy reduces the symptoms associated with attention deficit hyperactivity disorder, anxiety disorders, autism disorder, and trauma/PTSD specifically. I found that there are characteristics that will enhance the effect of animal-assisted psychotherapy. Moderators that were significant for more than one analysis were that animal-assisted therapy is more effective for women, on older populations, and when treatment fidelity is measured. I also found that there were characteristics that did not enhance animal-assisted therapy, specifically how subjects are recruited, the physical environment that the study was conducted in, and the species of animal employed. However, due to the small body of research, this conclusion is tentative at best. More research must be conducted.

Future Directions

What has been apparent in conducting this meta-analysis is the lack of studies that are published that investigate animal-assisted psychotherapy and its effect on mental disorders. Most of the research currently available utilizes less rigorous methodology (such as animal-assisted activities), with either a healthy population, an “at-risk” population, or a medical population (such as patients with cancer). This meta-analysis has brought to light the sheer lack of studies that examine the effect of incorporating an animal in directed goal-orientated therapy. Nimer and Lundhal (2007) examined animal-assisted therapy and found moderate effect sizes for changes in

autism spectrum behaviors (d = 0.72), wellbeing indicators (d = 0.39), behavioral indicators (d = 0.51), and medical indicators (d = 0.59). Chitic, Rusu, and Szamoskozi (2012) examined animal-assisted therapy and found a large effect size of d = 0.79. Virues-Ortega, et al (2010) examined animal-assisted therapy and found a large effect size of d = 1.06. As my meta-analysis also found moderate to large effect size estimates, this paper gives evidence that incorporating animals in directed goal-orientated therapy is as beneficial as having an animal present in the therapy environment. Further, this study generally found large effect size estimates with pre-versus post-comparison data as well as treatment versus control data. As treatment versus control comparison data is likely to be more accurate as it removes confounding factors, I can provide a cautious conclusion about animal-assisted psychotherapy and its effectiveness at treatment of mental disorders. Given the small size of this meta-analysis, future research should focus on developing the body of primary research.

A second area of focus for future meta-analyses would be to continue to examine moderator variables. Some moderators were only significant in one comparison analysis where others were significant in multiple analyses. It would be important to assess if which if any variables are more "universal" and moderate the effects for animal-assisted psychotherapy applied to any mental disorder, and if any variables are "specific" and only moderate animal-assisted psychotherapy for certain mental disorders. When more data is available, it will be important to reassess this meta-analysis and to re-conduct the moderator analyses to see if the trends hold true in larger samples.

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Chapter 3: Animal-Assisted Psychotherapy and Internalizing Disorders: A Systematic Review and Meta-Analysis

Abstract

The present systematic review and meta-analysis examined the efficacy of animal-assisted psychotherapy on individuals with internalizing disorders. Three studies were examined in the systematic review and three studies quantitatively assessed the treatment effects following involvement in animal-assisted psychotherapy. I found in the systematic review that the majority of studies reported no statistical difference between their experimental group and their control group (treatment versus treatment-as-usual). The one study that found statistical significance examined treatment versus no treatment. I used the random effects model to aggregate each study into an overall effect size for the meta-analysis (total $N = 42$). I found a large effect overall ($g = 0.83$, $p = .03$). I was not able to conduct moderator analyses as due to lack of studies included in the meta-analysis they were not able to be computed. The results cautiously indicate that animal-assisted psychotherapy is an efficacious treatment for internalizing disorders.

Keywords: animal-assisted psychotherapy, internalizing disorders, depression, anxiety

Internalizing disorders are disorders that have symptoms that are directed inward and include disorders such as depressive disorders and anxiety disorders (Liu, Chen & Lewis, 2011). Major depressive disorder alone affects approximately 16.6% of adults and adolescents at least once in their lifetime (Kessler et al., 2005), with one-year rates at approximately 7% (American Psychological Association, 2013). Somers, Goldner, Waraich and Hsu (2006) found similar rates for anxiety disorders. The one-year rate is estimated between 10.1-17.2% and lifetime rates are estimated between 14.6-28.8%. In looking at the pragmatic consequences of these prevalence rates, the World Health Organization posits that major depression is one of the leading causes of years lived with disability worldwide (2013). Strine et al. (2008) have suggested that depression and anxiety disorders account for two of the major causes of morbidity and mortality in the United States.

Depressive and anxiety disorders have several identifying characteristics (Kring, Johnson, Davison, & Neale, 2016). Depressive disorders involve mood and cognitions associated with overwhelming sadness and/or an inability to experience pleasure (Kring et al., 2016). Anxiety disorders centre on excessive fear and/or anxiety (Kring et al., 2016). Fear is a response to immediate threat, whether real or imagined (Kring et al., 2016). It involves the activation of the fight or flight system which encompasses processes such as arousal, alertness, and readiness for action (Kring et al., 2016). In comparison, anxiety is the worry about upcoming or potential threats (Kring et al., 2016). Current conceptualizations indicate that individuals with depression and individuals with anxiety disorders have an increased activation in portions of the brain (Ball, Ramsawh, Campbell-Sills, Paulus, & Stein, 2013; Blair et al., 2008; Drevets et al., 1992; McClure et al., 2011; Monk et al., 2008; Price & Drevets, 2010; Sheline et al., 2001). As a result, both behaviourally and physiologically, an individual with depression or anxiety becomes highly

sensitive to negative stimuli, or neutral stimuli that is perceived negatively (Drevets et al., 2001; Sheline et al., 2001). In both depressive and anxiety disorders, the emotional part of the brain (the amygdala) becomes over-activated and the rational thinking part of the brain (the prefrontal cortex) becomes under-activated (Kring et al., 2016). As a result, individuals with depression become highly sensitive to negative stimuli and find positive stimuli less rewarding. This leads to the characteristic symptoms of depressive disorders– lack of motivation, profound sadness, and hopelessness (Kring et al., 2016). Individuals with anxiety also become highly sensitive to stimuli perceived to be threatening and are unable to extinguish the produced fears and anxiety. The individual become highly reactive and impulsive in their behaviours leading to a central symptom of anxiety disorders - avoidance (Ball et al., 2013; Blair et al., 2008; Kring et al., 2016; McClure et al., 2011, Monk et al., 2008). This conceptualization impacts treatment, as internalizing disorders can be thought of as a transient state of physiological arousal rather than a pervasive, enduring personality trait (Drevets et al., 1992).

Given that sensitivity to negative stimuli is central to internalizing disorders, there are a variety of treatments that target and are successful in decreasing sensitivity to perceived negative stimuli (Young et al., 2001). Therapies targeting depression employ several different foci depending on the orientation of the therapy (Kring et al., 2016). Such therapies include: interpersonal therapy, which examines interpersonal problems; cognitive therapy, which targets maladaptive thought patterns; mindfulness-based cognitive therapy, which focuses on separating one's thoughts and beliefs about who they are; and behavioural activation, which encourages individuals to go out and do things (Barlow, 2008; Kring et al., 2016). Treatment for anxiety disorders typically involves exposures, or experiencing the anxiety provoking stimuli (Kring et al., 2016). Mindfulness-based approaches have often been incorporated in anxiety treatment.

Even with the variety of empirically-based treatments available for internalizing disorders, there are considerable barriers to treatment. A recent survey of Canadians noted that approximately 40% of individuals who had concerns about anxiety and depression never sought help (Environics Research, 2016). Young (2001) found that for individuals with depression that seek out treatment, only 20% of those will actually receive medication or counseling that is consistent with treatment guidelines and only half of those will complete treatment. Slightly more individuals with anxiety disorders will complete treatment (approximately 75-93% - Smits & Hofmann, 2009), but only when they are motivated to seek out treatment. Iza et al. (2013) found that treatment-seeking rates for individuals with anxiety disorders were low, and often were accompanied by delayed first treatment contact ranging anywhere from 1- 16 years after symptoms manifested. What these statistics illustrate is that a large percentage of individuals with anxiety and/or depression do not seek treatment, and an even larger percentage either a) receive care that is inconsistent with best care practices, b) have difficulty getting motivated to initiate therapy, or c) simply fail to complete treatment.

Another barrier to treatment may lie in the uni-focused nature of many manualized treatments. There are many interventions that target only one specific disorder. This is despite the fact that internalizing disorders overlap considerably in mood, cognitive, somatic changes, and resulting problematic functioning, and are considered to be strongly related (Barlow, 2008). Studies have found that internalizing disorders have comorbidity rates up to 76% (Barlow, 2008). This comorbidity is in part due to similar brain structures, brain activation, neurotransmitters, genetics, and environments for the comorbid disorders (Barlow, 2005). This leaves clinicians with access to treatments that we know are efficacious, but that potentially require multiple treatment rounds as comorbidity has been shown to increase treatment attrition

(Issakidis & Andrews, 2004). It is important to develop and evaluate treatments that target change in the individual, which the individual is willing to engage in, and which also could target comorbid internalizing disorders.

Therapies using animals have been developed in an attempt to fill this need. Animal therapy, animal interaction, animal interventions, animal-assisted activities, and animal-assisted therapy are all different types of therapies that have emerged. As the incorporation of animals in therapy is still new, the field suffers from a lack of standardization with regards to terminology. Often terms are used interchangeably to describe differing therapeutic approaches and program content. These include terms such as "therapy," "activity," and "intervention." Animal-assisted therapy has been defined by Pet Partners (2015) as a targeted intervention incorporating an animal within the intervention that improves human physical, social, emotional, and/or cognitive functioning. Other organizations have made attempts to further standardize the terms in the field. The Equine Assisted Growth and Learning Association (EAGALA, 2012) calls for a separate category of animal-assisted therapy called equine assisted psychotherapy. This category requires a specific goal be targeted. Moreover, the goal-directed intervention must specifically target psychotherapeutic treatment goals (EAGALA, 2012). While not specified within their definition, these therapies will also utilize an animal within a psychotherapeutic intervention context (e.g., using the horse as a metaphor for the individual during a session). There is considerable diversity in the content of animal therapies. Given this, it does not seem appropriate to compare a study that attempts to decrease depressive symptoms by having participants teach a dog to sit with another which utilizes participant-animal interaction as metaphors for relationships and life. While the objective of a meta-analysis is to examine broader questions than individual studies can answer, it is important to correctly match the overall broad question with the selection of

included studies (Borenstein et al., 2009). Therefore, for the purposes of this paper, I will be examining a specific category – animal-assisted psychotherapy. Animal-assisted psychotherapy requires all the components of animal-assisted therapy (a goal-directed intervention which focuses on promoting improvement in human physical/social/emotional/ cognitive functioning, and is provided by a health/human service professional with specialized expertise – Pet Partners, 2015) along with two additional components. First the goal-directed intervention must specifically target psychotherapeutic treatment goals. Second, the animal must be incorporated as part of a psychotherapeutic intervention.

There is a substantial body of research to suggest that animal-assisted psychotherapy could be an efficacious treatment for individuals with internalizing disorders. Animals, in general, have been shown to affect a human's basic physiological state (or in other words, can affect physiological activation) which has implications for animal-assisted psychotherapy. One study examining this effect was conducted by Somervill, Kruglikova, Roberston, Hanson, and MacLin (2008). They examined whether a dog or cat could decrease blood pressure and heart rate in college students. They found that interacting with either animal produced a statistically significant reduction in both blood pressure and heart rate. Studies have further examined the effect of an animal's presence on depression (an animal-assisted therapy with no psychotherapeutic intervention). Folse, Minder, Aycock, and Santana (1994) found that when individuals participated in an animal intervention, they had significant reductions in depression symptom ratings. Fenstermaker, McKendree, and Swope (2016) also explored the effect of an animal on self-reported symptoms of depression and found a significant reduction in scores. Research on anxiety shows a similar trend. Shiloh, Sorek, and Terkel (2003) found that when faced with a fearful experience, participant's subjective ratings of anxiety decreased when

holding a live rabbit or turtle. In similar research, Buttelmann and Rompke (2015) found that when university students were faced with speech anxiety, being presented for five minutes with a dog or a fish produced a reduction in anxiety.

Providing a novel approach to the treatment of internalizing disorders may increase the likelihood that individuals are motivated for treatment engagement, which can be a challenge for individuals with internalizing disorders. Although working with a different population, Bernstein, Friedmann, and Malaspina (2000) examined how animal-assisted therapy affected social stimulation for residents at long term care facilities. They found that residents that participated in an animal-assisted therapy group had a greater number and longer conversations than residents who did not participate. They additionally found that residents who participated in the animal-assisted therapy program increased their frequency of speech while touching the animal. They concluded that touch likely contributed as a social stimulant for treatment engagement. A similar process of motivation may be at work for those with internalizing disorders. Providing a novel approach to the treatment of internalizing disorders may further provide a solution to the treatment of comorbid internalizing disorders concurrently. Several studies have been conducted examining the effect of animal-assisted therapy on multiple differing symptoms. One such study was conducted by Kemp et al. (2014). They found that an animal-assisted psychotherapy treatment targeting trauma symptoms resulted in reductions in internalizing symptoms (including separate measures of anxiety and depression symptoms), and externalizing symptoms.

Several studies have examined the effect of animal-assisted psychotherapy (as defined by method content rather than program name) on the treatment of internalizing disorders. One such study was conducted by Zents (2017). Zents (2017) investigated the effect of animal-assisted

psychotherapy on anxiety symptoms in children aged 10-15 years. She compared a treatment as usual manualized cognitive behavioural treatment (the C.A.T. Project) to incorporating an animal in the same treatment. Efficacy was measured by change scores on the Zung Self-Assessment of Anxiety scale and the SCARED inventory. Zents (2017) found no significant differences between the treatment and control groups.

There have been two previous reviews that have some relevance for the current study. The first meta-analysis was broad in scope and examined the effect of animal-assisted therapy (not animal-assisted psychotherapy) on the treatment of mental health difficulties (Nimer & Lundhal, 2007). They defined mental health difficulties as any diagnosis including: Alzheimer's, depression, and problematic behaviours (including conduct disorder and childhood aggression). As such, they did not calculate the specific effect of animal-assisted therapy on internalizing disorders, and included 49 studies. They found a moderate effect for reducing symptoms overall. The second meta-analysis was more specific in scope and examined the effect of animal-assisted activities or animal-assisted therapy (not animal-assisted psychotherapy) on the treatment of depression alone (Souter & Miller, 2007). As their scope was narrow, they included five studies in their meta-analysis. They found a moderate effect, where participation in an animal-assisted activity or animal-assisted therapy program significantly reduced depressive symptoms. To date, no systematic reviews or meta-analyses have been done examining the effect of animal-assisted psychotherapy on the treatment of internalizing disorders. This is surprising given the current community support for incorporating animals in therapy. For example, massive organizations have started to implement large scale pet therapy programs. One such organization is Kent State University which has been running a "Dogs on Campus" program that boasts 26 dogs that have conducted over 100,000 sessions since the programs' inception (Castellano, 2015).

Organizations which have a significant proportion of individuals with depression and anxiety (such as palliative/hospice care – Mitchell et al., 2011) are also delivering a staggering number of pet therapy services. Mitchell et al. (2011) reported that 58.6% of hospice care providers in the United States utilized pet therapy as part of their service in 2007. A comprehensive investigation is essential to determine whether animal-assisted psychotherapy is an efficacious treatment for internalizing disorders. This is important not only to ascertain the true effect of animal-assisted psychotherapy, but also to obtain an understanding of what factors are associated with better treatment outcomes.

The objective of this study is to examine the efficacy of animal-assisted psychotherapy in the treatment of internalizing disorders, utilizing a systematic review and meta-analytic procedure. As noted above, there is considerable flexibility regarding terminology within the field of animal-assisted therapy. Studies did not need to specifically use the term 'animal-assisted psychotherapy' in their methodology to be included here; however, the study's methodology was required to adhere to the definition of an animal-assisted psychotherapy as reviewed above. Additionally, to be included in this study, studies must have included participants who had either: a diagnosable internalizing disorder (defined as any anxiety or depressive disorder from the current and previous of the Diagnostic and Statistical Manual for Mental Disorders (American Psychiatric Association, 1980, 1994, 2000, 2013) or who had clinically elevated symptoms of any internalizing disorder. The current study included both published and unpublished research.

RESEARCH QUESTION

This study addressed the following research question by systematic analysis and meta-analytic procedures: Is animal-assisted psychotherapy efficacious for treatment of internalizing disorders?

METHOD

Meta-Analysis Research Design

This study utilized a random effects model with efficacy as the main outcome variable. This model was used over a fixed-effect model as a random effects model assumes that the true effect size varies from study to study and allows for the assumption that situational factors affect the outcome of each study differently (Borenstein et al., 2015). Comparatively, a fixed-effect model assumes the effect size is equal in all studies (Borenstein et al., 2015). As the studies included in this meta-analysis were not identical, it is reasonable to assume that each would have differing effect sizes.

Procedure for the Systematic Review and Meta-Analysis

Data extraction. This systematic review and meta-analysis were conducted using a manualized process to ensure consistency and transparency (Liberati et al., 2009). The Preferred Reporting Items for Systematic Review and Meta-analyses guidelines (PRISMA) were used for study identification, screening, and eligibility determination (see Figure 1- Moher, Liberati, Tetzlaff & Altman, 2009).

The following databases were systematically searched to locate studies: PsycINFO, ERIC, ProQuest Dissertations & Theses, Scopus, PUBMED, EMBASE, and Google Scholar. These keywords were searched in combination in order to find all relevant studies: interspecies,

animal, animals, pet, pets, human animal, dog, dogs, canine, canines, equine, equines, horse, horses, dolphin, dolphins, mammal, mammals, therapy, therapies, psychotherapy, psychotherapies, intervention, interventions, facilitated, assisted, activity, activities, interaction, interactions, program, programs, programming, counselling, counseling, emotional development, school phobia, anxiety, anxiety disorders, social anxiety, generalized anxiety disorder, GAD, specific phobia, emotions, agoraphobia, internalizing disorders, internalizing symptoms, depression, depressive disorders, major depressive disorder, persistent depressive disorder, dysthymia, anxiety disorders, panic disorder, separation anxiety disorder, emotional disorders, inhibited, inhibition, and shyness. Descriptors were additionally utilized to search each database when available.

A list of potential studies was generated after the search terms were entered into each database. The title of each study was screened based on clearly outlined exclusion criteria (Appendix E). The study was excluded if its title clearly indicated it was not relevant to the proposed study. If the title was potentially related to animal-assisted psychotherapy and any mental health concern, the abstract of that study was further screened using the inclusion and exclusion criteria. The study was excluded if the abstract review clearly met exclusion criteria. A full manuscript review was completed on the remaining studies. Studies that successfully passed through each phase of the screening process were included in the meta-analysis. If two studies were found to use the same data, the study with the most comprehensive information was included. In other words, the study with the greatest amount of usable data was selected for inclusion. This was done to ensure that each study was independent from the others. Wood's (2008) detection strategy was utilized to determine if two studies with similar authors and content had overlapping samples (Appendix C). One study was found to have overlapping

samples. Henry and Crowley (2015) was excluded as it was a publication from Henry's (2014) dissertation, which was more comprehensive and included.

Once the included studies list was finalized, the references of each eligible study were then examined for studies not located in the database searches (termed "backwards searching"). Citation indices (available through the databases) further enabled identification of any additional studies citing an eligible study that had not been previously located (termed "forwards searching"). Previous relevant reviews (Nimer, & Lundhal, 2007; Souter & Miller, 2007) were examined to identify any study not found elsewhere. A journal that publishes a large quantity of animal-assisted psychotherapy articles (i.e., *Anthrozoos*) was hand-searched for relevant articles that met the inclusion criteria. Documentation of the number of studies excluded and a supplemental rationale for each study excluded at the full manuscript review level was recorded as required by PRISMA (Moher et al., 2009 – See Figure 1).

Eligibility. The eligibility criteria (Appendix A) utilized during the search process above were as follows. Only studies reported in English were eligible. Qualitative studies and narrative reviews were excluded from both the systematic review and the meta-analysis as they do not have the statistical components required for analysis. Eligible studies must have had an animal-assisted psychotherapy component outlined in their methods section, which specifically targeted internalizing disorders/symptoms. Studies that had participants with comorbid disorders, other than internalizing disorders, were excluded. Studies must have had quantitative data amenable to systematic review and/or meta-analysis. Specifically, I investigated treatment versus control comparisons, also known as between-subjects designs. They examine two groups and compare either: each group's post-intervention scores or compare both group's pre- versus post-intervention scores (sometimes referred to as mean change scores). Depending on the research

design, there may be a 'true' control group where no intervention takes place (e.g., waitlist control) or an alternative intervention group (e.g., treatment as usual). When considering the true effect of animal-assisted psychotherapies, examining a treatment versus control experimental design allows one to see the effect of an intervention without additional sources of error, such as maturation (Gravetter & Forzano 2012). Participants of eligible studies must have had a diagnosis or a clinical measure of internalizing disorder symptoms. Likewise, the treatment goal of eligible studies must have been to decrease internalizing symptoms. Outcome measures of eligible studies must have been standardized and aimed to assess internalizing disorder symptoms. Due to the varied sample of studies included in the systematic review and meta-analysis, no preferential measures were required for inclusion.

Coding and reliability. Each study included in the systematic review and meta-analysis was subject to data extraction using a coding manual (Appendix D) to ensure consistency. Relevant demographic, bibliographic information, and outcome data were extracted from each study. The primary coding for each study was completed by the primary investigator. A research assistant double-coded the included studies to assess interrater reliability. The research assistant has a Bachelor's Degree in Psychology and is proficient in meta-analytic procedures. If any discrepancies between the two coders arose, the principal investigator reviewed the inconsistency with the research assistant. Each inconsistency was discussed until agreement was reached; however, if an agreement could not be reached, an additional trained collaborator was consulted. Extracted data was then formatted for data analysis.

Systematic Review Data Synthesis

Data was analyzed in five major categories: bibliographic content, sample characteristics, intervention characteristics, intervention characteristics, methodological characteristics and

intervention results. Interventions were classified as having positive, negative, or no effect as determined by whether or not significant differences were reported by each study. Relevant data are summarized in Table 2.

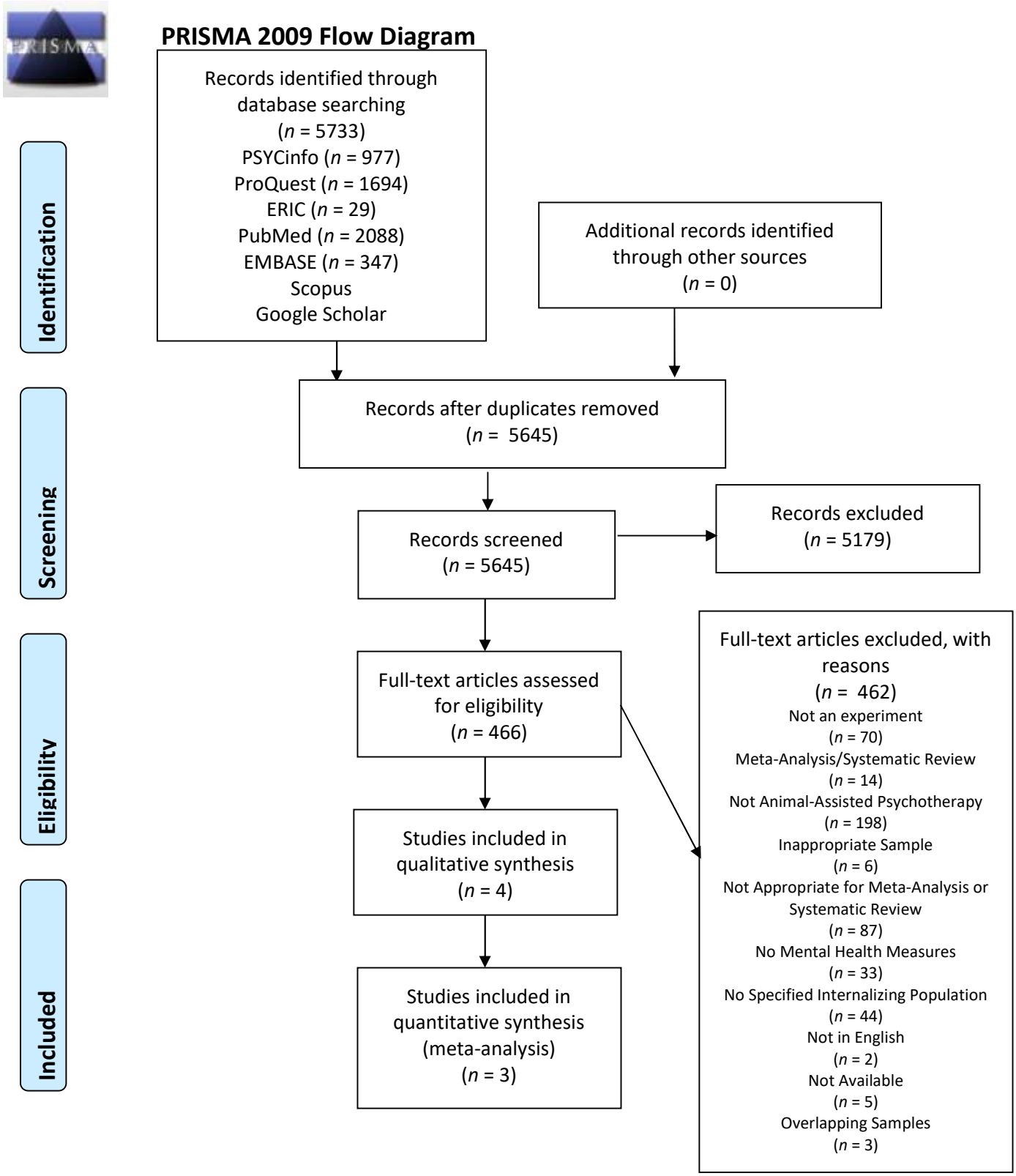
Meta-Analysis Data Analysis

The Comprehensive Meta-Analysis Version 3.0 program was utilized to analyze the data once it was coded and entered. Comprehensive Meta-Analysis program is a computer software program specifically designed to calculate an effect size from each of the individual studies and weight them to provide a summary effect (Borenstein et al., 2015). Studies often provide more than one measure of data, such as two different measures of depression symptoms. When this occurred, the results from these measures were aggregated to avoid dependence in the analysis (Borenstein, Hedges, Higgins, & Rothstein, 2009).

Overall effect size. Each study's outcome scores were converted into a standardized mean difference utilizing Hedge's *g*. This was done to ascertain whether or not animal-assisted psychotherapy was efficacious in the treatment of internalizing disorders. Once each study's effect size was calculated, the overall weighted mean effect size calculation was done. Hedge's *g* was selected over Cohen's *d* as the effect size statistic, since Hedge's *g* is more accurate when intra-study sample sizes are small. Hedge's *g* provides a conservative corrective factor which counteracts positive bias. (Borenstein et al., 2009). Lipsey and Wilson (2001) offer the following guidelines to interpret the magnitude of effect sizes that were utilized in the interpretation of the results: < 0.20, small; 0.50, medium; > 0.80, large.

Heterogeneity. Heterogeneity refers to the variation in study outcomes within the distribution of effect sizes (Borenstein et al., 2009). Essentially it is a measure of how similar the studies are that have been included in the meta-analysis. The Q_T statistic and the I^2 statistics were

*Figure*1. PRISMA diagram.



Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*n
The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

used to assess heterogeneity in this study. A forest plot of the effect size data was examined for the presence of outliers and to visually assess heterogeneity.

Publication bias. Publication bias is widely considered to be a significant threat to meta-analytic methodology (Kepes, Banks, & Oh, 2014). It refers to the trend that journals are more likely to publish interesting studies (i.e., studies which have statistically significant results). Therefore, to guard against the pitfall of publication bias, both unpublished and published reports were included in this systematic review and meta-analysis in order to reduce this potential bias.

Funnel plots were visually examined to assess publication bias. Funnel plots are scatter plots of the study effect size against study size or study standard error (Higgins, & Green, 2011). They are a useful initial tool in assessing the presence of publication bias as analysis relies upon easily identifiable patterns (Rothstein, Sutton & Borenstein, 2005). If publication bias does exist, the funnel plot will be asymmetrical (Higgins & Green, 2011).

RESULTS

Search Results

The searches yielded 6720 articles from seven databases (PsycINFO, ProQuest Dissertations & Theses, ERIC, PubMed, EMBASE, Scopus, and Google Scholar) – refer to Figure 1 for specific numbers associated with each database. There were no articles identified through additional sources. Once duplicates were removed, 6502 articles were screened by title and abstract. Of these, 539 articles were screened by full-text analysis. Three of these studies met the inclusion criteria. Studies were included up to December 2019. See Figure 1.

Reliability

Given the small number of studies included in this systematic review and meta-analysis, all studies were double coded to ensure reliability. Interrater reliability was calculated for each variable in the coding system. Agreement was 100%.

Systematic Review

Three studies examined the efficacy of animal-assisted psychotherapy for internalizing disorders (See Table 1 for summary of study characteristics - Alfonse et al., 2015; Henry, 2014; Zents, 2017).

Bibliographic Content. Studies were published between 2014 (Henry, 2014) and 2017 (Zents, 2017). One study was published in a journal (Alfonso et al., 2015) whereas the other two were dissertations (Henry, 2014; Zents, 2017). Of note, the data in Henry (2014) was published in Henry and Crowley (2015). All three studies were conducted in the United States.

Sample Characteristics. Two studies examined the effect of animal-assisted psychotherapy on anxiety (Alfonso et al., 2015; Zents, 2017), and one study looked at both anxiety and depression (Henry, 2014). One of the studies utilized horses (Alfonso et al., 2015) and the other two studies utilized dogs (Henry, 2014; Zents, 2017). Two studies recruited from schools (Alfonso et al., 2015; Zents, 2017). Alfonso et al. (2015) additionally recruited from community postings. One study recruited from mental health clinics (Henry, 2014). The sample size ranged from 10 (Zents, 2017) to 21 (Henry, 2014). The mean age of participants ranged from 10 (Zents, 2017) to 54 years (Henry, 2014), with the majority examining adult populations (Alfonso et al., 2015, Henry, 2014). One study had an exclusively female population (Alfonso et al., 2015), while others had a mixture of males and females (Henry, 2014; Zents, 2017). The attrition rate ranged from 0% (Zents, 2017) to 19.23% (Henry, 2014).

Intervention Characteristics. Studies utilized differing intervention programs: one study utilized Project Stride (Alfonso et al., 2015), one study utilized a modified mindfulness-based stress reduction program (Henry, 2014), and the last used a cognitive behavioral therapy (CBT) program with the addition of animal-assisted therapy (Zents, 2017). Two studies utilized a cognitive-behavioural theoretical orientation (Alfonso et al., 2015; Zents, 2017), while the other study utilized a mindfulness orientation (Henry, 2014). Two studies incorporated dogs (Henry, 2014, Zents, 2017) and one study incorporated horses into the intervention (Alfonso et al., 2015).

The majority of studies ran a group format (Alfonso et al., 2015; Zents, 2017). One study utilized an individual approach (Henry, 2014). Duration and frequency of intervention varied. Sessions varied from 6 weeks/sessions (Alfonso, et al., 2015) to 9 weeks/sessions (Henry, 2014; Zents, 2017). Interventions ran weekly from 50 minutes (Henry, 2014) to 150 minutes (Alfonso et al., 2015). The range of total intervention hours ranged from 5 hours (Henry, 2014) to 15 hours (Alfonso et al., 2015). Studies were either run by a psychologist (Alfonso et al., 2015; Henry, 2014), or a combination of a psychologist, social worker, and school counsellor (Zents, 2017).

Methodological Characteristics. One study ran a randomized control trial (Alfonso et al., 2015). The other two studies used manualized treatment protocols (Henry, 2014; Zents, 2017). Henry (2014) and Zents (2017) conducted fidelity checks throughout the study. Alfonso et al. (2015) did not. The studies measured efficacy using different measures including: The Liebowitz Social Anxiety Scale (Alfonso et al., 2015), the Beck Anxiety Inventory (Henry, 2014), the State-Trait Anxiety Inventory (Henry, 2014), the Beck Depression Inventory (Henry, 2014), the Outcome Questionnaire-45 (Henry, 2014), the Zung Self-Assessment of Anxiety scale (Zents,

Table 1.

Characteristics of Included Studies in the Systematic Review

Study	Sample Characteristics, *n*	Theoretical orientation and Intervention	Assessment	Outcome
Alfonso, Alfonso Llabre, & Ferandez, 2015	- Examined social anxiety - Recruited from school and community postings - *n* = 11 (tx[1] = 5, con[2] = 6) - 100% female - Mean age 21.36 years (SD = 3.30) - Age Range not reported - Attrition = 8.33 %	- Utilized a RCT[3] Manualized Treatment - CBT approach - Utilized Horses -Group format -Conducted outdoors - Tx group received 2-2.5 hours of AAPT[4] for 6 weeks -Both tx and con had regularly scheduled programming - Conducted by a Psychologist	- Scores compared pre and post treatment versus control using statistical analysis - Liebowitz Social Anxiety scale	- The tx group had significantly greater reductions than the control group from baseline to immediate-post-treatment and from baseline to follow-up
Henry, 2014	- Examined anxiety and depression - Recruited from mental health clinics - *n* = 21(tx = 10, con =11) - Tx = 80% female- Con = 63.64% Female - Mean age 25 years (SD 8.79) - Age range 18-54 years - Attrition = 19.23 %	- Utilized a Manualized Treatment (not an RCT) -Mindfulness approach - Utilized a dog -Individual format -Conducted indoors - Tx received 50-75 minutes of AAPT for 6-9 weeks - Con received the same program without the dog - Conducted by a Psychologist	- Scores compared pre and post treatment versus control using statistical analysis - All measures were assessed at each session - Beck Anxiety Inventory - State/Trait Anxiety Inventory - Beck Depression Inventory II - Outcome Questionnaire -45 - Blood Pressure monitor	- No significant differences were found between the tx and con groups - All participants experienced reductions in anxiety and depressive symptoms, psychological distress, and increased mindfulness skills from pre- to post treatment. - State anxiety, blood pressure, and heart rate decreased within sessions.
Zents, 2017	- Examined anxiety - Recruitment from school population - *n* = 10 (tx = 6 con = 4) - 30% female	- Utilized a Manualized Treatment (not an RCT) -CBT approach - Utilized a dog -Group format	- Scores compared pre and post treatment versus control using statistical analysis.	- No significant differences were found between the tx and con groups - Con group found a decrease in anxiety whereas the tx group found an increase in anxiety. Neither of the differences were statistically significant.

- Mean age not reported (SD not reported) -Age range 10-15 years - Attrition = 0%	-Conducted in unknown location - Tx received 60 minutes of AAPT for 9 weeks - Con received the same program without the dog - Conducted by a psychologist, social workers, and school counsellor	- Zung Self-Assessment of Anxiety scale -SCARED inventory	-Con group had an increase in anxiety from first session to last session anxiety ratings. Tx group had a decrease from first session to last session anxiety ratings.

[1]*Note.* Tx refers to Treatment Group
[2]Con refers to Control Group.
[3] RCT refers to Randomized Controlled Trial.
[4] AAPT refers to animal-assisted psychotherapy

2017), and the Screen for Child Anxiety Related Emotional Disorders (SCARED) Inventory (Zents, 2017).

Intervention Results. Alfonso et al. (2015) explored the efficacy of animal-assisted psychotherapy to decrease symptoms of social anxiety for adult women. The authors recruited women using flyers and by directly approaching women. Eligible women in the study had to self-endorse a minimum of four symptoms of social anxiety. The authors utilized a randomized controlled trial with a pre-post measures design method to assess if the six-week Project Stride program was efficacious as measured by the Liebowitz Social Anxiety Scale. The author compared a treatment group that participated in Project Stride to a control group. Participants in the treatment group had significantly greater reduction in social anxiety scores from pre- to post-intervention. Alfonso et al. (2015) was the most effective program of the included studies.

Henry (2014) examined the efficacy of animal-assisted psychotherapy in reducing anxiety and depression symptoms in Utah State University students. The author utilized a randomized, treatment control pre-post design method to assess if the addition of animal-assisted psychotherapy to a modified mindfulness-based stress reduction program had an effect on the efficacy of the program. Participants were recruited through Utah State University, and had to have had a minimum cut-off score of 53 on the Outcome Questionnaire-45 (which measures psychological distress). The author assessed efficacy by using several measures examining state and trait anxiety, depressive symptoms, and physiological measures. Participants had six, 50-minute individual therapy sessions with a certified therapy dog. Henry (2014) found that all participants experienced fewer anxiety and depressive symptoms, and decreased psychological distress from pre- to post-treatment. However, no significant difference was found between the control and experimental groups.

Zents (2017) examined the efficacy of animal-assisted psychotherapy in reducing anxiety symptoms for students ages 10 to 15 years. Students were recruited from a rural middle school in Western New York, and from a suburban alternative school in Eastern Tennessee. She wanted to explore if a dog could increase the efficacy of the version of the C.A.T. Project, which is a manualized CBT treatment program for adolescents aged 14 through 17. Efficacy was measured by change scores on the Zung Self-Assessment of Anxiety scale and the SCARED inventory (Zents, 2017). Zents (2017) found no significant differences between the treatment and control groups. Additionally, she found that the control group had a decrease in anxiety whereas the treatment group had an increase in anxiety (neither of the differences were statistically significant). Further, the control group had an increase in anxiety from first session to last session, whereas the treatment group had a decrease from first session to last session in anxiety ratings.

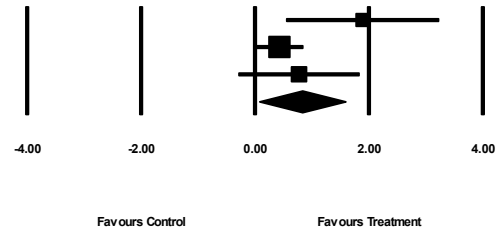
Meta-Analysis

Characteristics of Included Studies. Refer to the systematic review for characteristics of included studies. For a summary of study characteristics, refer to Table 2.

Main Results. Three effect sizes were included in the analysis (Alfonso et al. 2015; Henry, 2014; Zents, 2017). The effect size calculations were quantified by comparing the mean change of the treatment group with the mean change of the control group. All three effect sizes were calculated by measuring the difference of treatment data to control data. The results indicated a large effect size ($g = 0.83$, $p = .03$). Refer to Figure 2 for individual effect size calculations.

Figure 2. Effect size calculations and forest plot

Study name	Outcome	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Alfonso et al. (2015)	Anxiety	1.889	0.685	0.469	0.547	3.231	2.759	0.006
Henry (2013)	Anxiety	0.430	0.213	0.045	0.012	0.847	2.019	0.044
Zents (2017)	Combined	0.773	0.542	0.294	-0.290	1.836	1.426	0.154
		0.829	0.386	0.149	0.073	1.585	2.151	0.032



Heterogeneity. Heterogeneity refers to the degree to which each study included in a meta-analysis varies within the distribution of effect sizes (Borenstein et al., 2009). The main heterogeneity statistic is noted as Q_T. In essence, the Q_T statistic allows a researcher to assess whether or not the studies included in the meta-analysis have unaccounted variance. In other words, this statistic indicates whether or not characteristics specific to individual studies are moderating the effect in addition to the assumption of random error.

The heterogeneity among the studies indicated a lower variance ($Q = 4.28$, $p = .12$). It is important to note that the Q_T statistic is vulnerable to non-detection of heterogeneity in small sample sizes (as the null hypothesis cannot be proven). Therefore, one must use caution in interpreting this statistic (Huedo-Medina et al., 2006). The I^2 statistic measures the proportion of variance that is due to real differences or due to characteristics inherent to each study. $I^2 =$ 53.31%, suggesting that almost half all of the variance is potentially explained by study characteristics. The lack of significant findings does not necessarily confirm a lack of heterogeneity. However, if theoretically there is no heterogeneity present, the use of a random effects model is statistically equivalent to the use of a fixed effect model. Therefore, the use of a random effects model in this analysis was ideal. A forest plot was not examined as there were only three studies included in this analysis.

Table 2

Characteristics of Included Studies in Meta-Analysis

Study	Type	Place of Study	*n*	Age Range (Years)	Identified Concern	**Data Analysis**	Orientation	Animal	Provider	Duration of Program	Form	Attrition (%)	% Female
Alfonso, Alfonso Llabre, & Ferandez, 2015	Journal Article	United States	11	Not Avail.	Social Anxiety	Both[1]	CBT[2]	Horse	Psychologist	42 Days	Group	8.33	100
Henry, 2014	Dissertation	United States	21	18-54	Anxiety	Tx/Control[3]	Mindfulness	Dog	Psychologist	6-9 Weeks	Individual	19.23	71.43
Zents, 2017	Dissertation	United States	10	10-15	Anxiety	Tx/Control	CBT	Dog	Multiple	9 Weeks	Group	0	30

[1] *Note* Both = Data available with pre- versus post-intervention data and treatment versus control data
[2] CBT refers to Cognitive Behavioural Therapy.
[3] Tx/Cont = Data available with treatment versus control data

Publication Bias. Due to the limited number of studies included in the primary analysis, funnel plots and moderator analyses were unable to be produced.

DISCUSSION

Overall, the tentative results of this study found that animal-assisted psychotherapy was efficacious in decreasing symptoms associated with internalizing disorders when compared to standard treatment. The systematic review supported this conclusion, though more specifically that animal-assisted psychotherapy was not more efficacious than treatment-as-usual conditions and was more efficacious than no-treatment control conditions. While the meta-analysis showed a statistically significant large effect in treatment versus treatment-as-usual comparisons, it is important to interpret these findings with caution. Cohen and Becker (2003) note that the goal of conducting a meta-analysis is to increase statistical power to be able to detect otherwise obscured relationships present in the data. While the majority of studies reported no statistical difference between their experimental group and their control group (Henry, 2014; Zents, 2017), one outlier study found a statistically significant strong positive effect (Alfonso et al., 2015). A major confounding factor was the design of the differing programs. For the two studies that did not find a difference between treatment and control groups, each offered programs of animal-assisted psychotherapy incorporated with regular programming in comparison to regular programming. In essence, these studies compared a treatment versus treatment experimental design. Alfonso et al. (2015) compared animal-assisted psychotherapy program to a no-program control, or in other words they examined a treatment versus no treatment experimental design. It is likely if all three programs had been similar, the results from each individual study would have been equivalent.

Despite the confounding nature of the results of this study, the findings of this systematic review and meta-analysis are consistent with the literature base, where animal-assisted

psychotherapy is more efficacious than no-treatment control conditions. Previous meta-analyses examining animal-assisted therapy (not psychotherapy as they did not require included studies to be a psychotherapeutic intervention) have found moderate effects on overall mental health symptoms (Nimer & Lundahl, 2007). A specific meta-analysis on animal-assisted therapy (not psychotherapy) for depressive symptoms also found moderate effects (Souter & Miller, 2007). Additionally, the rates of attrition for studies included in the present study were low overall (with two studies at 8.6% and lower), and with one study at 19.23% (Henry, 2014). Further, one study included in the systematic review and in the meta-analysis examined co-morbid disorders and did not have differing effect size estimates as compared to the studies that only targeted one disorder.

The resounding conclusion of the current literature base is that more research is needed. As noted above, animal-assisted therapy is still in its infancy as an intervention field, animal-assisted psychotherapy even more so. While this study provided summative information regarding the effect of animal-assisted psychotherapy on internalizing disorders, what this study illuminated was the lack of primary research that is currently available. Only four studies met criteria for inclusion in the systematic review and meta-analysis. It is not farfetched to conclude that the popularity of animal-assisted psychotherapy far outstrips its research base, given the small number of studies included in this research, and given that pet therapy in general is widely used (Bercovitz, Sengupta, & Haris-Kojetin, 2011). More research is absolutely required to determine the essential components of animals utilized in psychotherapy.

Limitations

This study presented a number of limitations. First and foremost, the limited number of studies included restricts the conclusions that this study can make on the efficacy of animal

assisted psychotherapy for internalizing disorders. The limiting factor that contributed to the small number of studies was the critical exclusionary criteria that the intervention must be a psychotherapeutic intervention. The current research excluded 96 studies that were animal-assisted therapy without a psychotherapeutic intervention. This alone in comparison to the four studies that were included in the systematic review, and three in the meta-analysis, is staggering. While the use of animals in therapy has exponentially increased as time goes on, the use of animals specifically within a psychotherapeutic context is still incredibly limited. The only conclusion that can be made given the small body of literature on animal-assisted psychotherapy for the treatment of internalizing disorders is that animals are helpful in therapy. As noted above, the literature suggests that including an animal in therapy is beneficial, but it is important to further distinguish what aspect of the therapy is critical for therapeutic benefit. Given that the majority of studies show a moderate effect regardless of how prominent the animal is to the therapy, having an animal in the room may be as beneficial as using it as part of the therapy. As has previously been iterated, these conclusions would be sounder if they were conducted with strong rigorous designs, such as directly comparing waitlist controls, treatment-as-usual, animal-assisted therapies, and animal-assisted psychotherapies.

A second issue in the literature is the lack of reporting standards. The majority of included studies only reported data related to statistical testing (i.e., *t*-test statistics) and did not report effect size data. If effect size data reporting was standard practice, that study could have been included in the analysis. Beutler and Moleiro (2001) note that statistical significance testing only allows for the conclusion of whether two groups are reliability different from each other and cannot determine whether two groups are identical. Therefore, the only conclusion that can be reached by significance testing is ‘are the groups different enough from each other that we can

say they are likely different.' By utilizing effect size data, a quantifiable difference can be calculated as well as comparison of effects within a single study and across differing studies utilizing differing sample sizes and differing measures.

Implications

This meta-analysis has practical implications. It suggests that animal-assisted psychotherapy reduces symptoms associated with internalizing disorders. The research indicates that the utilization of animals in therapy produces changes which help circumvent the maladaptive behaviour patterns associated with internalizing disorders, as shown by the reduction in symptoms. Additionally, the incorporation of animals in therapy appears to increase motivational drive to attend therapy given the low rates of attrition. Incorporating animals within a psychotherapeutic context in the treatment of internalizing disorders may provide a pathway to increased mental health; however, more primary research is needed before substantive conclusions can be made.

Future Directions

Overwhelmingly, more research examining the effect of animal assisted psychotherapy needs to be conducted. Not only is there a lack of research regarding animal-assisted psychotherapy, there is even less research comparing the efficacy between the different categories of animal therapy in general. In other words, what is the difference in efficacy amoung an animal-assisted activity, an animal-assisted therapy, and an animal-assisted psychotherapy? Conducting a study where that is the only variable that changes would allow researchers to understand what component of animal therapy has the most benefit. If an animal assisted psychotherapy is found to be more effective than an animal assisted therapy or activity, increased intervention costs would be merited (such as for specialized animal training).

Another area of important focus would be a study examining the difference between species of animal utilized in treatment. This meta-analysis was unable to conduct moderator analyses to assess if species of animal changed the efficacy of the treatment. While the systematic review appeared to suggest equal efficacy, statistical confirmation is essential. Primary research needs to be conducted assessing an equivalent treatment where species is the only variable to change. If it is found that differing species have equivalent treatment gains, using a lower-cost species (e.g., dog vs. horse) would be infinitely more pragmatic. Similarly, given that moderator analyses were not possible in this study, determining which if any, type of therapeutic modality is associated with further treatment gains is imperative.

A final area of focus would be examining treatment engagement for individuals with internalizing disorders and animal-assisted psychotherapy. Primary research could examine participants choosing their treatment, and examine treatment outcomes. Review research could conduct a meta-analysis on treatment attrition rates, if data is provided in primary research. As noted above, treatment engagement can be problematic for individuals with internalizing disorders, and animal-assisted psychotherapy may provide additional motivation to engage in treatment.

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Chapter 4: Animal-Assisted Psychotherapy and Trauma: A Meta-Analysis

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Abstract

The present meta-analysis examined the efficacy of animal-assisted psychotherapy for individuals who have experienced trauma. Eight studies quantitatively assessed the treatment effects of involvement in animal-assisted psychotherapy. I used a random effects model to aggregate each study into an overall effect size. I calculated two separate summary effect size estimates, one for the pre- and post-comparison and one for the treatment versus control comparison. I included eight individual effect sizes in the pre- versus post-comparison analysis. The results indicate a large effect size ($g = 0.86$, $p < 0.001$, 95% CI [.53, 1.18]). I included two individual effect sizes in the treatment versus control comparison analysis. The results indicated a moderate effect size ($g = 0.46$, $p = 0.03$, 95% C.I. [0.04, 0.06]). Limited moderator analyses were able to be conducted due to lack of consistent reporting across studies. Place of study and percentage of female participants in the treatment group were found to statistically moderate the effect of animal-assisted psychotherapy. My results indicate that animal-assisted therapy is an efficacious treatment for trauma. The program associated with Kemp et al (2014) and Signal et al. (2013), which was conducted in Australia and with 100% women, was associated with a larger intervention effect.

Keywords: animal-assisted psychotherapy, meta-analysis, trauma, traumatic event, post-traumatic stress disorder, PTSD

MacFarlane (2010) has posited that “one of the greatest challenges to the field of traumatic stress has been the observation that many individuals who coped at the time of their traumatic exposure became unwell at a later date” (p. 3). Prevalence rates indicate that up to 80% of individuals will experience some sort of traumatic event in their lifetime (de Vries & Olff, 2009). While most individuals show subclinical mental health symptoms early after the trauma, a portion of these individuals will go on to develop serious mental health disorders, such as post-traumatic stress disorder (Copeland, Keeler, Anglod, & Costello, 2007). Trauma researchers have shown time and again that time does not heal and instead leaves the individual more vulnerable to environmental stress and additional trauma exposures (MacFarlane, 2010).

This vulnerability is partly due to how the brain changes after experiencing a traumatic event. Rauch, Shin, and Phelps (2006) found neurobiological changes after trauma. They showed that the amygdala (the portion of the brain associated with emotions) becomes more active when fear associations are present. They further showed that the frontal lobe (essential for higher order reasoning) becomes under-activated. What this means practically is that individuals experience more intense fear and are unable to rationally understand they should not be fearful following a trauma. Behaviourally, the individual becomes highly vigilant about potential dangers (MacFarlane, 2010). Research has also looked at the brain system associated with the fight or flight system (processes such as arousal, alertness, and readiness for action; Elzinga & Bremner, 2002). In individuals who develop post-traumatic stress disorder the norepinephrine system malfunctions and remains activated which leaves the individual in a perpetual state of heightened arousal. This system malfunction has also been implicated in other mental disorders, such as those involving psychosis (Miller, 2000). The experience of a trauma thus leaves an individual at risk not only for trauma-specific disorders but also for other mental health

disorders, such as psychotic disorders (Barrigón et al., 2015). As these factors work within the same brain system, Hedtke et al. (2008) have suggested that there is a cumulative risk from trauma. Given the potential widespread effects of experiencing a trauma and the associated risk of developing maladaptive behavioural disturbances, the identification of efficacious treatments should be a first line concern.

Treatment of trauma comes in many different forms, including individual and group psychotherapy and pharmacological intervention. Psychotherapeutic treatment of trauma generally falls under the following broad categories: cognitive behavioural therapies, stress management, eye movement desensitization and reprocessing (EMDR), family therapy, hypnotherapy, psychodynamic therapy, interpersonal therapy, and counseling (Ponniah & Hollon, 2009). Ponniah and Hollon (2009) conducted a systematic review examining these broad categories and concluded that there were only two treatment modalities that had supporting evidence for reduction of post-traumatic stress disorder symptoms: trauma-focused cognitive-behavioural therapies (CBT including exposure and cognitive restructuring) and EMDR. This finding was corroborated in similar research by Cohen, Berliner, and Mannario (2010). That said, Imel, Laska, Jakupcak, and Simpson (2013) examined the dropout rates for post-traumatic stress disorder treatments. They found that approximately 18% of individuals dropped out of treatment and this number actually increased when individuals participated in trauma-focused treatments (such as trauma-focused CBT). This leaves clinicians with access to treatments that we know are efficacious, but that are more likely to promote client dropout. Additionally, if clinicians modify trauma-focused treatments to decrease client aversion, they may simultaneously decrease the efficacy of those treatments (Simila, Neilson, Thompson & Cook, 2015). It is important to develop and determine which treatments have both evidence-

based efficacy and clinical utility. Over the past few years, novel approaches have been developed in an attempt to fill this need.

One such novel approach is animal-assisted therapy. Several differing interventions incorporating animals have been developed including: animal therapy, animal interaction, animal interventions, animal-assisted activities, and animal-assisted therapy. Unfortunately, as the use of animals in therapy is still relatively new the field suffers from a lack of standardization with regards to terminology. Often terms such as "therapy," "activity," and "intervention" are used interchangeably to describe varying therapeutic contexts and programs. Pet Partners (2015 describes animal-assisted therapy (AAT) as stimulating improvements in human functioning in several domains by use of a goal-directed intervention where the animal plays an integral part of the treatment. Equine Assisted Growth and Learning Association (EAGALA; 2012) has further developed this conceptualization with the inclusion of a subcategory called equine assisted psychotherapy. In this subcategory, the goal-directed intervention specifically targets psychotherapeutic treatment goals (EAGALA, 2012). These interventions typically utilize the animal within a psychotherapeutic intervention context (e.g., using the horse as a metaphor for the individual during a session). These two factors are important to consider when examining the large body of literature encompassing therapy that utilizes animals. How can one compare studies that attempt to decrease post-traumatic stress symptoms where one study has participants teach a dog to sit and another utilizes participant-animal interaction as metaphors for relationships and life? Therefore, for the purposes of this paper, I will be examining a subcategory of animal-assisted therapy – animal-assisted psychotherapy. Animal-assisted psychotherapy, like equine-assisted psychotherapy, holds all the tenets of an animal-assisted therapy (a goal-directed intervention provided by a health/human service provider with

specialized expertise, focused on improving in human physical, social, emotional, and/or cognitive functioning where the animal is an integral part of the treatment process; Pet Partners, 2015) with the two additional caveats that a) the goal-directed intervention specifically targets psychotherapeutic treatment goals (e.g., decreasing trauma symptoms), and b) that the animal be utilized as part of a psychotherapeutic intervention (e.g., the animal must be used as a critical part of an intervention targeting symptom reduction).

There is a large body of research to suggest that animal-assisted psychotherapy could be an efficacious treatment for individuals with trauma-related disorders. In part, this has to do with the simple presence of an animal on an individual's basic physiological state. One early study examining this effect was conducted by Friedmann, Katcher, Thomas, Lynch, and Messent (1983). They examined whether or not the presence of a dog could decrease blood pressure in children who read aloud. They found a statistically significant decrease in blood pressure rates. Viau et al. (2010) examined the effect of service animal interaction on cortisol levels in children diagnosed with Asperger's Syndrome and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS). The introduction of a therapy animal produced a decrease in physiological arousal overall. In similar research, Cole, Gawlinski, Steers, and Kotlerman (2007) looked at the effect of animal interactions on cardiovascular measures in patients with advanced heart failure. They found that receiving a 12-minute interaction with a dog (and its volunteer) significantly lowered cardiopulmonary pressures, and epinephrine and norepinephrine levels. Research has shown that familiarity does not change this calming effect. Odendaal and Meintjes (2003) examined the differences between a familiar dog, an unfamiliar dog, and reading a book. Both dog conditions significantly lowered cortisol levels compared to the reading condition.

Another factor which suggests that animal-assisted psychotherapy would be an efficacious treatment for individuals with trauma-related disorders centers around motivation to attend therapy. Holcomb and Meacham (1989) retrospectively examined the effect that an animal-assisted therapy group program had on attendance in an inpatient psychiatric unit. They found that the animal-assisted therapy group had the highest attendance and attracted the most isolated individuals. Nathans-Barel, Feldman, Berger, and Silver (2005) found that for individuals with schizophrenia, animal-assisted therapy showed a trend towards improved motivation. Macauley (2006) found a similar effect. She compared traditional therapy to animal-assisted therapy for individuals with aphasia. While both therapies were efficacious at decreasing symptomology, the participants endorsed a higher motivation to attend therapy when it included an animal. Similarly, Lang, Cox, Bernert, and Jenkins (2007) found that animal-assisted group therapy had a calming effect on individuals and increased their motivation to attend sessions.

A number of studies have examined the effect of animal-assisted psychotherapy on the treatment of trauma and post-traumatic stress disorder. Dietz, Davis, and Pennings (2012) examined the effect of animal-assisted psychotherapy on trauma symptoms for children who had been sexually abused. Their intervention consisted of combinations of group therapy, social stories, and a therapy dog. They found that groups that included a therapy dog showed statistically significant reductions in trauma symptoms, whereas the group therapy alone condition did not. A study by Earles, Vernon, and Yetz (2015) examined the effects of equine-assisted therapy on trauma symptoms. Their intervention focused on mindfulness training incorporating a horse. The participants experienced a statistically significant reduction in post-traumatic stress ($d = 1.21$), trauma emotion ($d = 0.60$), generalized anxiety ($d = 1.01$), and depression ($d = 0.54$). McCullough (2011) conducted an 8-week study evaluating equine-

facilitated psychotherapy. In particular, horse activities served as the catalyst to develop metaphors for the participant's life and circumstances. The metaphor and mechanisms of change were discussed between the participant and the therapist. Finally, homework for practicing change in the participant's life was given. Individuals that participated in the program had a reduction of post-traumatic symptoms from baseline to program completion.

Similarly, Kemp, Signal, Botros, Taylor, and Prentice (2014) examined the effect of an equine-facilitated group therapy program on mental health outcomes in children who experienced sexual abuse. They incorporated horses within an experiential learning framework to facilitate issues to be addressed by the therapist team. They examined mental health symptom measures at time of referral, after in-clinic counseling, and after equine-facilitated therapy. They found there was a statistically significant reduction in symptoms from after in-clinic counseling to post equine-facilitated therapy. Signal et al. (2013) expanded on Kemp et al. (2014) using the same program and examining women aged 19-50. They also found a statistically significant reduction in symptoms from after in-clinic counseling to post equine-facilitated therapy. Kruger (2012) examined the effect of a trauma-focused equine-assisted psychotherapy program for children and adolescents who had severe abuse or neglect in their history. The program incorporated a horse within an EMDR framework using bilateral stimulation to increase the participants' ability to regulate their own physiology and psychology. EMDR is an empirically-validated psychotherapy treatment for mental health disorders including post-traumatic stress disorder (Lyhus, 2002). In this therapy, the participant completes exposure exercises while having bilateral (both sides of the body) sensory input (Lyhus, 2002). They found the program had a significant effect in reducing negative moods/emotions and in reducing problem behaviours (including at school, home, community and directed towards others).

Not all research shows such positive results. Balluerka, Muela, Amiano, and Caldentey (2015) examined the effects of animal-assisted psychotherapy for adolescents who had suffered traumatic childhood experiences. Their intervention incorporated both a dog and a horse in an attachment-based psychotherapy program. They found a non-statistically significant reduction in clinical symptoms for those who completed the program. Whittlesey-Jerome (2014) compared equine-facilitated therapy and traditional treatment for adult female victims of interpersonal violence. The equine-facilitated therapy program involved 2 months of programming targeting several different domains all integrating the animal. While both groups showed a reduction in depressive and anxiety symptoms from time 1 to time 2, neither group nor group by time interaction analyses were significant.

To date, no systematic reviews or meta-analyses have been done examining the effect of animal-assisted psychotherapy in the treatment of trauma and post-traumatic stress disorder. Examining the varied results from these studies suggests that a comprehensive investigation is essential. This is important not only to ascertain the true effect of animal-assisted psychotherapy, but also to obtain an understanding of what factors are associated with better treatment outcomes.

The objective of this study is to examine the efficacy of animal-assisted psychotherapy in the treatment of trauma/post-traumatic stress disorder, utilizing meta-analytic procedures. As noted above, there is considerable flexibility regarding terminology within the field of animal-assisted therapy. Studies did not need to specifically use the term ‘animal-assisted psychotherapy’ in their methodology; however, the study’s methodology was required to adhere to the definition of an animal-assisted psychotherapy, as reviewed above. Additionally, to be included in this study, studies must have included participants who had been exposed to trauma,

who had diagnosable post-traumatic stress disorder symptoms, or who had a diagnosis of post-traumatic stress disorder (from the current or previous versions of the Diagnostic and Statistical Manual for Mental Disorders [American Psychiatric Association, 1980, 1994, 2000, 2013]). Trauma was defined as an external event (e.g., sexual assault) where an individual is unable to cope with the resulting intense anxiety and fear (Dulmus & Hilarski, 2003).

Moderator analyses were conducted to see under which circumstances, if any, animal-assisted psychotherapy works most efficaciously. The currently available literature is unclear as to animal-assisted psychotherapy's efficacy, with some studies showing it is efficacious (Dietz et al., 2012; Earles et al., 2015; Kemp et al., 2014; Kruger, 2012; Signal et al., 2013), while others show it is not (Balluerka et al., 2015; Whittlesey-Jerome, 2014). Part of the answer to why different studies have different effects may lie in the differing characteristics of each study. By running moderator analyses, this project may provide an explanation for why there are inconsistencies in the current literature. If animal-assisted psychotherapy is associated with a reduction of symptoms, treatment resources may be funneled into additional programming and research.

The current meta-analysis included both published and unpublished works. Bibliographic variables tend to vary widely in the literature and may play a role in intervention efficacy. For example, location where the study takes place ranged from the United States (e.g., Dietz et al., 2012; Earles et al., 2015; Kruger, 2012; Whittlesey-Jerome, 2014), Australia (Kemp et al., 2014; Signal et al., 2013), and Spain (Balluerka et al., 2015). Studies were published from 2005-2015. Historically, greater intervention efficacy has been found in earlier studies, sometimes known as the decline effect (Lehrer, 2010). This may or may not be the case with this small body of literature

Sample characteristics vary widely also. Different types of trauma may lead to differing treatment outcomes. Some studies focused on a sample of sexually abused participants (Dietz et al., 2012; Kemp et al., 2014; Kruger, 2012; Signal et al., 2013), some on victims of interpersonal violence (Whittlesey-Jerome, 2014), and some on a non-specific traumatic event (Balluerka et al., 2015; Earles et al., 2015). Some types of traumatic event may respond better to this treatment than others. Another sample characteristic that dramatically varies from study to study is participant age. Some studies focused on children (Dietz et al., 2012; Kemp et al., 2014), some on adolescents (Balluerka et al., 2015; Kemp et al., 2014; Kruger, 2012), and some on adult populations (Earles et al., 2015; Signal et al., 2013; Whittlesey-Jerome, 2015). Another characteristic to consider is gender. Some studies had exclusively female populations (Kemp et al., 2014; Signal et al., 2013; Whittlesey-Jerome, 2014), while others had a mixture of males and females (Balluerka et al., 2015; Dietz et al., 2012; Earles et al., 2015; Kemp et al., 2014; Kruger, 2012). Attrition is another sample characteristic that varies. The attrition rate ranged from 0% (e.g., Dietz et al., 2012) to 8.33% (McCullough, 2011).

Therapeutic modality is another factor that varied widely from group to group. Some studies utilized a social learning perspective (Dietz et al., 2012; McCullough, 2011). Others utilized an experiential framework (Kemp et al., 2014; Signal et al., 2013; Whittlesey-Jerome, 2014), mindfulness (Earles et al., 2015), attachment (Balluerka et al., 2015), or bilateral stimulation (Kruger, 2012).

Many studies utilized a group format (Earles et al., 2015; Kemp et al., 2014; McCullough, 2011; Signal et al., 2013; Whittlesey-Jerome, 2014), while one utilized an individual format (Dietz et al., 2012) and two utilized a combination of group and individual formats (Balluerka et al., 2015; Kruger 2012). There were also several other characteristics in the intervention that

varied. One such variable was length of the intervention. Sessions ranged from 6 weeks (Earles et al., 2015) to 12 weeks (Balluerka et al., 2015) to one outlier study that ran its program for a maximum of 6 months (Kruger, 2012). Another variable was therapy animal. Some studies utilized horses (Earles et al., 2015; Kemp et al., 2014; Kruger, 2012; McCullough, 2011; Signal et al., 2013; Whittlesey-Jerome, 2014), some studies utilized dogs (Dietz et al., 2012), and one study used multiple animals (Balluerka et al., 2015). Given the varying results of these studies there is the possibility that there are factors within animal-assisted psychotherapy that affect treatment outcome.

RESEARCH QUESTIONS

The proposed study will address the following research questions:

1. Is animal-assisted psychotherapy efficacious for treatment of trauma/post-traumatic stress disorder?
2. What factors (bibliographic variables, sample characteristics, methodological characteristics, characteristics of the intervention) affect the effect size of animal-assisted psychotherapy for trauma/post-traumatic stress disorder?

METHOD

Research design

A random effects model was used in this study with efficacy as the main outcome variable. The random effects model was used as it assumes that the true effect size varies from study to study, rather than assuming that the effect size is equal in all studies as in a fixed-effect model (Borenstein, Hedges, Higgins, & Rothstein, 2015). In other words, a random effects model assumes that situational factors may affect the studies differently. It is reasonable to assume that the studies that were included in the meta-analysis had differing effect sizes as the

studies that were included were not identical. Utilizing a random effects model additionally allowed for analysis to assess the presence of moderators.

Procedure

Data extraction. This meta-analysis was conducted using a systematic review process to ensure consistency and transparency (Liberati et al., 2009). The process of study identification, screening, and eligibility determination were undertaken utilizing the Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines (see Figure 1- Moher, Liberati, Tetzlaff, & Altman, 2009).

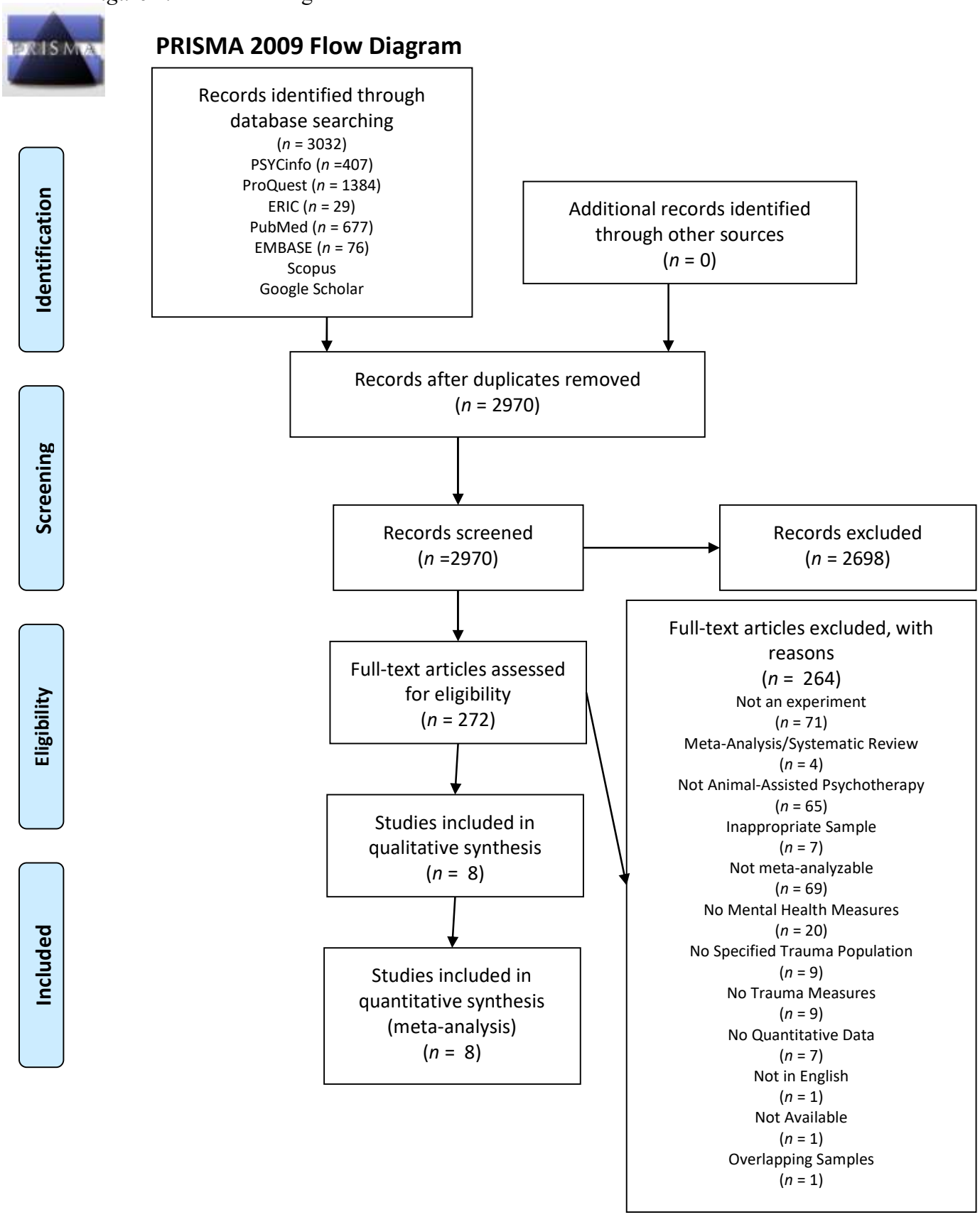
Initially, studies were located by systematically searching the following databases: PsycINFO, ERIC, ProQuest Dissertations & Theses, Scopus, PUBMED, EMBASE, and Google Scholar. In order to find all relevant studies, the following keywords were searched in combination in each database: interspecies, animal, animals, pet, pets, human animal, dog, dogs, canine, canines, equine, equines, horse, horses, dolphin, dolphins, mammal, mammals; and therapy, therapies, psychotherapy, psychotherapies, intervention, interventions, facilitated, assisted, activity, activities, interaction, interactions, program, programs, programming, counselling, counseling; and post traumatic stress disorder, PTSD, post traumatic stress, trauma, emotional trauma, sexual abuse, physical abuse, child abuse, verbal abuse, emotional abuse, partner abuse, abuse, rape, military, soldier, victimization, and victim. Descriptors were additionally utilized to search each database when available.

Once the search terms were entered into each database, a list of potential studies was generated. The title of each study was screened based on the clearly outlined exclusion criteria (see Appendix F). If the study's title clearly indicated it was not relevant to the proposed study, it was excluded. If the title was potentially related to animal-assisted psychotherapy and any mental

health concern, the abstract of that study was further screened using the inclusion and exclusion criteria. Upon this review, if an article met the exclusion criteria, it was excluded from the study. The next phase of the screening process involved a full manuscript review. Studies that successfully passed through each phase of the screening process were included in the meta-analysis. As study duplication is another concern with meta-analysis (as studies included in the meta-analysis must have independence from one another in order for the meta-analysis to be statistically valid), a detection strategy developed by Wood (2008) was utilized (see Appendix C). If two studies were found to use the same data, the study with the most comprehensive information was included. In other words, the study with the greatest amount of usable data was selected for inclusion. This occurred for one study included in this meta-analysis (McCullough, 2011). McCullough, Risley-Curtiss, and Rorke (2015) was a publication from McCullough's (2011) dissertation. Therefore McCullough (2011) was included as it had more comprehensive information, and McCullough et al. (2015) was excluded.

The references of each eligible study were then examined for studies not located in the database searches (termed "backwards searching"). Citation indices (available through the databases) further allowed the primary researcher to identify any additional eligible studies citing an eligible study that had not been previously located (termed "forwards searching"). A Previous review by O'Haire, Guerin, Kirkham, and Daigl (2015) was examined to identify any study not found elsewhere. Finally, a journal that publishes a large quantity of animal-assisted psychotherapy articles (i.e., *Anthrozoos*) was hand-searched for relevant articles that met the inclusion criteria. Reporting, as required by PRISMA, included documentation of the number of studies excluded and a supplemental rationale for each study excluded at the full manuscript review level (Moher et al., 2009 – See Figure 1).

Figure 1. PRISMA Diagram.



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

Eligibility. The eligibility criteria (Appendix F) utilized during the search process included the information below. Only studies reported in English were eligible. Qualitative studies, single-case study participant designs, designs that included a sample of 2, and narrative reviews were excluded as they do not have the statistical components required for a meta-analysis. Eligible studies must have had an animal-assisted psychotherapy component outlined in their methods section, which specifically targeted trauma and/or post-traumatic stress disorder/symptoms. Quantitative data amenable to meta-analysis was required.

There are two study designs which allow for meta-analytic analysis: Pre- versus post-comparisons examine a single group and compare change in participants from pre- to post-intervention (within-subjects design). Treatment versus control comparisons (between-subjects designs) examine two groups and compare each group's post-intervention scores or compare both group's pre- versus post-intervention scores (often referred to as mean change scores). In treatment versus control comparisons, the control group may have been a true control group where no intervention takes place (e.g., waitlist control) or it may have been an alternative intervention group (e.g., treatment-as-usual). Methodologically, the conclusions drawn from a treatment versus control experimental design would likely be more accurate as treatment versus control designs do not have the same threats to validity that pre- versus post-comparison designs do (Gravetter & Forzano 2012); however, due to the small body of literature available, all study designs amenable to meta-analysis were included. Participants of eligible studies must have experienced a trauma. Likewise, the treatment goal of eligible studies must have been to decrease trauma and/or post-traumatic stress symptoms. Outcome measures of eligible studies must have been standardized and aimed to assess trauma or post-traumatic stress symptoms. Due to the

varied sample of studies included in the meta-analysis, no preferential measures were required for inclusion.

Coding and reliability. After eligibility was determined, study information was extracted using a coding manual (Appendix D) to ensure consistency. Relevant demographic and bibliographic information, as well as outcome data, were extracted from each study. In order to maintain consistency throughout coding, quantitative data was limited to pre- and post-intervention only. In other words, if an eligible study measured multiple time points, only the first measurement (pre-intervention) and last (excluding follow-up) measurement (post-intervention) were recorded. The primary coding for each study was completed by the primary investigator. A research assistant double-coded all of the included studies to assess interrater reliability. The research assistant has a Bachelor's Degree in Psychology and is proficient in meta-analytic procedures. If any discrepancies between the two coders arose, the principal investigator reviewed the inconsistency with the research assistant. Each inconsistency was discussed until agreement was reached; however, if an agreement could not be reached, an additional trained collaborator was consulted. Extracted data was then formatted for data analysis. Interrater reliability was calculated using Cohen's Kappa. The kappa statistic is used for assessing interrater reliability for categorical data (McHugh, 2012). Values of "0" indicate no agreement while values of .81 or higher are considered to be "almost perfect" agreement (McHugh, 2012).

Data analysis

The Comprehensive Meta-Analysis Version 3.0 program was utilized to analyze the data once it was coded and entered. The Comprehensive Meta-Analysis program is a computer software program specifically designed to calculate an effect size from each of the individual

studies and weight them to provide a summary effect (Borenstein, Hedges, Higgins & Rothstein, 2015). Studies often provide more than one measure of data, such as two different measures of anxiety symptoms. When this occurred, the results from these measures were aggregated to avoid dependence in the analysis (Borenstein et al., 2009).

Overall effect size. In order to ascertain whether or not animal-assisted psychotherapy was efficacious in the treatment of trauma and/or post-traumatic stress, each study's outcome scores were converted into a standardized mean difference utilizing Hedge's *g*. This was done to allow for the calculation of the overall mean effect size. Hedge's *g* was selected over Cohen's *d* as the effect size statistic, as Hedge's *g* is more accurate when intra-study sample sizes are small. Hedge's *g* does this by providing a corrective factor which counteracts positive bias. In other words, Hedge's *g* is a more conservative and therefore more accurate measure (Borenstein et al., 2009). Lipsey and Wilson (2001) offer the following guidelines to interpret the magnitude of effect sizes that were utilized in the interpretation of the results: < 0.20, small; 0.50, medium; > 0.80, large.

Heterogeneity. Heterogeneity refers to the variation in study outcomes within the distribution of effect sizes (Borenstein et al., 2009). Essentially it is a measure of how similar the studies are that have been included in the meta-analysis. The Q_T statistic and the I^2 statistic were used to assess heterogeneity in this study. A forest plot of the effect size data was examined for the presence of outliers and to visually assess heterogeneity.

Moderator analyses. The next component of data analysis involved moderator analyses to determine what other, if any, variables were associated with efficacy. In other words, moderator analyses assess whether study or participant characteristics altered the efficacy of animal-assisted psychotherapy. Moderator analyses were performed using meta-regression. The

unit of analysis was the individual study and variables that had data from 4 or more studies were analyzed. Graphs were additionally examined to assess the presence of outliers or to determine if a curvilinear relationship better explained the data pattern.

Publication bias. Publication bias refers to the trend that journals are more likely to publish interesting studies (i.e., studies which have statistically significant results). Kepes, Banks, and Oh (2014) have gone so far as to suggest that publication bias "is one of the greatest threats" to meta-analysis methodology (p. 183). Therefore, to guard against the pitfall of publication bias, both unpublished and published reports were included in this meta-analysis in order to reduce this potential bias. Specific databases were searched in an attempt to safeguard against publication bias (e. g. ERIC) as they index unpublished research, such as conference proceedings as well as unpublished master's theses/dissertations, in addition to published research.

Funnel plots were visually examined to assess publication bias. Funnel plots are scatter plots of the study effect size against study's size or study's standard error (Higgins, & Green, 2011). They are a useful initial tool in assessing the presence of publication bias as analysis relies upon easily identifiable patterns (Rothstein, Sutton & Borenstein, 2005). If publication bias does exist, the funnel plot will be asymmetrical (Higgins & Green, 2011). Moderator analyses were additionally conducted to assess for publication bias.

RESULTS

Search Results

The searches yielded 3032 articles from seven databases (PsycINFO, ProQuest, ERIC, PubMed, EMBASE, Scopus, and Google Scholar) – refer to Figure 1 for specific numbers associated with each database. There were no articles identified through additional sources. Once

duplicates were removed, 2970 articles were screened by title and abstract. Of these, 272 articles were screened by full-text analysis. Eight of these studies met the inclusion criteria. Refer to Figure 1.

Characteristics of Included Studies

Six published and two unpublished studies met the inclusion criteria for the meta-analysis. Studies were published between 2011 and 2015. Participants' age across all studies ranged between 8 and 62 years of age, with five of the studies focusing on child and adolescent populations and four examining adult populations. Gender was heavily weighted to female participants, ranging from 25% to 100%. Regarding type of trauma experienced by participants, one study each examined: interpersonal violence (defined as domestic abuse), intra family violence, and experience of a traumatic childhood event. Three studies examined childhood sexual abuse and three studies examined post-traumatic stress disorder symptoms. The majority of studies included in this meta-analysis had zero percent attrition. The three studies that had an attrition rate greater than zero had rates of 5.97%, 7.14%, and 8.33%. Theoretical orientation utilized in each study varied considerably. An experiential approach was used in four out of eight studies. Mindfulness, eye movement desensitization movement (EMDR-bilateral stimulation), attachment, and a combination of cognitive behavioural and social learning (by the use of social stories) were used by the remaining five studies.

The majority of studies ran a group format (six of the eight). Two additional studies utilized a group format with segments of one-to-one animal assisted psychotherapy, while one study utilized an individual approach. Seven studies incorporated horses, one study incorporated dogs, and one study incorporated both horse and dogs in the intervention. Duration and frequency of intervention varied. Average duration varied from 6 weeks to 18 weeks including

one outlier study that ran its program for a maximum of 6 months (26 weeks). Interventions ran weekly from 50 minutes to two hours. Most interventions were run by counsellors, though some were run by a psychologist, a psychiatrist, or a social worker. Interventions used differing measures including trauma measures (the Trauma Symptom Checklist, the Trauma Emotion Questionnaire, the Children's Revised Impact of Event Scale, the PTSD Checklist – Civilian Version, the Civilian Administeresd PTSD Scale), as well as other symptom inventories (Behavioral Assessment System for Children, the Generalized Anxiety Disorder Scale , the Patient Health Questionnaire, the Somatic Symptom Severity Scale, the Child Behavior Checklist, the Children's Depression Inventory, Beck Depression Inventory, Beck Anxiety Inventory, Child and Adolescent Functional Assessment Scale, Burns Anxiety Scale). The majority of interventions also involved an animal specialist (six of the eight), in addition to the mental health specialist. For a summary of study characteristics, refer to Table 1.

Reliability. Interrater reliability was calculated for each variable in the coding system, using Cohen's kappa statistic. Agreement was 100%.

Main Results

All Symptom Measures. Two separate summary effect size estimates were calculated, one for the pre- and post-comparison and one for the treatment versus control comparison. There are inherent differences in effect size estimates when considering pre- versus post-comparison estimates with treatment versus control comparisons. Treatment versus control estimates are typically smaller as they are not as vulnerable to factors inherent in a within-subjects design (includeing placebo effects, maturation, and spontanious remission; Gravetter & Forzano, 2012).

Table 1. Characteristics of included studies

Study	Publication Type	Place of Study	*n*	Age Range (Years)	Identified Concern	Data Analysis	Theoretical orientation	Animal	Interventionist	Duration of Program	Form	Attrition (%)	% Female Total
Balluerka, 2015	Journal Article	Spain	63	12-17	TCE[1]	Pre/Post[2]	Attachment	Horse and Dog	Psychologist Animal Specialist	12 Weeks	Combo[3]	5.97	38.31
Dietz, 2012	Journal Article	United States	153	7-17	CSA[4]	Both[5]	CBT[6] and Stories	Dog	Psychologist Social Workers Counsellors Dog handlers	12 Sessions	Group	0	93.46
Earles, 2015	Journal Article	United States	16	33-62	PTSD[7] Traumatic Event	Pre/Post	Mindfulness	Horse	Psychiatrist	6 weeks	Group	0	75.00
Kemp 2014-Child Group	Journal Article	Australia	30	8-17	CSA	Pre/Post	Experiential	Horse	Counsellor	9-10 Weeks	Group	0	60.00
Kemp, 2014-Adolescent Group	Journal Article	Australia	30	8-17	CSA	Pre/Post	Experiential	Horse	Counsellor	9-10 Weeks	Group	0	100.00
Kruger, 2012	Dissertation	United States	15	7-17	CSA	Pre/Post	Bilateral Stimulation	Horse	Therapist Animal Specialist	6 Months	Combo	0	26.67
McCullough, 2011	Dissertation	United States	11	10-18	PTSD	Pre/Post	Experiential	Horse	Therapist RI[8]	6-8 Weeks	Group	8.33	45.45
Signal, 2013	Journal Article	Australia	14	19-50	CSA	Pre/Post	Experiential	Horse	Counselors	9-10 Weeks	Group	0	100.00
Whittlesey-Jerome, 2014	Journal Article	United States	13	28-64	IV[9]	Tx/ Control[10]	Experiential	Horse	Therapist Equine Specialist	8 Weeks	Group	7.14	100.00

[1]Note TCE = Traumatic Childhood Experience
[2] Pre/Post – Data available with pre- versus post-intervention data
[3]Combo = Combination of individual and group therapy
[4] CSA = Childhood Sexual Abuse
[5] Both = Data available with pre- versus post-intervention data and treatment versus control data
[6] CBT = Cognitive Behaviour Therapy
[7]PTSD = Post traumatic stress disorder

[8]RI = Riding Instructor
[9] IV = Interpersonal Violence
[10]Tx/Control = Data available with treatment versus control data

Eight effect sizes (from seven studies) were included in the pre- versus post-comparison analysis (Balluerka et al., 2015; Dietz et al., 2012; Earles et al., 2015; Kemp et al., 2014 [Child Group]; Kemp et al., 2014 [Adolescent Group]; Kruger, 2012; McCullough, 2011; Signal et al.,2013). All eight effect sizes were calculated by measuring the difference of pre-intervention data to post-intervention data. The results indicated a moderate effect size ($g = 0.86$, $p < .001$). Refer to Appendix H Figure 1 for individual effect size statistics and to Appendix H Table 1 for main effect statistics. Two effect sizes were included in the treatment versus control comparison analysis (Dietz et al., 2012; Whittlesey-Jerome, 2014). One effect size was quantified by measuring the difference of post-test scores between the treatment group and control group (Dietz et al., 2012). The second effect size was quantified by comparing the mean change of the treatment group with the mean change of the control group (Whittlesey-Jerome, 2014). The results indicated a moderate effect size ($g = 0.46$, $p = .03$). Refer to Appendix H Figure 2 and for individual effect size statistics. Refer to Appendix H Table 1 for main effect statistics.

Trauma Measures. Four studies reported on trauma measures and their individual effect sizes and were included in the pre- versus post-comparison analysis (Dietz et al., 2012; Earles et al., 2015; Kemp, et al., 2014 [Adolescent Group]; McCullough, 2011). All four effect sizes were calculated by measuring the difference of pre-intervention data to post-intervention data. The results indicated a large effect size ($g = 1.11$, $p = .001$; Refer to Appendix H Table 1 for main effect statistics. Refer to Appendix H Figure 3 for individual effect size statistics).

Depression Measures. Four studies reported on depression measures and their individual effect sizes were included in the pre- versus post-comparison analysis (Dietz et al., 2012; Earles et al., 2015; Kemp et al., 2014 [Child Group], Kemp et al., 2014 [Adolescent Group], Signal et al., 2013). All four effect sizes were calculated by measuring the difference of pre-intervention

data to post-intervention data. The results indicated a large effect size ($g = 1.09$, $p < .001$; Refer to Appendix H Table 1 for main effect statistics. Refer to Appendix H Figure 4 for individual effect size statistics).

Anxiety Measures. Three studies reported on anxiety measures and their individual effect sizes were included in the pre- versus post-comparison analysis (Dietz et al., 2012; Earles et al., 2015; Kemp et al., 2014 [Adolescent Group]). All three effect sizes were calculated by measuring the difference of pre-intervention data to post-intervention data. The results indicated a large effect size ($g = .99$, $p < .001$; Refer to Appendix H Table 1 for main effect statistics. Refer to Appendix H Figure 5 for individual effect size statistics).

Heterogeneity

Heterogeneity, represented by Q_T, is a measure that represents the degree to which each study's effect size varies within the distribution of effect sizes (Borenstein, et at. 2009). The Q_T statistic allows one to see whether or not the studies included in the meta-analysis have unaccounted variance. In other words, this statistic indicates whether or not characteristics specific to individual studies are moderating the effect in addition to the assumption of random error. The I^2 statistic measures the proportion of variance that is due real differences or due to characteristics inherent to each study.

All Symptom Measures. After testing for heterogeneity among the studies that utilized a pre- versus post-comparison, the results suggest that the pre- versus post-comparisons studies are heterogeneous ($Q = 146.26$, $p < .001$). $I^2 = 95.21\%$, suggesting that almost all of the variance is potentially explained by study characteristics. This meta-analysis used a random effects model as the studies included in the analysis were presumed to not share a common effect size, meaning the true effect size varies from study to study A forest plot was created to visually inspect the

dispersion of effect sizes and identify any observable outliers which were defined as studies with a standardized residual greater than 1.96 (see Appendix H Figure 1). Among the pre- versus post-comparison effect sizes, two studies were identified as outliers (Kemp et al., 2014; McCollough, 2011).

Comparatively, heterogeneity for the treatment versus control group comparison was not statistically significant ($Q = 0.023$, $p = .88$). The lack of significant findings does not necessarily confirm a lack of heterogeneity. It is important to note there were far fewer effect sizes included in the treatment versus control analysis ($k = 2$). The Q_T statistic is particularly vulnerable to detection of homogeneity in small sample sizes and one must use caution in interpreting this statistic (Huedo-Medina et al., 2006). However, if theoretically there is no heterogeneity present, the use of a random effects model is statistically equivalent to the use of a fixed effect model. Therefore, the use of a random effects model in this analysis was ideal. The I^2 statistic is much less vulnerable to low power. The I^2 statistic was < .001% suggesting that none of the variance was due to study characteristics. A forest plot was not created as there were only two studies included in this analysis.

Trauma Measures. After testing for heterogeneity among the studies that utilized trauma measures, the results suggest that the pre- versus post-comparisons studies are heterogeneous ($Q = 28.74$, $p < .001$). The I^2 statistic = 89.56%, suggesting that almost all of the variance is potentially explained by study characteristics.

Depression Measures. After testing for heterogeneity among the studies that utilized depression measures, the results suggest that the pre- versus post-comparisons studies are heterogeneous ($Q = 31.68$, $p < .001$). The I^2 statistic = 87.38%, suggesting that almost all of the variance is potentially explained by study characteristics.

Anxiety Measures. After testing for heterogeneity among the studies that utilized anxiety measures, the results suggested moderator variables may partially be responsible for the distribution of effect sizes ($Q = 14.96$, $p = .001$). This suggests that the pre- versus post-comparisons studies are heterogeneous. The I^2 statistic = 86.63%, suggesting that almost all of the variance is potentially explained by study characteristics.

Moderator Analyses

Moderator analyses were only conducted for variables that had four or more studies that provided data on that variable.

All Symptom Measures. There were 20 moderator analyses conducted in total for the pre- versus post-comparison analysis. See Appendix H Table 2 for the statistics for all of the moderator analyses and Appendix G Table 3 for the studies that were included in each moderator analysis. The graph of each moderator analysis was visually examined to determine the presence of outliers and to assess if a curvilinear relationship provided a better explanation for the data. There were six moderator analyses were statistically significant. Studies conducted in Australia were associated with a larger effect (Appendix H Figure 6 and Appendix H Table 4). Additionally, when the provider of the intervention was someone other than a psychologist, psychiatrist, or a therapist, the effect of the intervention was greater (Appendix H Figure 7). Interventions that had additional in-clinic individual therapy in conjunction with an animal-assisted psychotherapy program were associated with a larger effect (Appendix H Figure 8). When there was greater percentage of women in the total sample there was an associated larger effect (Appendix H Figure 9). Interventions that were provided in a group format were found to be more efficacious than interventions that were provided in both group and individual format

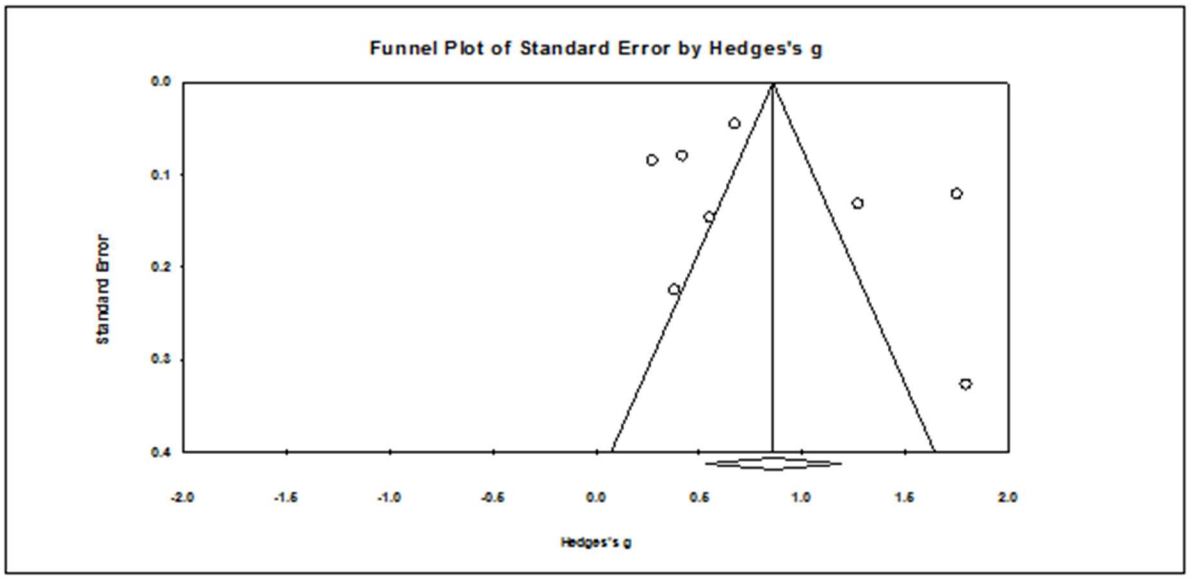
(Appendix H Figure 10). Finally, interventions that were conducted outside were associated with a greater effect (Appendix H Figure 11).

No moderators were conducted for the treatment versus control analysis as only two studies were included in the main analysis.

Publication Bias

Funnel plots were created to visually detect the presence of publication bias among the sample of studies (see Figure 2). Rothstein, Sutton, and Borenstein (2005) suggest that funnel plots are a practical first step in detecting publication bias as easily identifiable patterns in the effect size distribution emerge. As the name states, the effect size distribution will symmetrically resemble an inverted funnel where larger studies congregate at the apex (illustrating the summary effect size) and smaller studies symmetrically distributed around the base. If publication bias is present, there is a shift in the distribution of smaller studies, where a

Figure 2. Pre- versus post-comparaison funnel plot



distinctive clustering pattern of effect seizes emerges on the right side of the funnel distribution rather than being equally distributed on both sides of the funnel pattern. By reviewing the funnel plots generated by the data for the pre-versus post-comparison analysis, publication bias does not seem to be evident (Figure 2). The moderator analyses echo this result finding no significant differences between published and unpublished studies. Due to the limited number of studies included in the treatment versus control analysis, funnel plots were unable to be produced.

DISCUSSION

Overall, this research found that animal-assisted psychotherapy programs are efficacious in decreasing symptoms associated with traumatic experiences and post-traumatic stress disorder. This meta-analysis showed a statistically significant large effect for pre- versus post-intervention comparisons and a significant moderate effect for treatment versus control comparisons. This meta-analysis additionally found a large effect for pre-versus post intervention comparisons for trauma, depression, and anxiety measures. These results are consistent with the animal-assisted therapy literature base. Previous meta-analyses examining animal-assisted therapies have found moderate effects on depressive symptoms (Souter & Miller, 2007) and overall mental health symptoms (Nimer & Lundahl, 2007). One systematic review has examined animal-assisted interventions for trauma (O'Haire et al., 2015). They concluded that the initial body of research that exists for animal-assisted intervention for trauma are promising. A significant strength of this study was the reliability, where agreement was 100%.

The results from this meta-analysis are not wholly consistent with the literature for standard cognitive behavioural treatments (i.e., without animal-assisted psychotherapy) for post traumatic stress disorder. Otte (2011) reviewed the literature available for the treatment of post traumatic stress disorder to find the effect for naturalistic settings and for randomized controlled

trials. He found a large effect size of 2.59 for uncontrolled pre- versus post-comparisons. This was inconsistent with my findings. Otte (2011) found that randomized placebo-controlled efficacy trials produced an effect size of .62 or medium effect, which was consistent with my findings. Given that the pre- versus post-comparison data was inconsistent and the treatment versus control comparison data was consistent, it is likely the difference found in the pre-versus post-comparison data is due to threats to internal validity. Pre- versus post-comparison analyses are more likely to be vulnerable to effects such as maturation and placebo and/or factors like spontaneous remission (Gravetter & Forzano, 2012). In other words, pre- versus post-comparison analyses are more vulnerable to error, and therefore more variability between results of differing studies would be expected.

The majority of the moderator analyses were non-significant. Six moderator analyses were statistically significant for all measures. The first moderator found to significantly moderate the effect was a bibliographic variable – 'location of study', and in particular studies conducted in Australia were associated with a larger effect. The second moderator that significantly moderated the effect was the sample characteristic 'percentage of women in the total sample', where a greater percentage of women was associated with a larger effect. When the 'provider of the intervention' was someone other than a psychologist, psychiatrist, or a therapist, there was an associated larger effect. Interventions that had 'additional therapy', specifically in-clinic individual therapy, in conjunction with an animal-assisted psychotherapy program were associated with a larger effect. Interventions that were provided in a group format were found to be associated with a larger effect. The last moderator that was found to significantly moderate the effect was interventions that were conducted outside were associated with a greater effect. It should be noted that the factors that were associated with larger effects in all six moderator

analyses were the factors associated with two studies (Kemp et al., 2017; Signal et al., 2013). These two studies were conducted in Australia were conducted by the same group of researchers using the same treatment program. Kemp et al. (2014) and Signal et al. (2013) both used an equine-facilitated therapy program (an animal-assisted psychotherapy) run by Phoenix House in Australia between March 2010 and September 2011. "The Trails of Discovery" program is based on EAGALA principles and experiential learning where the activities promote metaphors between session content and every-day life. The program is designed to uncover "patterns of thinking, reactions/responses to different situations and outcomes, and reactions to dynamics within the family group or within the group of participants" (Kemp et al., 2014, p. 561). Both studies examined the effect of this program on mental health outcomes in children and on adult women who experienced sexual abuse. Signal et al. (2013) additionally reported on the same child and adolescent groups as reported in Kemp et al. (2014). The data that Signal et al. (2013) provided was less comprehensive than Kemp et al. (2014) so only the adult women group was extracted from Signal et al. (2013).

This meta-analysis found that group, individual, or combination formats were found to not moderate the effect. Additionally, length of intervention did not appear to moderate the effect. The shortest intervention included in this study was 6 weeks. This suggests that different lengths of interventions do not moderate the effect. Further, it appears that differing animals do not moderate the effect. These findings together suggest that animal-assisted psychotherapy programs could be run at minimum 6 weeks with any species without any reduction in efficacy. This has powerful implications regarding cost of intervention. It suggests that if cost is a factor, a less costly animal could be utilized for fewer weeks. One limitation of this study that will be

explored below is the number of moderators that were unable to be analyzed due to lack of reported data or lack of variation in the studies.

Imel et al. (2013) approximate that 18% of individuals will drop out of treatment targeting trauma-based experiences. They also note that this drop out number increases when the treatment focuses on exposure-based principles. The majority of studies included in this meta-analysis had zero percent attrition (Table 6). The three studies that had an attrition rate greater than zero had rates of 5.97% (Balluerka et al., 2015), 7.14 (Whittlesey-Jerome, 2014), and 8.33% (McCullough, 2011). These studies had a theoretical orientation that varied from attachment to cognitive-behavioural to experiential. Overall, animal-assisted psychotherapy produced attrition rates less than what would be predicted across differing orientations. This research indicates that animal-assisted psychotherapy programs may provide an additional incentive for participants to continue to engage in therapy. It further suggests that there is a component in animal-assisted psychotherapy that circumvents the participant's desire to avoid the unpleasant aspects of trauma therapy.

Limitations

This study presented a number of limitations. First, there were a limited number of studies included. One factor that led to the limited number of studies was the inclusion criterion that the studies use a psychotherapeutic intervention. While the incorporation of animals in therapy has exponentially increased as time goes on, the incorporation of animals specifically within a psychotherapeutic context is limited. Overwhelmingly, the literature suggests that including an animal in therapy is beneficial, but it is important to distinguish what aspect of the therapy is critical for therapeutic benefit. Given that the majority of studies showed a moderate effect regardless of how prominent the animal was to the therapy, having an animal in the room

may be as beneficial as using it as part of the therapy. A second factor that led to the limited number of studies was the simple lack of quantitative research available. Fifty-three studies were excluded as they only presented qualitative data. Many studies only examined the theoretical benefits of animal-assisted psychotherapy – 75 were excluded for this reason. Systematic reviews (n = 3), program guidelines (n = 8), treatment manuals/program protocols (n = 11), grant proposals (n = 13), and literary reviews (n = 40) fell under this umbrella. While it appears that animal-assisted psychotherapy is a popular concept, there is a staggering lack of research examining clinical implementation in quantitative research.

Another issue in the literature is the lack of reporting standards. Several studies were excluded from analysis as they did not provide data amenable to meta-analytic calculations (n = 7). These studies reported limited data related to statistical testing and did not report effect size data. Beutler and Moleiro (2001) note that statistical significance testing only allows for the conclusion of whether two groups are reliably different from each other. We cannot determine whether two groups are identical. Fritz, Morris, and Richler (2011) state that using a standardized measure of effect provides a "generally interpretable, quantitative description" of the study's results (p. 2). Other benefits to using an effect size calculation in addition to significance testing include: the comparison of effects within a single study and across differing studies utilizing differing sample sizes and differing measures. In other words, using a standard practice of reporting effect size data allows for more studies to be included in a summative analysis. Had those excluded seven studies reported effect size data, they would have been eligible for inclusion in this meta-analysis and moderator analyses.

The majority of moderator analyses run for the pre- versus post-comparison analysis provided data from all 7 pre-post studies. However, there were six moderator analyses that were

unable to be run due to lack of available data. Some were unable to be calculated due to collinearity (theoretical orientation, treatment fidelity, treatment randomized controlled trial versus not, percentage of female participants in the control group, and mean age of the control group). Additionally, due to the lack of studies included in the treatment versus control analysis ($k = 2$), moderator analyses were unable to be completed on this data. I am unable to conclude whether or not any characteristics moderate the effect for the treatment versus control analysis, and therefore am limited in the general conclusions I can draw regarding the efficacy of animal-assisted therapy. This is problematic given that treatment versus control analyses are methodologically a higher quality type of study.

Implications

This meta-analysis has several practical implications. It suggests that animal-assisted psychotherapy reduces trauma and post-traumatic stress symptoms. As noted above, individuals who develop post-traumatic stress disorder have associated brain changes; in particular, the norepinephrine system malfunctions and remains activated (Elzinga & Bremner, 2002). Additionally, individuals with post-traumatic stress are more likely to drop out of trauma-focused treatments (Imel et al., 2013). The animal itself may provide incentive above and beyond treatment for the individual to engage in therapy. Incorporating animals within a psychotherapeutic context in the treatment of trauma and post-traumatic stress disorder appears to circumvent these barriers to efficacious treatment.

Future Directions

There are a small number of studies that have been published examining the effect of animal-assisted psychotherapy for the treatment of trauma and/or post traumatic stress disorder. Most of the studies published focused on less rigorous interventions (such as animal-assisted

activities). Given the moderate effect size estimates that were found in this meta-analysis, future research should focus on examining animal-assisted psychotherapy as a methodology. Further to this point, the majority of studies included in this meta-analysis included pre- versus post-comparison data. Methodologically, the conclusions drawn from a treatment versus control experimental design would likely be more accurate as noted above (Gravetter & Forzano, 2012). Conducting randomized controlled trials would provide a more definite conclusion about the effectiveness of animal-assisted psychotherapy.

An important focus for future meta-analyses would be a study examining the difference between bibliographic, sample, study, and intervention characteristics. This meta-analysis found that the majority of moderators did not affect the overall effect of animal assisted psychotherapy. However, it is important to note that this meta-analysis included a relatively small number of studies. It is possible that the lack of significant findings is due to low power rather than a true lack of effect. When more data is available it would be pertinent to reassess this meta-analysis and to conduct the moderator analyses again to see if they still hold true in larger samples.

The results of this study make it clear that it is critical that more primary research be conducted for interventions that include animals. While this study helped clarify the effect of animals incorporated within a psychotherapeutic context, it also strongly indicated more research is needed to determine the essential components of animals incorporated in therapy.

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Chapter 5: Overall Disucssion

As I demonstrate in Chapter One, three major theoretical perspectives emerged to explain the effectiveness of animal-assisted psychotherapy: biophilia, cognitive behavioural, and attachment. Biophilia Theory suggests that animal-assisted psychotherapy is effective as animals are familiar to humans, animals signal security and safety, and animals have been shown to develop and promote emotional development that closely mimics human development (Melson, 2000). Cognitive Behavioural Theory suggests that animal-assisted psychotherapy is effective because the animal in therapy is incorporated to help modulate physiological arousal (negative emotional arousal) so that the client is able to cognitively make use of the therapy content (Beale, 2005). Attachment Theory suggests that animal-assisted psychotherapy is effective because animals provide a relationship that, while mimicking a human relationship, is actually more simple, predictable, and consistent than human-human relationships (Zilcha-Mano et al., 2011). Additionally, the animal functions as a transitional object in psychotherapy allowing for greater ease in communicating feelings and emotions as compared to direct communication with another human (Levinson, 1962). Consistent between all three theories is the notion that animals help change emotional arousal which subsequently leads to changes in cognitions and behaviours. Studies included in this dissertation covered the range of theoretical perspectives. The theoretical orientation utilized (such as cognitive behaviour or attachment) did not affect the outcome of the intervention in any of the three meta-analyses. This suggests that the mechanism of change for animal-assisted psychotherapy is a shared characteristic of all three theories. Due to the lack of data provided for moderator analyses from the studies included in this dissertation, I can only speculate on what that mechanism for change is. In examining these three theories, there appears to be one shared characteristic among the Biophilia, Attachment and Cognitive Behavioural Theories. This characteristic is the animal providing a basis for altering emotional

arousal. While this dissertation could not look at this hypothesis directly, it is an area for future research to explore.

Overall, this research project has tentatively found that animal-assisted psychotherapy programs are efficacious in reducing mental disorder symptoms. Moderator analyses were only conducted for the meta-analysis addressing all disorders and the trauma/PTSD meta-analysis (Chapters 2 and 4). Moderators were not conducted for the internalizing meta-analysis as there were not enough studies. The overwhelming majority of moderator analyses were non-significant. This is likely due to low power in the analyses as a result of the small number of included studies. This is especially true given that the I^2 statistic in many of the studies was substantial to considerable (over 50%), which indicates likely true study heterogeneity (rather than simply sampling error (Higgins & Green, 2011). Given a higher degree of power, the non-significant moderators likely would have yielded some statistically significant results. When examining the moderators that were statistically significant, there were three moderators that emerged as significant across studies. The first was a bibliographic characteristic, 'place of study.' Studies conducted in Australia, Hong Kong, and Italy were associated with the largest effects. The second significant moderator was a sample characteristic, 'percentage of women' (in the total sample and in the treatment group). Studies that had a greater percentage of women were associated with a larger effect. The third significant moderator was a methodological characteristic of the intervention, 'provider of the intervention.' When the 'provider of the intervention' was someone other than a psychologist, psychiatrist, or a therapist, there was an associated larger effect. It is important to note that these characteristics are associated with three particular studies, Kemp et al. (2014), Signal et al. (2013), and Menna et al. (2016). Both Kemp et al. and Signal et al. were conducted in Australia, for a population of 100% women, and were

conducted by the same group of researchers using the same treatment program. As noted in the previous chapters, there is likely something unique about this program which produced a large intervention effect (see Chapter 4 for a more thorough discussion of this issue). A third study, Menna et al. (2016), also appeared to significantly pull the significance of the moderator analyses in Chapter 2 as their calculated effect was very large (see Chapter 2 for a more thorough discussion of this issue). Menna et al. (2016) was conducted in Italy, for a population of 74-80% women, and conducted a reality orientation treatment program. As noted in the previous chapters, there is likely something unique about this program which produced a large intervention effect (see Chapter 2). One study was associated with two of the overall significant moderators ('place of study' and 'provider of intervention'). Fung and Leung (2014) was conducted in Hong Kong using play therapy for children with autism. Their program was conducted by someone other than a psychologist, psychiatrist, or a therapist. Fung and Leung (2014) had a large overall effect size which likely influenced the 'place of study' moderator. As noted in the previous chapters, there is likely something unique about this program which produced a large intervention effect (see Chapter 2)

Since there was low power in this dissertation, it is important that all conclusions be taken tentatively. These findings begin to suggest that animal-assisted psychotherapy programs could be conducted in any physical environment (indoors, outdoors, or in an arena), incorporating a dog or a horse, and have equivalent treatment efficacy. This has implications regarding cost of intervention. It suggests that if cost is a factor, a less costly animal could be utilized in a less costly location.

With regards to the overall effect, this research project has found that animal-assisted psychotherapy programs are efficacious in reducing mental disorder symptoms. In the All

Mental Disorders study, I found a large effect for pre-versus post intervention comparisons for all disorders ($g = 0.91$), attention deficit hyperactivity disorder ($g = 0.86$), reading disability ($g = 1.26$), and trauma/PTSD ($g = 0.92$). I found a moderate effect for the pre-versus post-comparison for autism ($g = 0.58$). I further found a large effect for treatment versus control comparisons for anxiety disorders ($g = 0.83$). A moderate effect was found for the treatment versus control comparison for all disorders ($g = 0.75$), reading disability ($g = 0.62$), autism measures ($g = 0.73$), and trauma/PTSD ($g = 0.44$). In the Internalizing Disorders study, I found a significant large effect ($g = 0.83$). Finally, in the Trauma/PTSD study, I found a large effect for pre-versus post-comparison ($g = 0.86$) and a moderate effect for treatment versus control comparison analysis ($g = 0.46$).

Generally, this research is consistent with the animal-assisted therapy (as opposed to animal-assisted psychotherapy) literature base. As noted in the introduction, Souter and Miller (2007) examined the efficacy of animal-assisted therapy on symptoms of depression and found a moderate effect on improving levels of depression. Nimer and Lundahl (2007) also found that animal-assisted therapy had a moderate effect on all disorders. Additionally, Chitic, Rusu, and Szamoskozi (2012) found that animal-assisted therapy had a large effect on communication and social skills on several populations. These results, while consistent with the results found in this dissertation, would suggest that utilizing animal-assisted psychotherapy might actually not be any more effective than utilizing an animal-assisted therapy.

GRADE Analysis

Grading of Recommendations, Assessment, Development and Evaluation (GRADE) is a quality measure for developing and presenting summaries of evidence (Guyatt, Oxman, Vist, Kunz, Falck-Ytter, Alonso-Coello, & Schünemann, 2008). The GRADE working group was

developed informally in 2000 by a group interested in providing a solution to the flaws of the current grading systems in the health care field (GRADE: Welcome to the GRADE Working Group, n.d.). Their goal was to develop a "common, sensible and transparent approach to grading quality (or certainty) of evidence and strength of recommendations." (GRADE: Welcome to the GRADE Working Group, n.d.). Additionally, the GRADE Working Group (2004) wanted to address shortcomings in other grading systems. It provides a systematic approach for making clinical practice recommendations (Siemieniuk & Guyatt, n.d.). GRADE is a subjective analysis where the authors decide on a clinical question (including population, alternatives, and outcomes), and rate the quality of evidence (Siemieniuk & Guyatt, n.d.). A summative overall GRADE quality rating score is then applied to the body of evidence, typically by taking the lowest quality of evidence from all of the outcomes (Siemieniuk & Guyatt, n.d.). GRADE has become a standard in guideline development (GRADE: Welcome to the GRADE Working Group, n.d.). Cochrane Training mandates that assessing the quality of the evidence is not only a fundamental element of reviews but a mandatory methodological expectation conduct standard for Cochrane intervention reviews (Lasserson, Santesso, Cumpston, Marshall, & Ní Ógáin, n.d.).

The overall GRADE quality score has four levels of evidence or certainty in/quality of evidence: A GRADE score of *Very Low* indicates that the true effect is probably markedly different from the estimated effect. A *Low* score indicates that the true effect might be markedly different from the estimated effect. A *Moderate* score indicates that the authors believe that the true effect is probably close to the estimated effect. A *High* score indicates that the authors have a lot of confidence that the true effect is similar to the estimated effect (Guyatt et al., 2008). High quality evidence would be comprised of studies that utilized a randomized control trial, whereas

low quality evidence would be comprised of studies that utilized observational data (Siemieniuk & Guyatt, n.d.). The rater additionally provides a certainty rating for each quality score (Siemieniuk & Guyatt, n.d.).

The Quality of Evidence Summary GRADE was utilized to assess the quality of the studies included in this dissertation. The GRADE analysis was undertaken here (in the overall discussion) to contextualize the findings of this entire dissertation rather than with each individual chapter. The Quality of Evidence Summary GRADE was used to assess the quality of evidence for the meta-analysis on all mental disorders (Chapter 2), with a specific focus on the treatment versus control meta-analyses as treatment versus control data has a higher quality methodology as compared to pre-versus post-comparison data. Each of the four different main analyses from Chapter 2 were individually assessed using the GRADE criteria. Analyses for reading disabilities, anxiety, autism, and trauma/PTSD outcomes scored *low* quality on the assessment (Appendix I Table 1). Quality of evidence for individual conditions is shown in Appendix I Table 2. GRADE Working Group (2004) provide definitions for the categories of quality assessment. They describe "low quality" as where "further research is very likely to have an important impact on [the] confidence in the estimate of effect and is likely to change the estimate" (p. 1494). The GRADE Working Group (2004) additionally states that the only recommendation that can be offered when there is a lack of good quality evidence, is the necessity to provide evidence required to inform a recommendation. While overall, my conclusions found that animal-assisted psychotherapy programs are efficacious in reducing mental disorder symptoms, given the state of the research base available these conclusions must be tentative at best. Therefore, my recommendation based upon this GRADE analysis is that

more research is required to further inform recommendations regarding the efficacy of animal-assisted psychotherapy.

Limitations

Echoing the GRADE recommendation, what I found to be apparent from this dissertation is the lack of studies that examine animal-assisted psychotherapy (refer to Appendix J and Appendix K). Given the popularity of therapy incorporating animals, very little primary research exists on animal-assisted psychotherapy. I assessed the full text of 1691 articles in an attempt to find research on animal-assisted psychotherapy (articles indicated by the initial searches, backwards/forwards searching, and articles published by journals with a concentration of publications for animals used in therapy). Only 28 studies were able to be included in the all disorders analysis, and less in the internalizing and trauma meta-analyses. This meant that over 1600 articles were excluded from these analyses. There were several limiting factors inherent in utilizing an animal-assisted psychotherapy that limited the studies eligible for this dissertation. One such limiting factor was the inclusion criterion of studies that utilize a psychotherapeutic intervention. Five hundred and sixty-five studies were excluded as they did not incorporate animals within a psychotherapeutic intervention. Many other studies were excluded based on inclusion criteria. One hundred and fourteen studies were excluded as they did not report on mental health measures (e.g., only reporting on wellbeing statistics such as self-esteem). Additionally, 119 studies were excluded as they did not report on a specific mental health population.

Another factor that led to the limited number of studies included in this dissertation was availability of quantitative research. One hundred and seventy-four studies were excluded as they only presented qualitative data. Three hundred and twenty-nine studies conducted literary

reviews on animal-assisted therapy. Sixteen articles were editorials, and 14 were letters to the editor. Grant/Program proposal/guidelines (n = 58), program descriptions (n = 53), systematic reviews/meta-analyses (n = 42), and studies with less than three subjects (n = 112) also fell into this category. These totaled 798 studies that were excluded for not including quantitative data amenable to meta-analysis.

A third factor that excluded a small number of studies in the animal-assisted psychotherapy research was the lack of reporting standards (such as having data amenable to meta-analysis, and being published in a common language). A small number of studies (n = 18) were excluded from analysis as they did not provide quantitative data amenable to be utilized by meta-analysis. One such example of this was a study by Katsinas (2001) where she reported only general approximations of behaviour change. Further, 31 studies were excluded as they were not published in English. Additionally, 38 studies were excluded as they could not be acquired (were not available by inter-library loan, unavailable for purchase, unavailable by author request [such as a dissertation], or the authors did not respond to correspondence). Finally, as noted in each meta-analysis, if two studies were found to use the same data, the study with the most comprehensive information (i.e., the study with the greatest amount of usable data) was included. Five studies were excluded from the three meta-analyses for representing overlapping samples.

Implications

Research and Policy Implications

The research that exists regarding animal-assisted psychotherapy is sparse. However, animal therapies are becoming embedded within mainstream psychology. Several universities offer certification or minor rotations in animal and equine therapy. A few of these programs are: North Dakota State University Equine Assisted Activities and Therapies Minor, Utah State

University Equine Assisted Activities and Therapies Minor, University of North Texas Animal Assisted Therapy Program (Consortium), University of Denver Equine Assisted Mental Health Practitioner Certificate, University of Denver Master's in Social Work Certificate in Animal Assisted Social Work, and Texas State University Animal-Assisted Counseling Academy. It is clear that the "hype" associated with animal-assisted psychotherapy has not been translated into the production of primary research. Overall, the quality assessment and the sheer number of studies that were excluded from analysis suggest that there is not enough research that exists currently to develop strong conclusions that have high validity. The research that does exist is simpler, less complex research, utilizing less rigorous methodology (such as animal-assisted activities), and does not target individuals with mental health disorders. Similarly, the research that exists typically examines healthy populations, "at-risk" populations, or medical populations (e.g., patients with cerebral palsy). To assess if animal-assisted psychotherapy is indeed effective at reducing symptoms associated with mental disorders, it is essential that this research gap be addressed. We cannot know conclusively if animal-assisted psychotherapy is truly effective without it.

Grant funders should call for research in this area to address this massive research gap. Currently, government agencies do not appear to currently cover or provide funds to examine animal-assisted psychotherapy. However, they have funded pilot projects in the past. In 2015, the Government of Canada announced funding examining the effectiveness of equine (horse) therapy for veterans with mental health conditions ("Equine Therapy," 2015). The Canadian Institute of Military and Veteran Health Research (CIMVHR) was given $250,000, and Can Praxis received $25,000 in an effort to assist in establishing an evidence base on the use of equine therapy for veterans with mental health conditions. The status of this project is not

known. Additionally, Youth Justice funded a pilot project from July 14, 2008 through July 13, 2011 ("Equine-Assisted Therapy Program," 2016). They were given $259,025.00 to test a unique drug treatment program for youth in conflict with the law. They reported that youth experienced: a reduction in their overall level of anger, less interest in using illicit drugs, improvements in their situations at home (for those living at home), a more positive attitude, increased levels of self-respect and self-esteem, and an increased ability to set, and work towards, personal goals and make better lifestyle choices. That said, no peer-reviewed articles have yet been published on this project. There has been limited funding since, or for other populations.

Clinical Implications

What can be cautiously concluded from this set of meta-analyses is that animal-assisted psychotherapy works, though the confidence in these conclusions is limited. There are several practical tentative implications. As noted above, this dissertation found that having women participants, being located in Australia, Hong Kong, or Italy, and having intervention providers that were not psychologists, psychiatrists, or a therapist were associated with larger effects. These moderators are potentially spurious since they are associated with the programs outlined in Kemp et al. (2014), Signal et al. (2013), and Menna et al. (2016). These programs were associated with larger effects. This suggests that program implementers might consider utilizing these programs [outlined in Kemp et al. (2014), Signal et al. (2013), and Menna et al. (2016)] as a springboard for program development of psychotherapies incorporating animals. Currently Kemp et al. (2014), Signal et al. (2013), nor Phoenix House (the facility of the research) offer training based on their program. Further Phoenix House no longer offers their equine program, unfortunately. Similarly, Menna et al. (2016) does not offer training for their program. None of these programs have publicly available manuals for either treatment.

An interesting finding from my results indicates that the effect of animal-assisted psychotherapy is consistent with the research examining animal-assisted therapy (not psychotherapy). This conclusion has important implications specifically related to requiring an animal to be used directly targeting mental health symptoms. In other words, in comparing across differing meta-analyses, the effect of animal-assisted psychotherapy is equivalent to animal-assisted therapy. To put it plainly, there appears to be no added benefit to having the goal-directed intervention specifically targeting psychotherapeutic treatment goals (e.g., decreasing maladaptive symptoms), with an animal being utilized as part of a psychotherapeutic intervention (e.g., the animal must be used as a critical part of an intervention targeting symptom reduction). It is imperative that primary research occurs to assess if animal-assisted psychotherapy is effective at reducing symptoms associated with mental disorders. This is a massive research gap that must be addressed, especially given the current social demand and social acceptance for animal-assisted psychotherapy and animal-assisted therapy. A randomized control trial comparing animal-assisted psychotherapy, animal-assisted therapy, and treatment as usual is critical for ascertaining the relative efficacy of each of these interventions, with more confidence than can be determined in this dissertation. Additionally, research examining a wide variety of mental disorders as well as differing populations is essential in determining the parameters of animal-assisted psychotherapy and its effectiveness. Furthermore, a randomized control trial comparing the differing theoretical orientations, holding all other factors identical (such as number of sessions, type of animal, practitioner, etc.) would be beneficial to ascertain which aspects of animal-assisted psychotherapy are associated with change, or if it is simply a matter of a having an animal present in the therapy room.

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Appendix A

Figures and Tables from Chapter 2

Figure 1. Pre-versus post-comparison effect size statistics and forest plot – all measures.

Study name	Outcome	Statistics for each study						
		Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Alfonso et al. (2015)	Anxiety	0.684	0.324	0.105	0.049	1.318	2.111	0.035
Ballureka (2015)	Combined	0.275	0.084	0.007	0.110	0.440	3.258	0.001
Bass et al. (2009)	Combined	0.488	0.058	0.003	0.374	0.601	8.447	0.000
Becker et al. (2017)	Combined	0.484	0.067	0.004	0.353	0.615	7.230	0.000
Burton et al. (2019)	PTSD	0.997	0.365	0.133	0.282	1.713	2.732	0.006
Contralbrigo et al. (2017)	Substance Craving	0.577	0.227	0.052	0.132	1.022	2.540	0.011
Dietz et al. (2012)	Combined	0.673	0.044	0.002	0.586	0.760	15.129	0.000
Earles et al. (2015)	Combined	0.560	0.141	0.020	0.283	0.837	3.957	0.000
Fung & Leung (2014)	Combined	5.414	2.803	7.856	-0.080	10.907	1.931	0.053
Jang et al. (2015)	Combined	0.759	0.099	0.010	0.566	0.952	7.699	0.000
Kemp et al. (2014)	Combined	2.050	0.256	0.066	1.548	2.552	7.999	0.000
Kruger (2012)	Combined	0.552	0.146	0.021	0.266	0.839	3.780	0.000
McCullough (2011)	PTSD	0.382	0.225	0.050	-0.059	0.822	1.699	0.089
Menna et al. (2016)	Combined	4.225	0.430	0.185	3.383	5.067	9.831	0.000
Mueller & McCullough (2017)	TOTAL	0.331	0.154	0.024	0.029	0.634	2.146	0.032
Oh et al. (2018)	Combined	1.001	0.115	0.013	0.775	1.227	8.678	0.000
Rector (2016)	WPM	0.840	0.279	0.078	0.293	1.387	3.008	0.003
Redefer & Goodman (1989)	Target Therapist	3.486	0.589	0.347	2.332	4.641	5.917	0.000
Signal et al. (2013)	Depression	1.793	0.327	0.107	1.153	2.434	5.486	0.000
Smith (2010)	Combined	1.617	0.162	0.026	1.299	1.934	9.989	0.000
Villalta-Gil et al. (2009)	Combined	0.534	0.081	0.007	0.375	0.692	6.602	0.000
Welsh Group 1 (2009)	Joint Attention	0.419	0.211	0.045	0.006	0.833	1.987	0.047
Welsh Group 2 (2009)	Joint Attention	0.048	0.216	0.047	-0.375	0.471	0.224	0.823
Wharton et al. (2019)	PCL	3.023	0.452	0.204	2.138	3.909	6.691	0.000
Yoo et al. (2016)	Combined	0.827	0.144	0.021	0.544	1.110	5.729	0.000

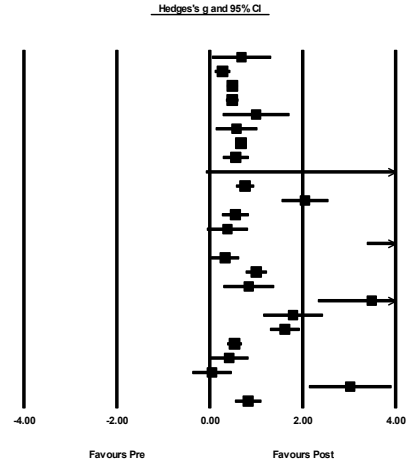
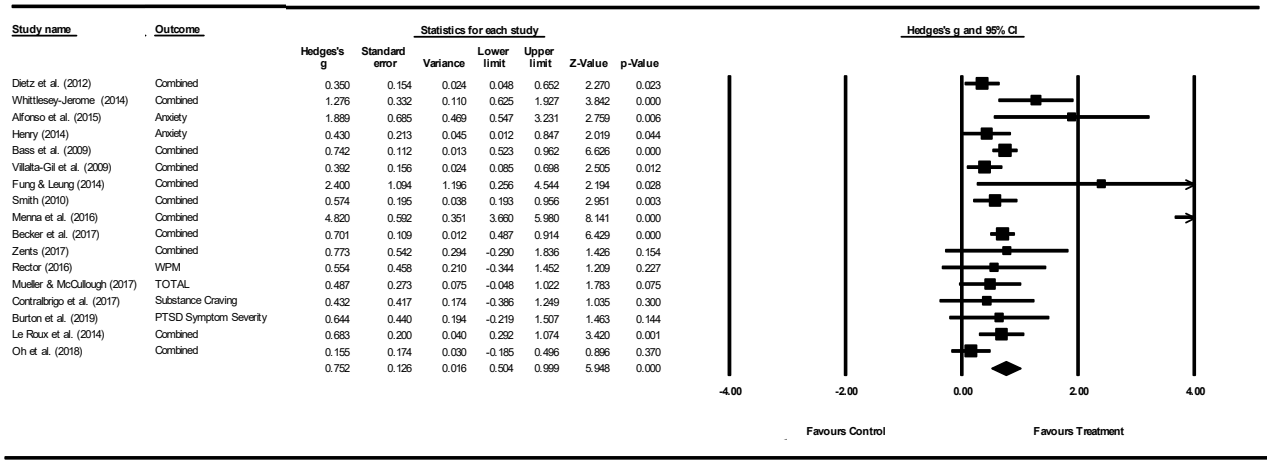
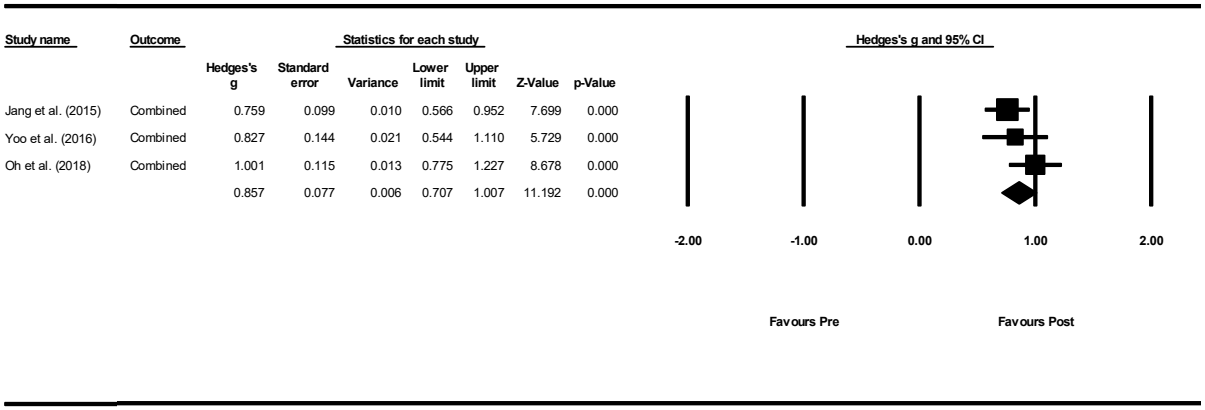


Figure 2. Treatment versus control effect size statistics and forest plot – for all measures.



Study name	Outcome	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Dietz et al. (2012)	Combined	0.350	0.154	0.024	0.048	0.652	2.270	0.023
Whittlesey-Jerome (2014)	Combined	1.276	0.332	0.110	0.625	1.927	3.842	0.000
Alfonso et al. (2015)	Anxiety	1.889	0.685	0.469	0.547	3.231	2.759	0.006
Henry (2014)	Anxiety	0.430	0.213	0.045	0.012	0.847	2.019	0.044
Bass et al. (2009)	Combined	0.742	0.112	0.013	0.523	0.962	6.626	0.000
Villalta-Gil et al. (2009)	Combined	0.392	0.156	0.024	0.085	0.698	2.505	0.012
Fung & Leung (2014)	Combined	2.400	1.094	1.196	0.256	4.544	2.194	0.028
Smith (2010)	Combined	0.574	0.195	0.038	0.193	0.956	2.951	0.003
Menna et al. (2016)	Combined	4.820	0.592	0.351	3.660	5.980	8.141	0.000
Becker et al. (2017)	Combined	0.701	0.109	0.012	0.487	0.914	6.429	0.000
Zents (2017)	Combined	0.773	0.542	0.294	-0.290	1.836	1.426	0.154
Rector (2016)	WPM	0.554	0.458	0.210	-0.344	1.452	1.209	0.227
Mueller & McQuilough (2017)	TOTAL	0.487	0.273	0.075	-0.048	1.022	1.783	0.075
Contraibrigo et al. (2017)	Substance Craving	0.432	0.417	0.174	-0.386	1.249	1.035	0.300
Burton et al. (2019)	PTSD Symptom Severity	0.644	0.440	0.194	-0.219	1.507	1.463	0.144
Le Roux et al. (2014)	Combined	0.683	0.200	0.040	0.292	1.074	3.420	0.001
Oh et al. (2018)	Combined	0.155	0.174	0.030	-0.185	0.496	0.896	0.370
		0.752	0.126	0.016	0.504	0.999	5.948	0.000

Figure 3. Pre-versus post-comparison effect size statistics and forest plot – attention deficit hyperactivity disorder measures.



Study name	Outcome	Statistics for each study						
		Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Jang et al. (2015)	Combined	0.759	0.099	0.010	0.566	0.952	7.699	0.000
Yoo et al. (2016)	Combined	0.827	0.144	0.021	0.544	1.110	5.729	0.000
Oh et al. (2018)	Combined	1.001	0.115	0.013	0.775	1.227	8.678	0.000
		0.857	0.077	0.006	0.707	1.007	11.192	0.000

Figure 4. Pre-versus post-comparison effect size statistics and forest plot – reading disability measures.

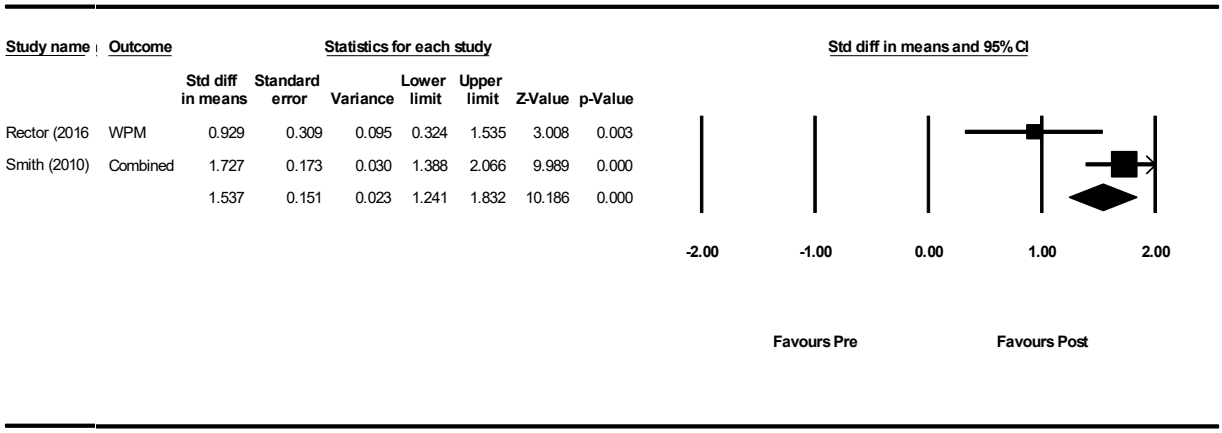
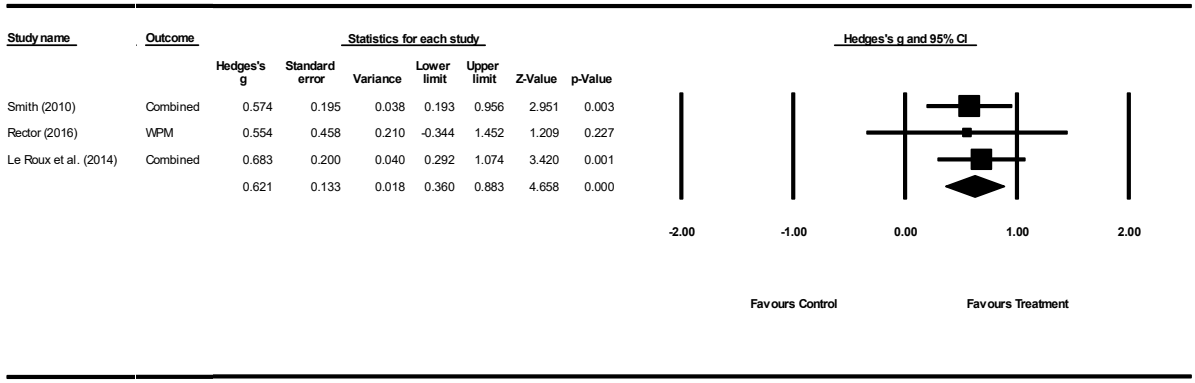
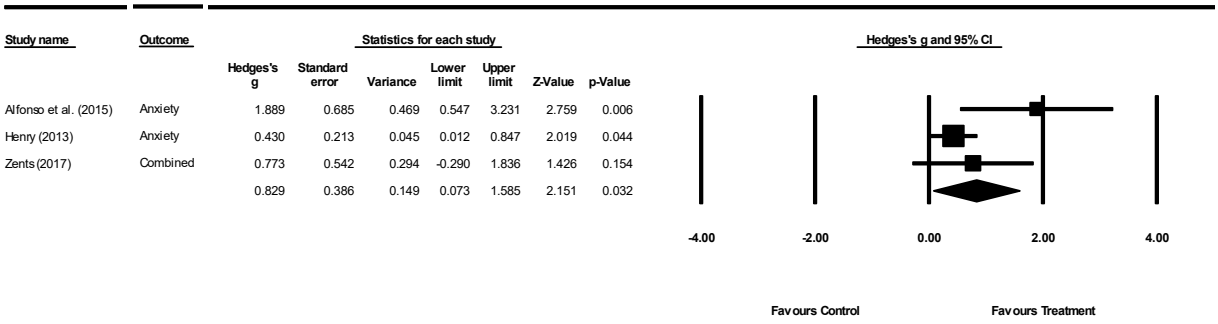


Figure 5. Treatment versus control comparison effect size statistics and forest plot – reading disability measures.



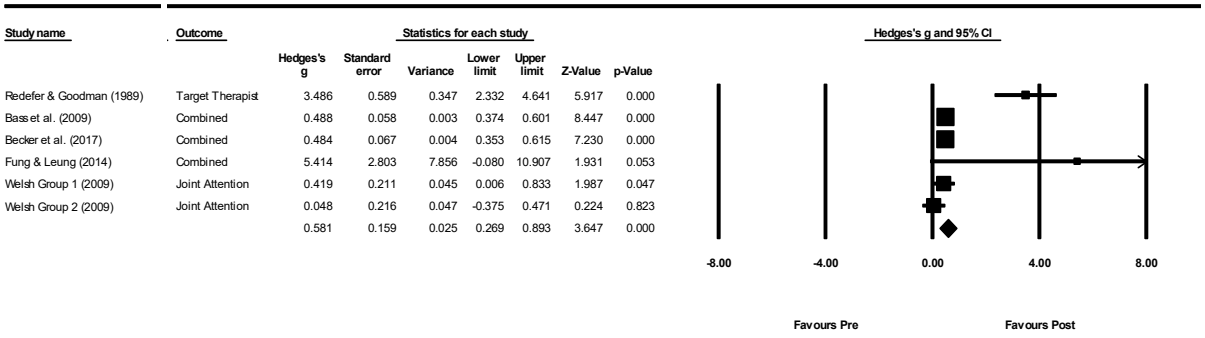
Study name	Outcome	Statistics for each study						
		Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Smith (2010)	Combined	0.574	0.195	0.038	0.193	0.956	2.951	0.003
Rector (2016)	WPM	0.554	0.458	0.210	-0.344	1.452	1.209	0.227
Le Roux et al. (2014)	Combined	0.683	0.200	0.040	0.292	1.074	3.420	0.001
		0.621	0.133	0.018	0.360	0.883	4.658	0.000

Figure 6. Treatment versus control comparison effect size statistics and forest plot – anxiety measures.



Study name	Outcome	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Alfonso et al. (2015)	Anxiety	1.889	0.685	0.469	0.547	3.231	2.759	0.006
Henry (2013)	Anxiety	0.430	0.213	0.045	0.012	0.847	2.019	0.044
Zents (2017)	Combined	0.773	0.542	0.294	-0.290	1.836	1.426	0.154
		0.829	0.386	0.149	0.073	1.585	2.151	0.032

Figure 7. Pre-versus post-comparison effect size statistics and forest plot – autism measures.



Study name	Outcome	Statistics for each study						
		Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Redefer & Goodman (1989)	Target Therapist	3.486	0.589	0.347	2.332	4.641	5.917	0.000
Basset al. (2009)	Combined	0.488	0.058	0.003	0.374	0.601	8.447	0.000
Becker et al. (2017)	Combined	0.484	0.067	0.004	0.353	0.615	7.230	0.000
Fung & Leung (2014)	Combined	5.414	2.803	7.856	-0.080	10.907	1.931	0.053
Welsh Group 1 (2009)	Joint Attention	0.419	0.211	0.045	0.006	0.833	1.987	0.047
Welsh Group 2 (2009)	Joint Attention	0.048	0.216	0.047	-0.375	0.471	0.224	0.823
		0.581	0.159	0.025	0.269	0.893	3.647	0.000

Figure 8. Treatment versus control comparison effect size statistics and forest plot – autism measures.

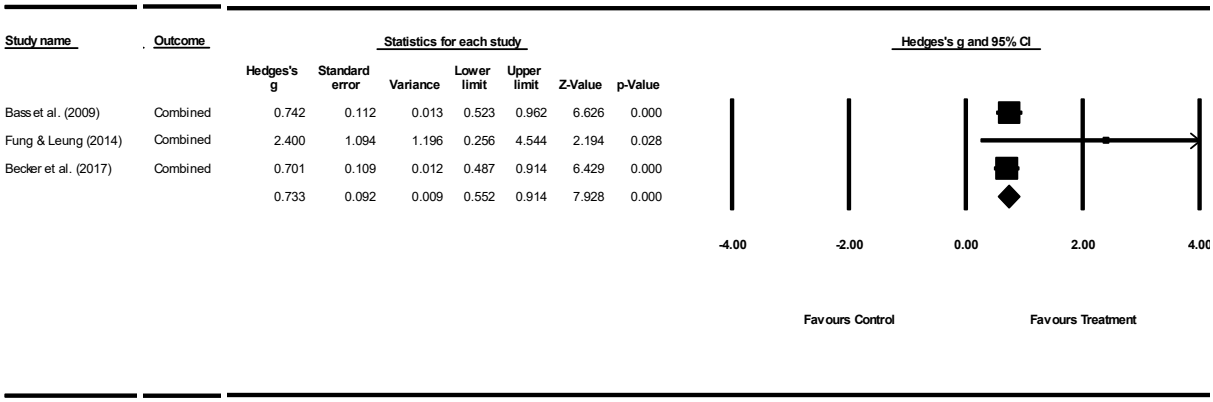
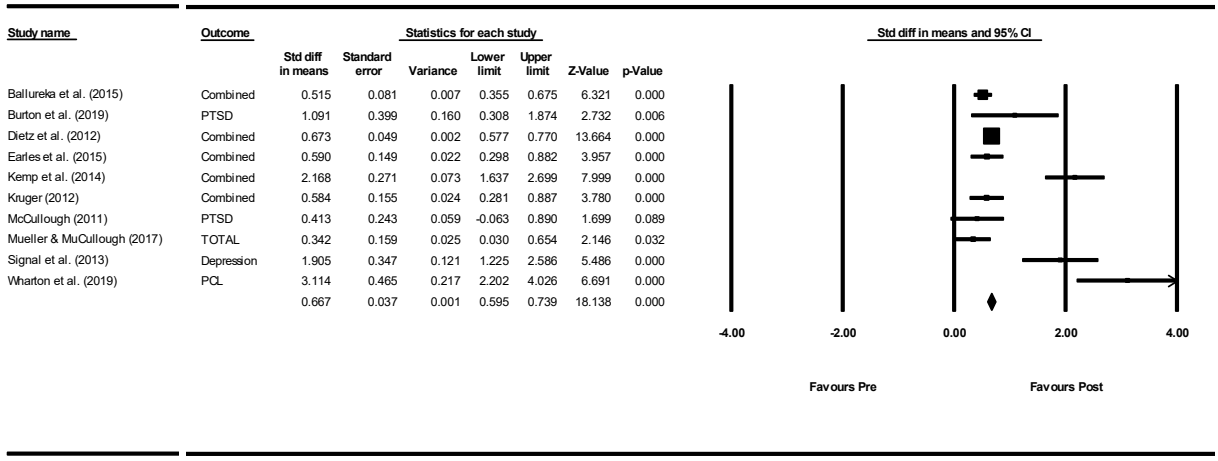


Figure 9. Pre-versus post-comparison effect size statistics and forest plot – trauma/PTSD measures.



Study name	Outcome	Statistics for each study						
		Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Ballureka et al. (2015)	Combined	0.515	0.081	0.007	0.355	0.675	6.321	0.000
Burton et al. (2019)	PTSD	1.091	0.399	0.160	0.308	1.874	2.732	0.006
Dietz et al. (2012)	Combined	0.673	0.049	0.002	0.577	0.770	13.664	0.000
Earles et al. (2015)	Combined	0.590	0.149	0.022	0.298	0.882	3.957	0.000
Kemp et al. (2014)	Combined	2.168	0.271	0.073	1.637	2.699	7.999	0.000
Kruger (2012)	Combined	0.584	0.155	0.024	0.281	0.887	3.780	0.000
McCullough (2011)	PTSD	0.413	0.243	0.059	-0.063	0.890	1.699	0.089
Mueller & MuCullough (2017)	TOTAL	0.342	0.159	0.025	0.030	0.654	2.146	0.032
Signal et al. (2013)	Depression	1.905	0.347	0.121	1.225	2.586	5.486	0.000
Wharton et al. (2019)	PCL	3.114	0.465	0.217	2.202	4.026	6.691	0.000
		0.667	0.037	0.001	0.595	0.739	18.138	0.000

Figure 10. Treatment versus control comparison effect size statistics and forest plot – trauma/PTSD measures.

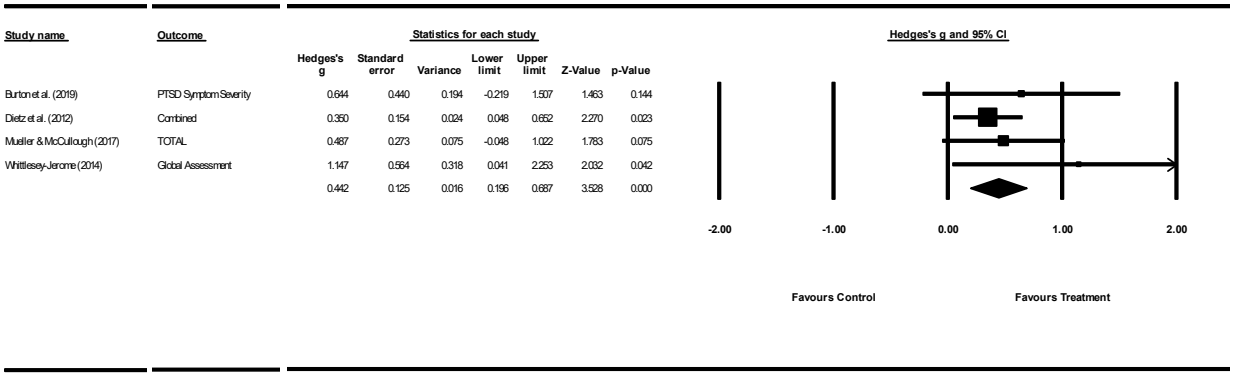


Figure 11. Pre-versus post-comparison scatterplot for all measures place of study.

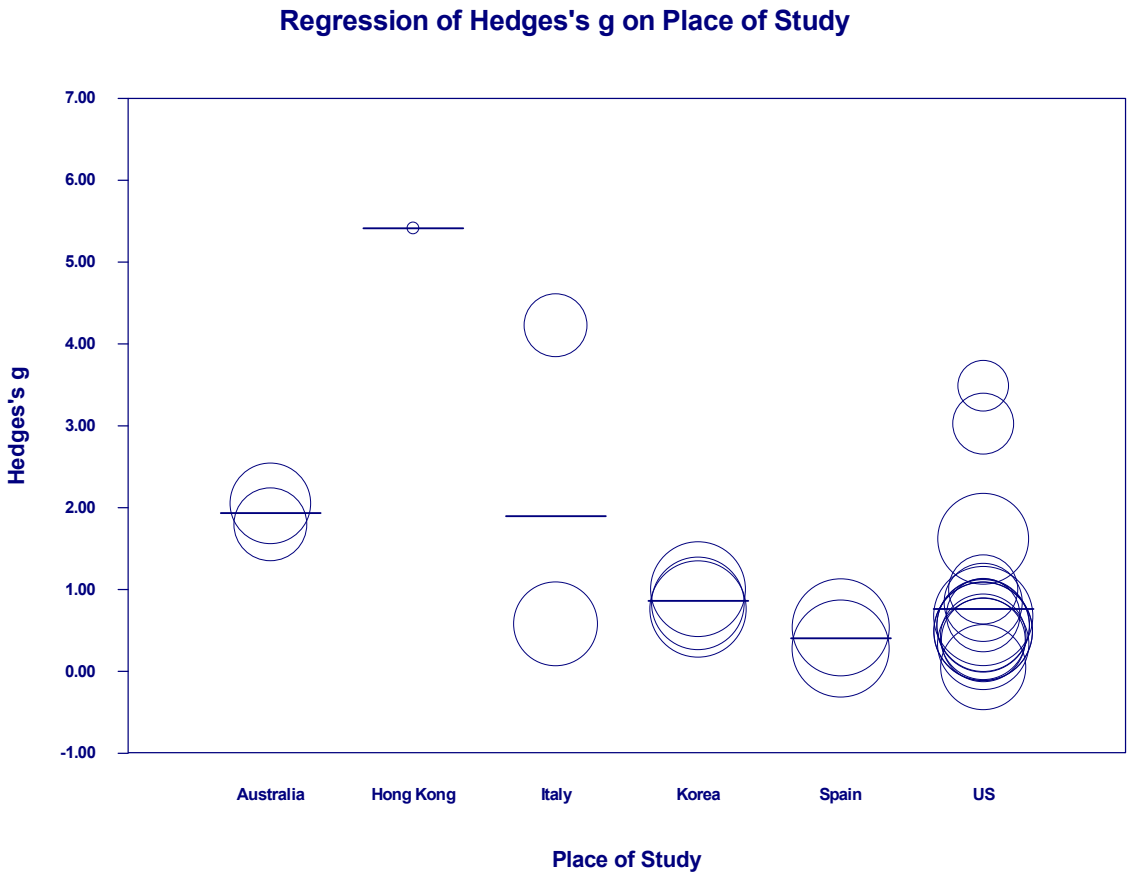
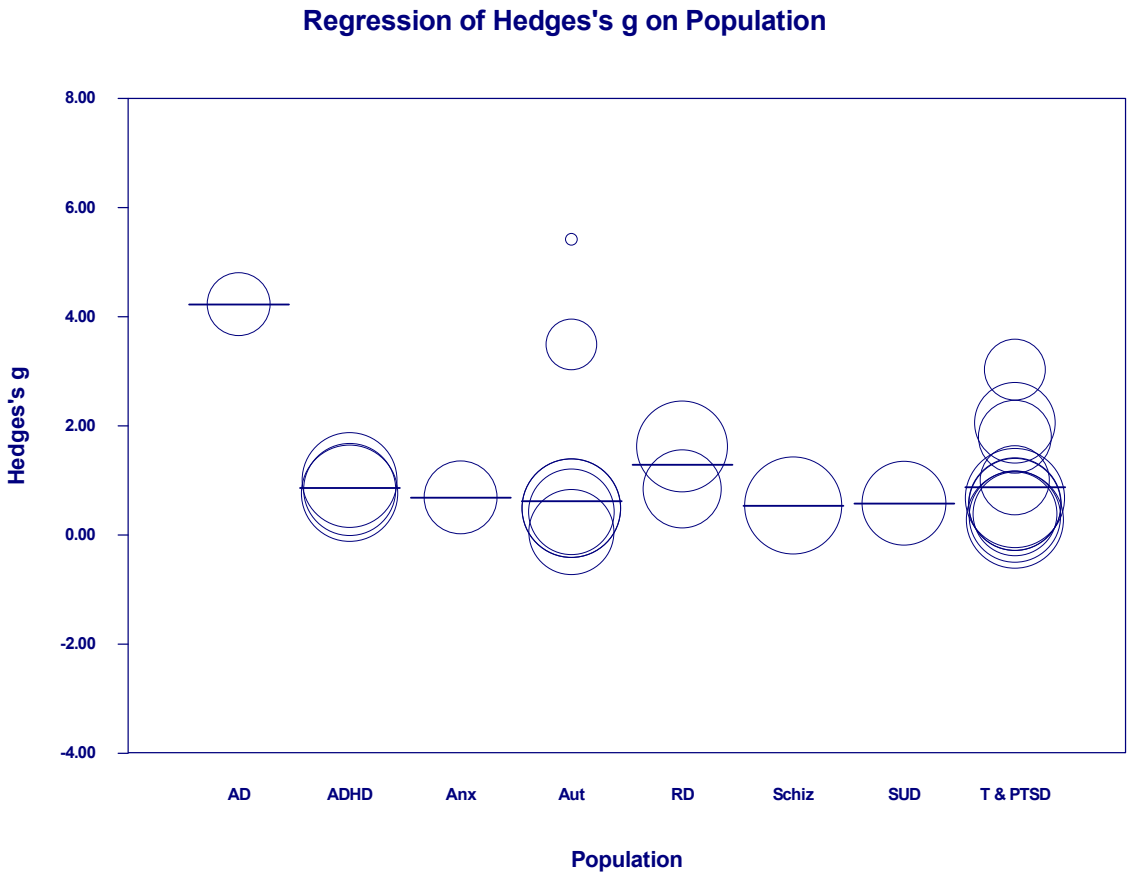


Figure 12. Pre-versus post-comparison scatterplot for all measures population.



Note. T & PTSD refers to Trauma and PTSD
ADHD refers to Attention Deficit Hyperactivity Disorder
AD refers to Alzheimer's Disease
Schiz refers to Schizoprehenia
RD refers to Reading Disability
SUD refers to Substance Use Disorder
Anx refers to Anxiety
Aut refers to Autism

Figure 13. Pre-versus post-comparison scatterplot for all measures %female total sample.

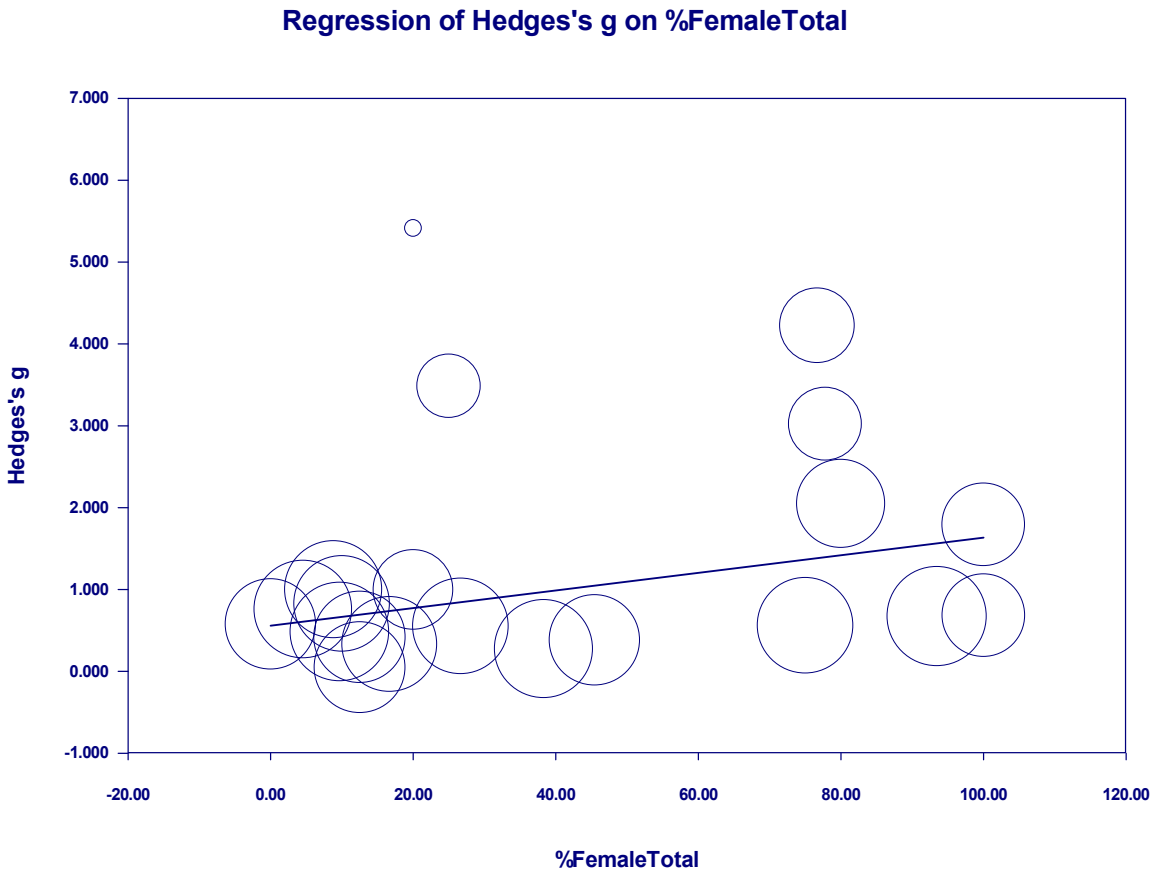


Figure 14. Pre-versus post-comparison scatterplot for all measures %female treatment group.

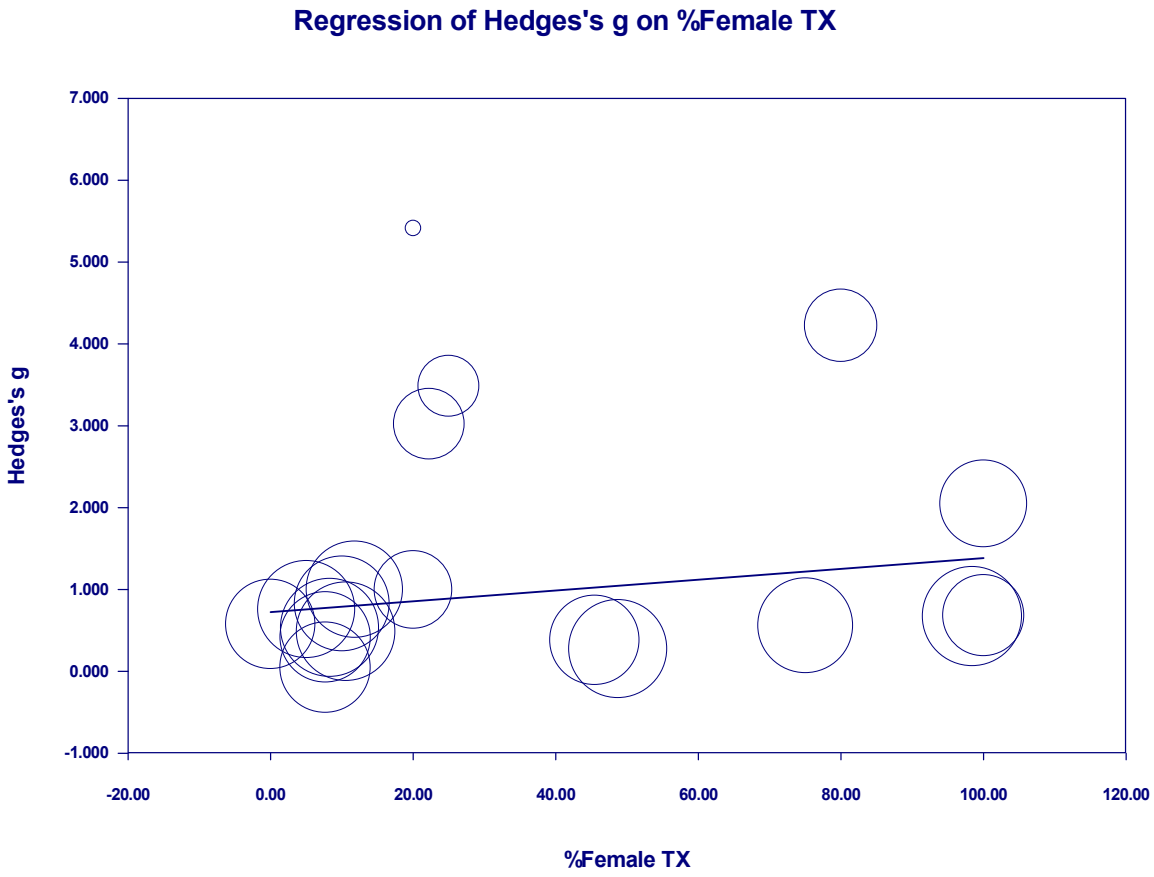


Figure 15. Pre-versus post-comparison scatterplot for all measures mean age total sample.

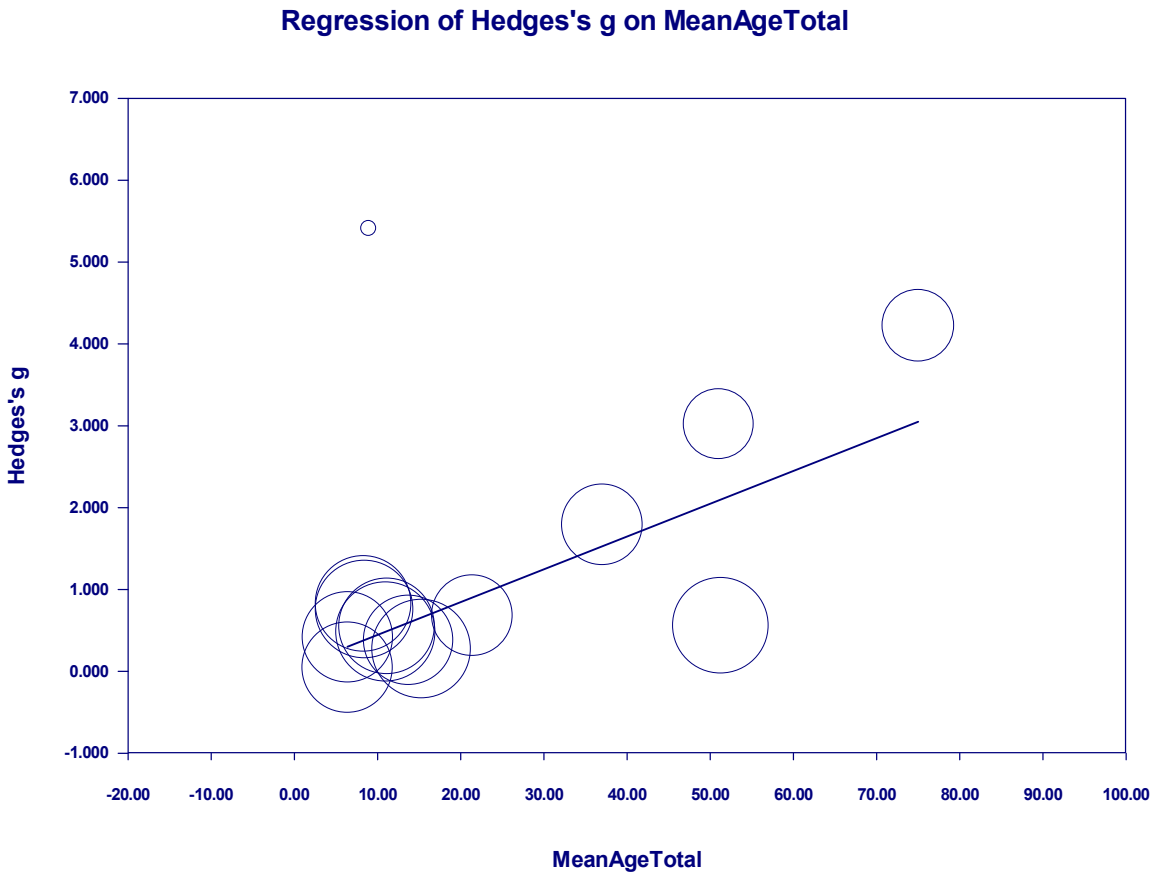
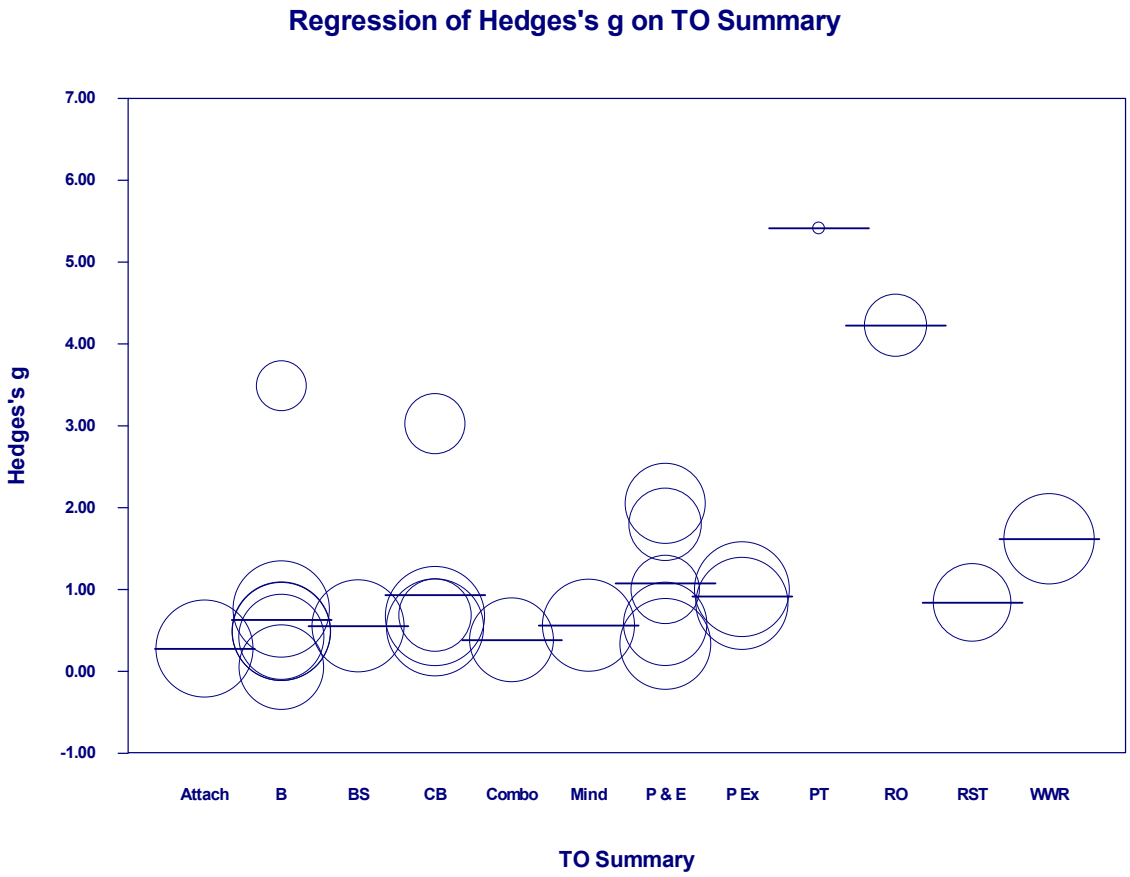


Figure 16. Pre-versus post-comparison scatterplot for all measures theoretical orientation.



Note. Attach refers to Attachment
B refers to Behaviourism
BS refers to Bilateral Stimulation
CB refers to Cognitive Behaviour
Combo refers to a combination of theoretical orientations
Mind refers to Mindfulness
P&E refers to Psychodynamic and Experiential
P Ex refers to Psychoexercise
PT refers to Play Therapy
RO refers to Reality Orientation
RST refers to Reading Strategies Training
WWR refers to Whole Word Reading

Figure 17. Pre-versus post-comparison scatterplot for all measures treatment fidelity.

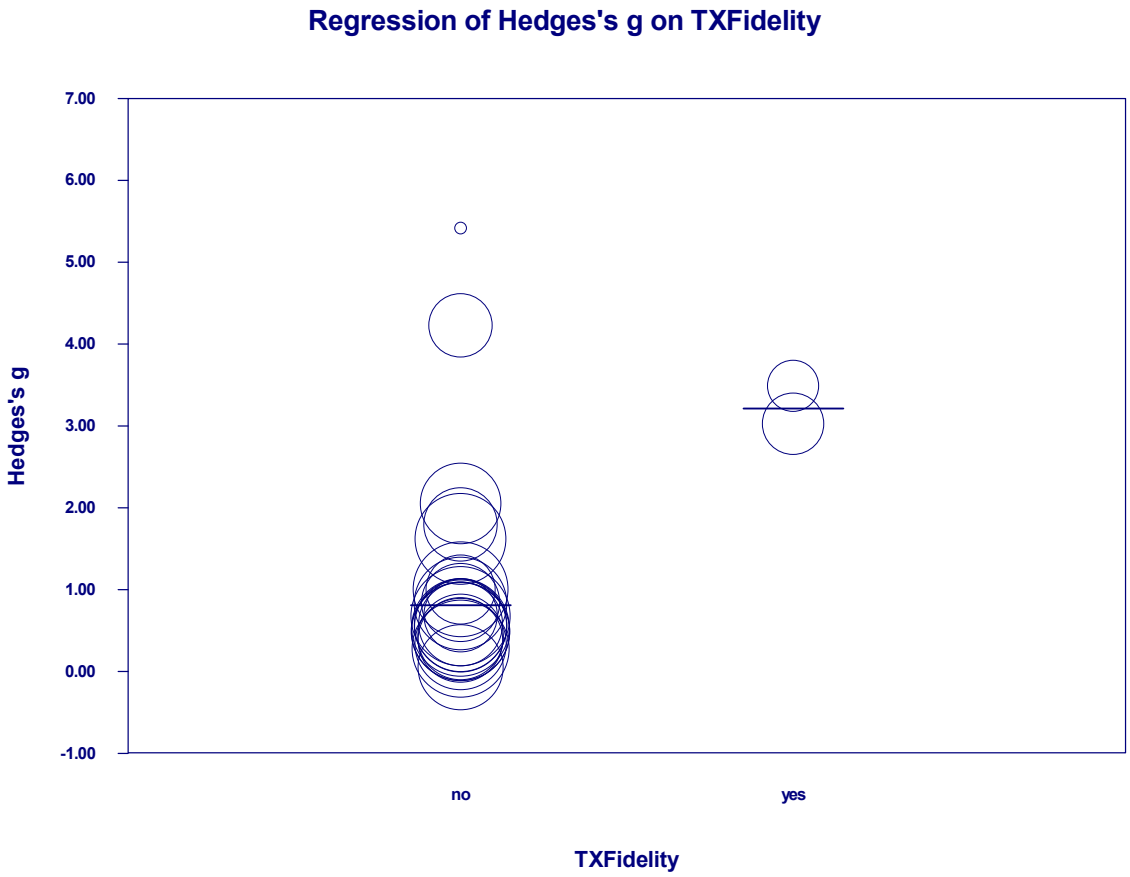


Figure 18. Pre-versus post-comparison scatterplot for all measures treatment manualized.

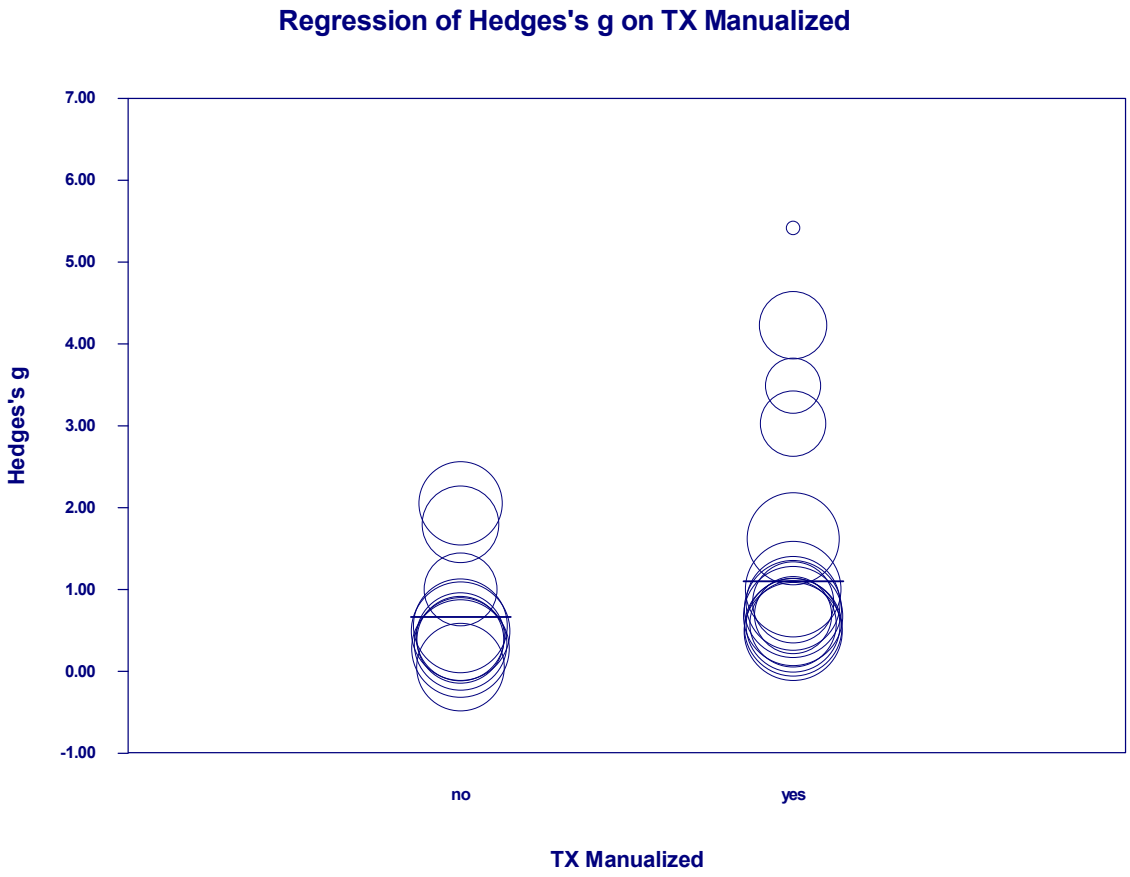


Figure 19. Pre-versus post-comparison scatterplot for all measures intervention frequency.

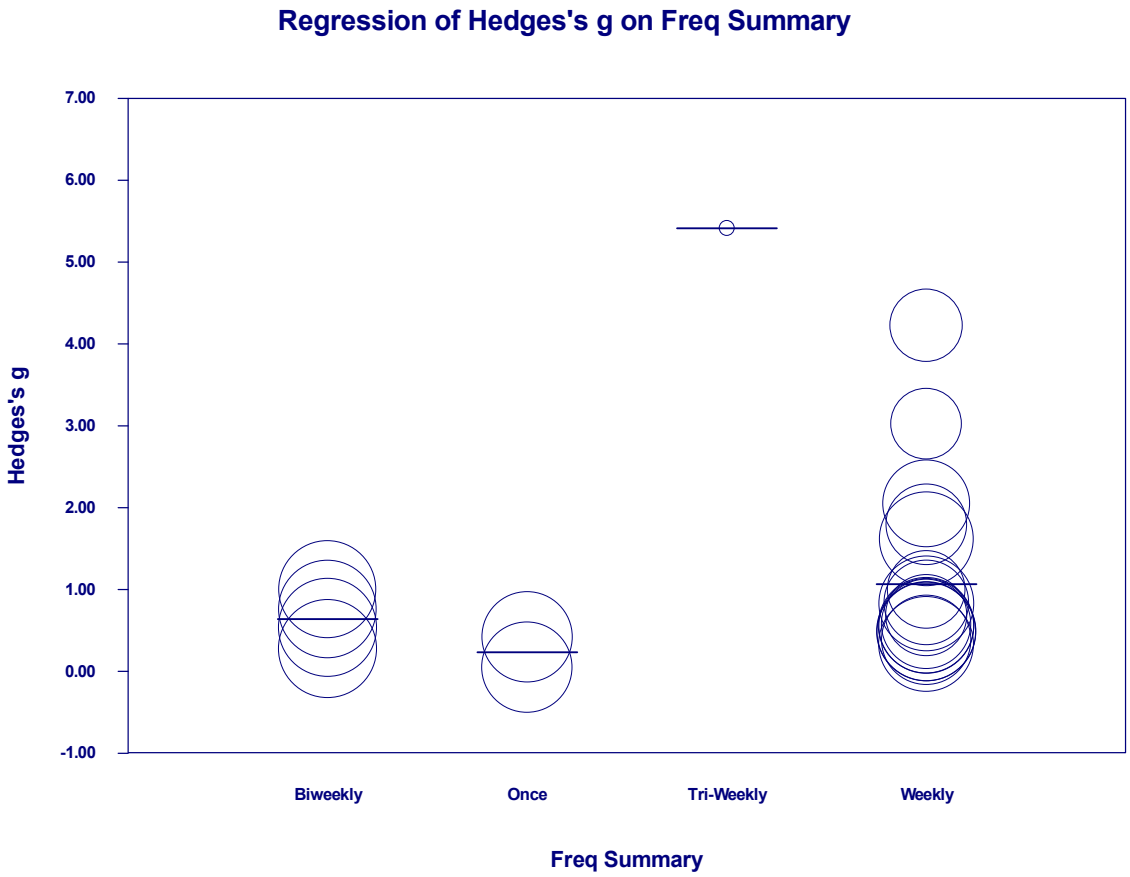


Figure 20. Pre-versus post-comparison scatterplot for all measures each session duration.

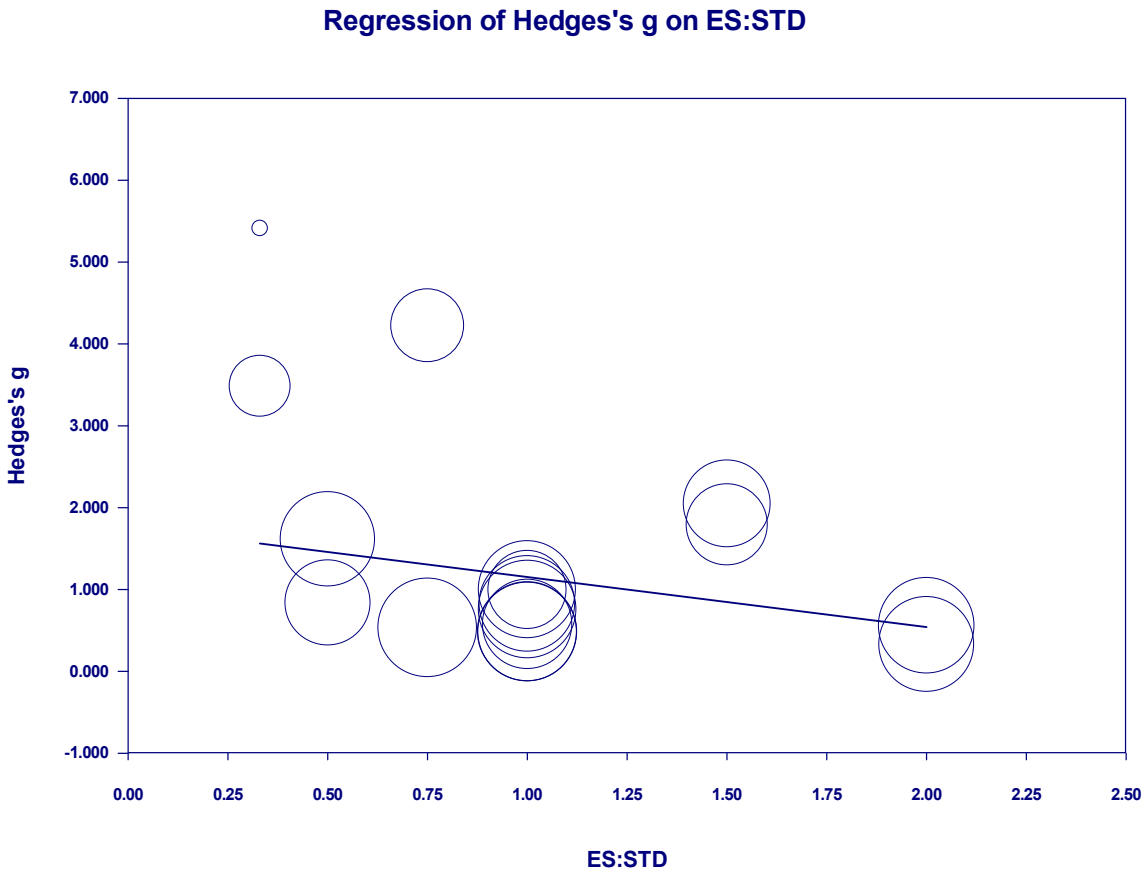


Figure 21. Pre-versus post-comparison scatterplot for all measures other therapy.

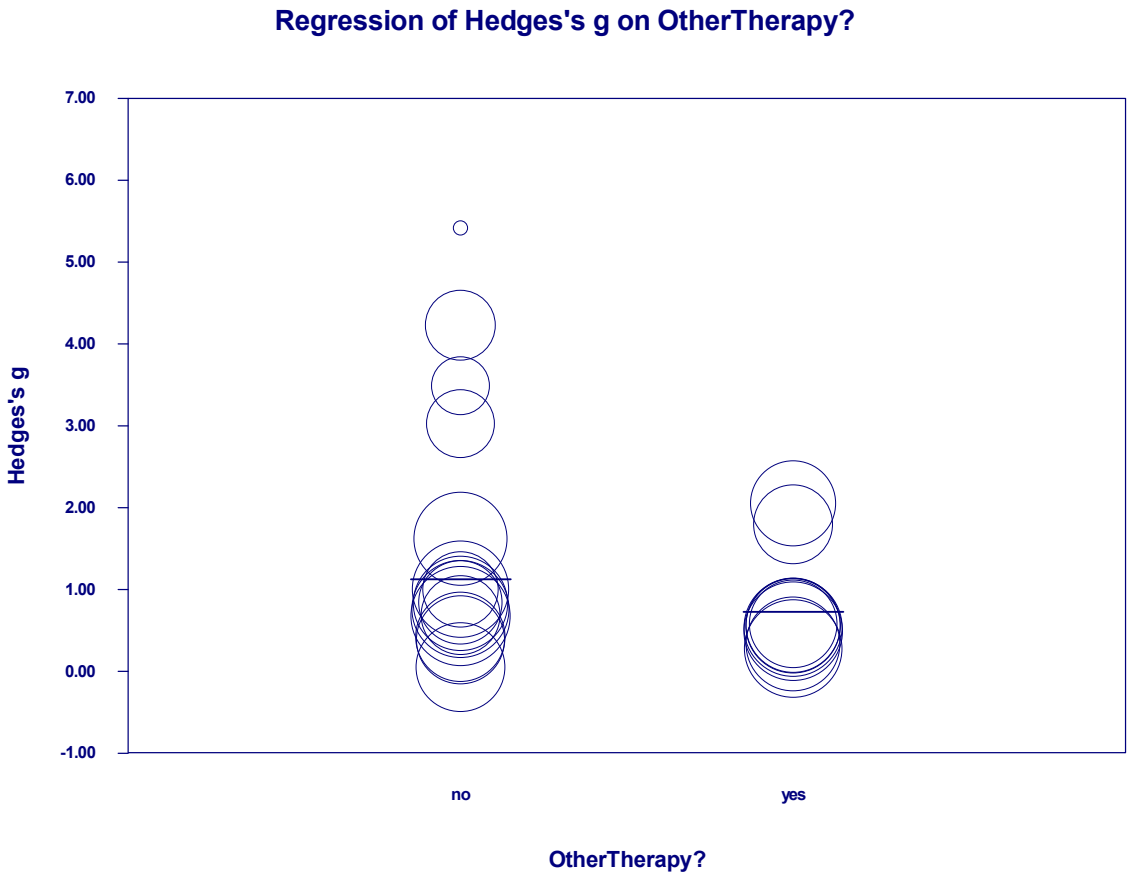


Figure 22. Treatment versus control comparison scatterplot for all measures place of study.

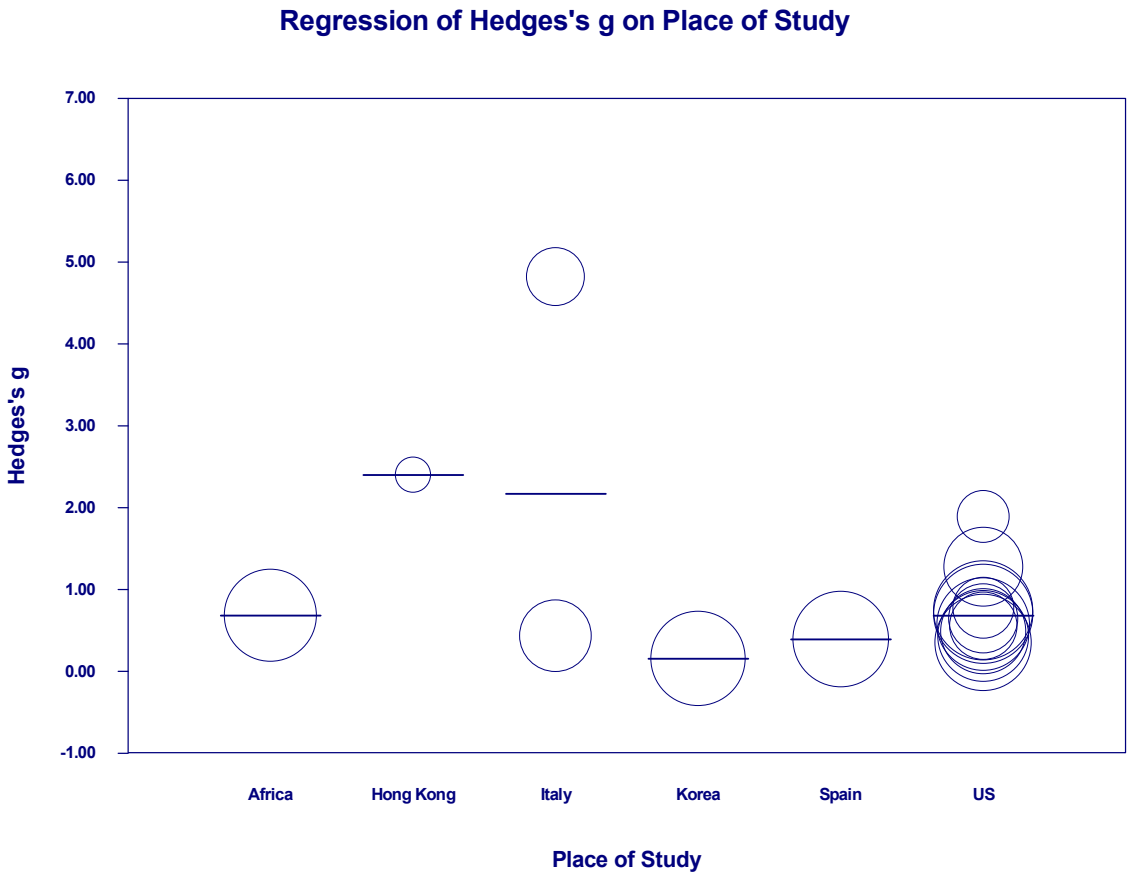
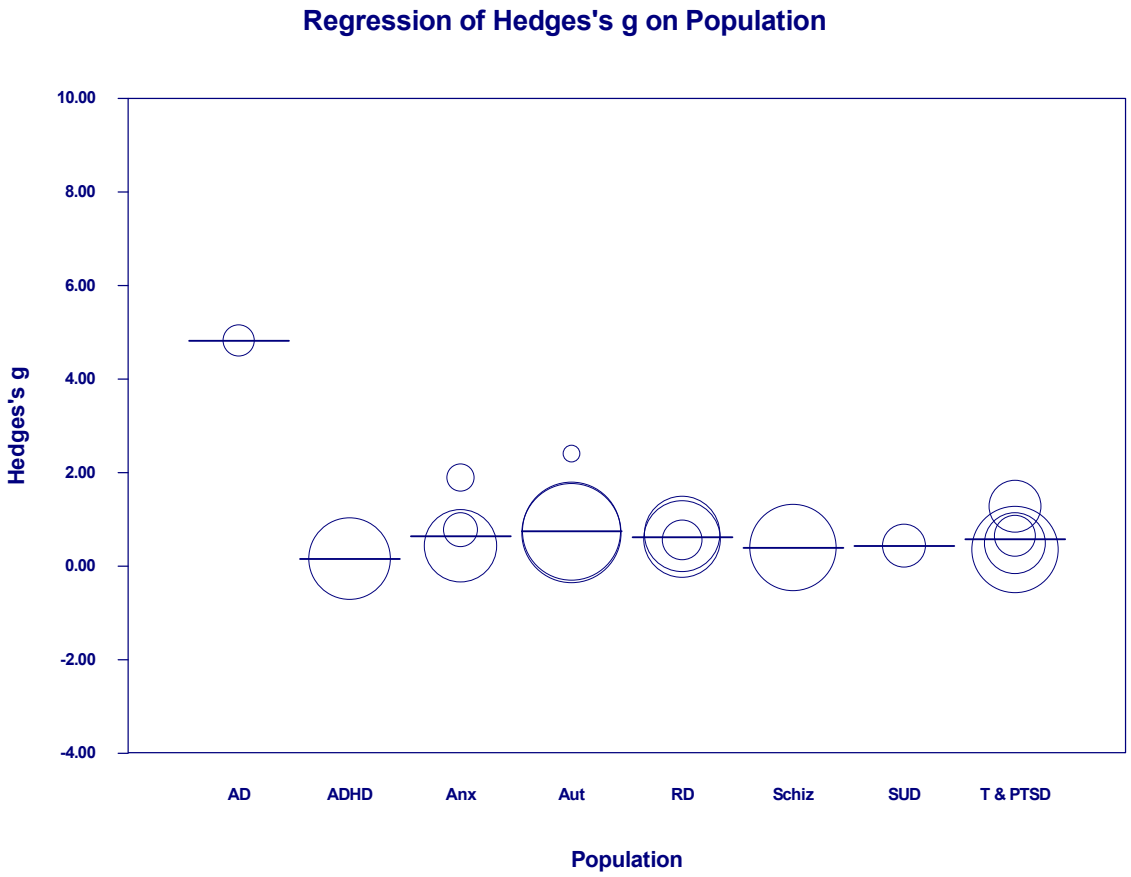


Figure 23. Treatment versus control comparison scatterplot for all measures type of disorder.



Note. AD refers to Alzheimer's Disease
ADHD refers to Attention Deficit Hyperactivity Disorder
Anx refers to Anxiety
Aut refers to Autism
RD refers to Reading Disability
Schiz refers to Schizoprehenia
SUD refers to Substance Use Disorder
T & PTSD refers to Trauma and PTSD

Figure 24. Treatment versus control comparison scatterplot for all measures mean age total.

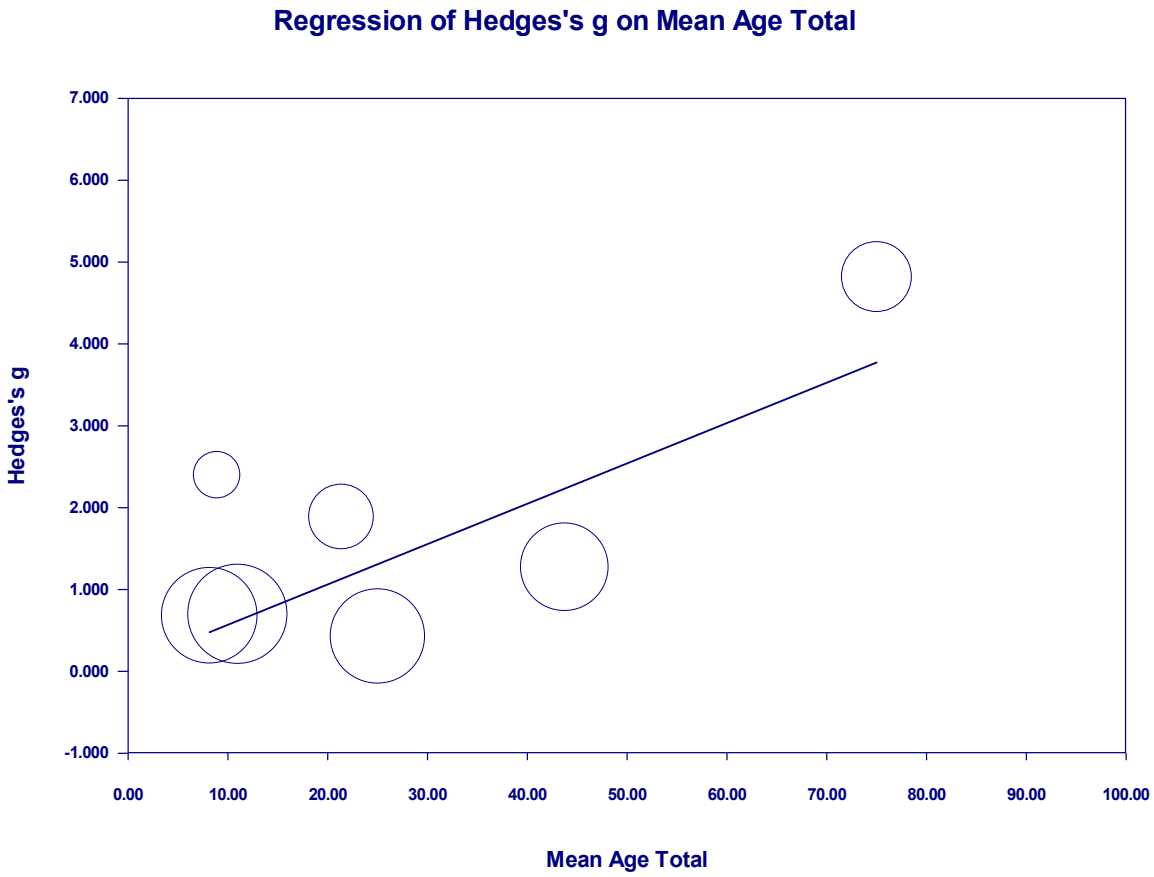


Figure 25. Treatment versus control comparison scatterplot for all measures mean age treatment group.

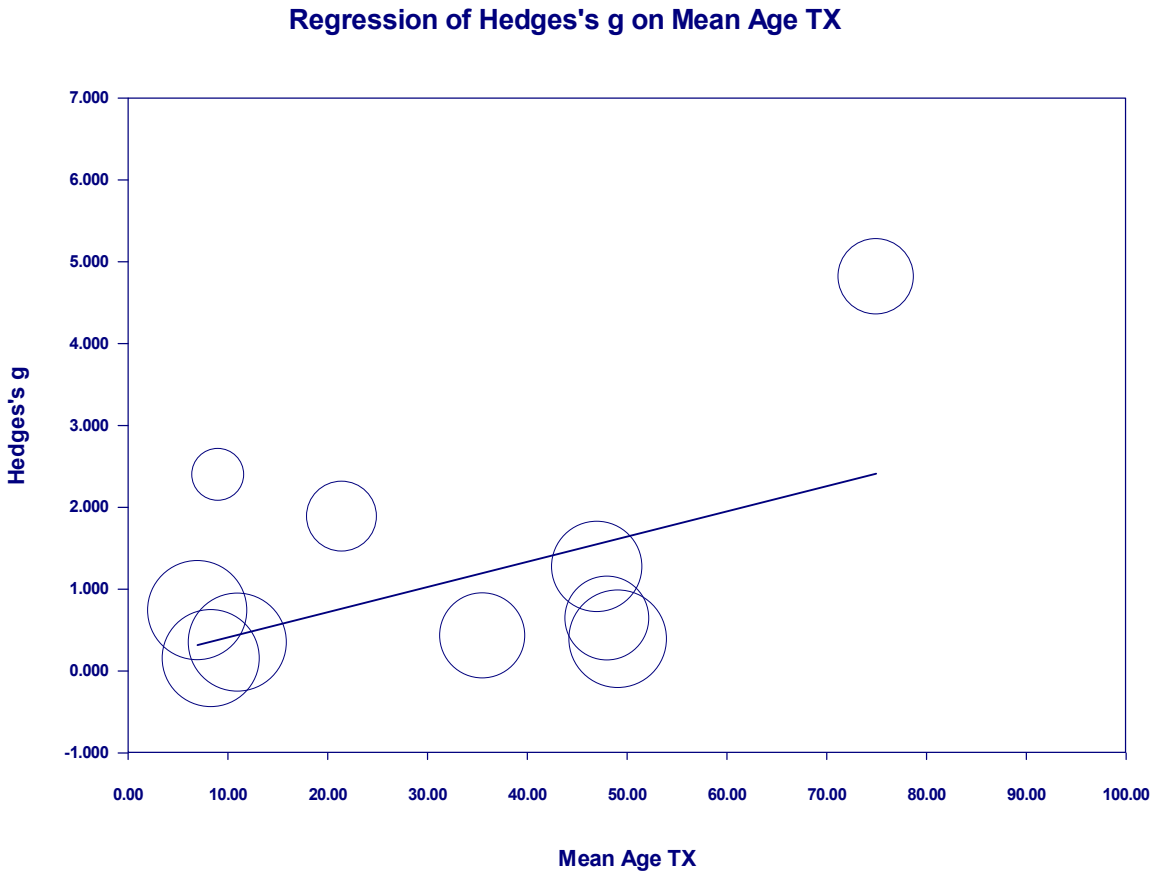


Figure 26. Treatment versus control comparison scatterplot for all measures mean age comparison group.

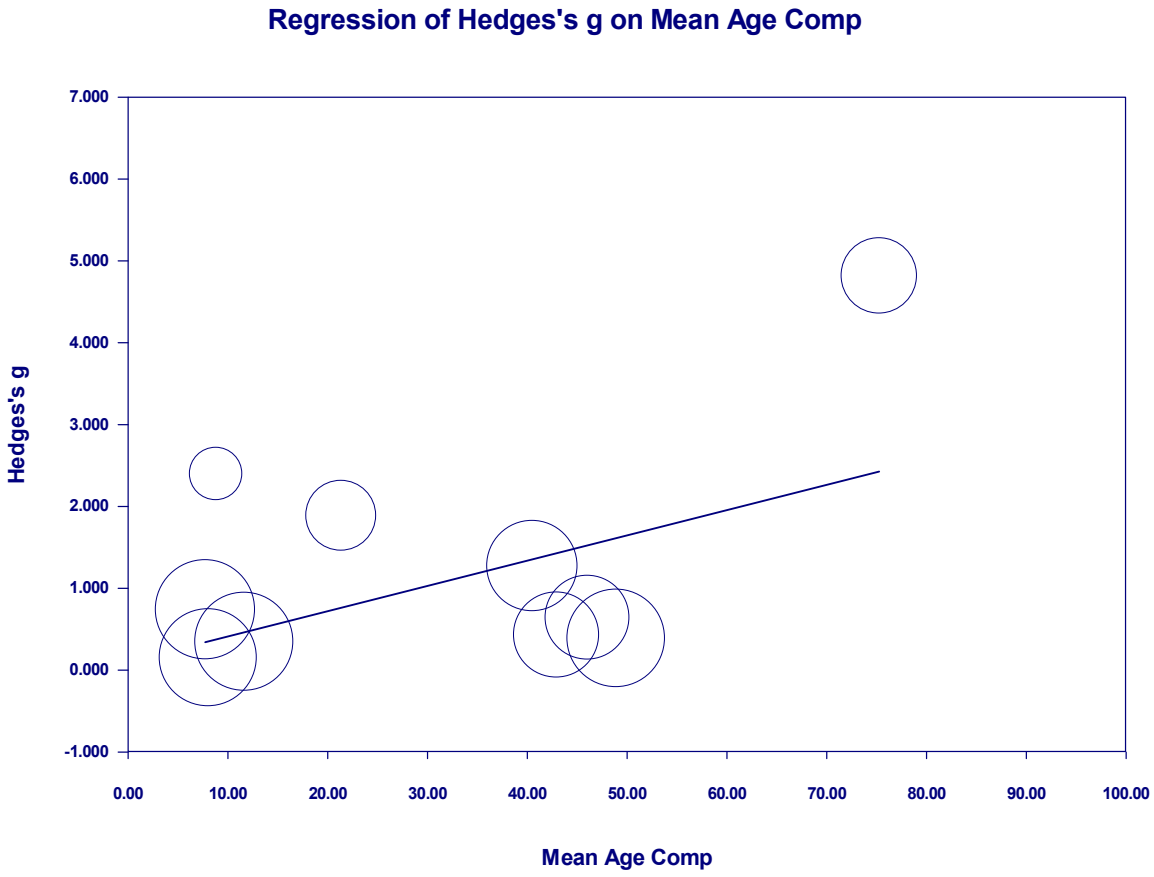
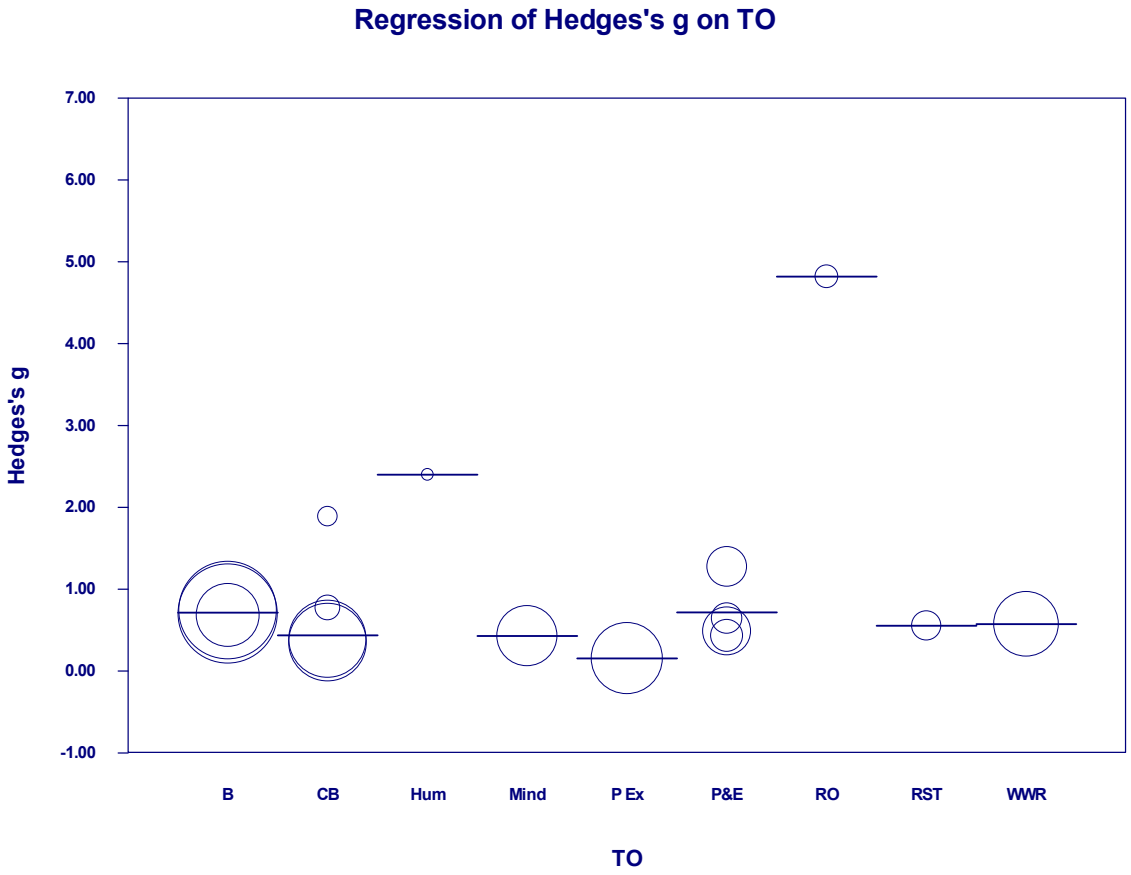


Figure 27. Treatment versus control comparison scatterplot for all measures theoretical orientation.



Note. B refers to Behaviourism
CB refers to Cognitive Behaviour
Hum refers to Humanistic
Mind refers to Mindfulness
P Ex refers to Psychoexercise
P&E refers to Psychodynamic and Experiential
RO refers to Reality Orientation
RST refers to Reading Strategies Training
WWR refers to Whole Word Reading

Figure 28. Treatment versus control comparison scatterplot for all measures duration of intervention.

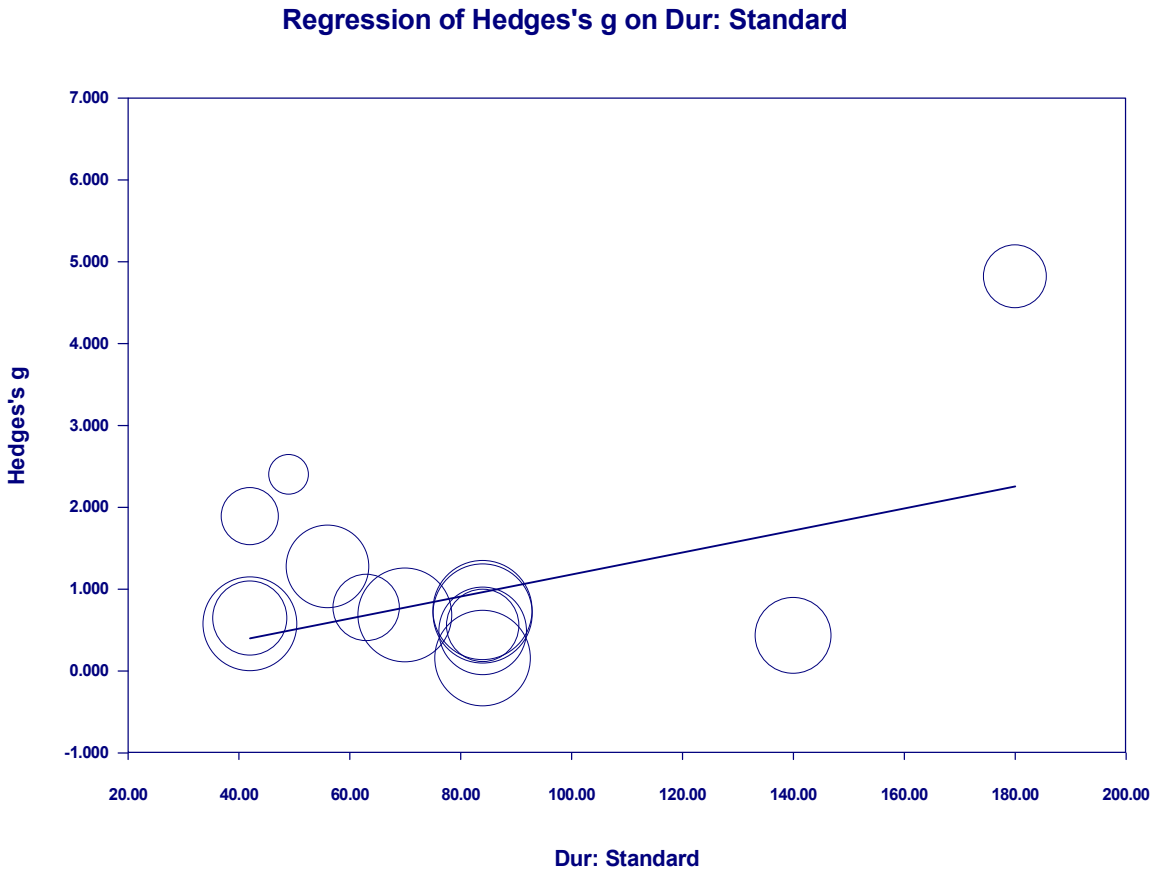


Figure 29. Pre-versus post-comparison scatterplot for autism measures publication year.

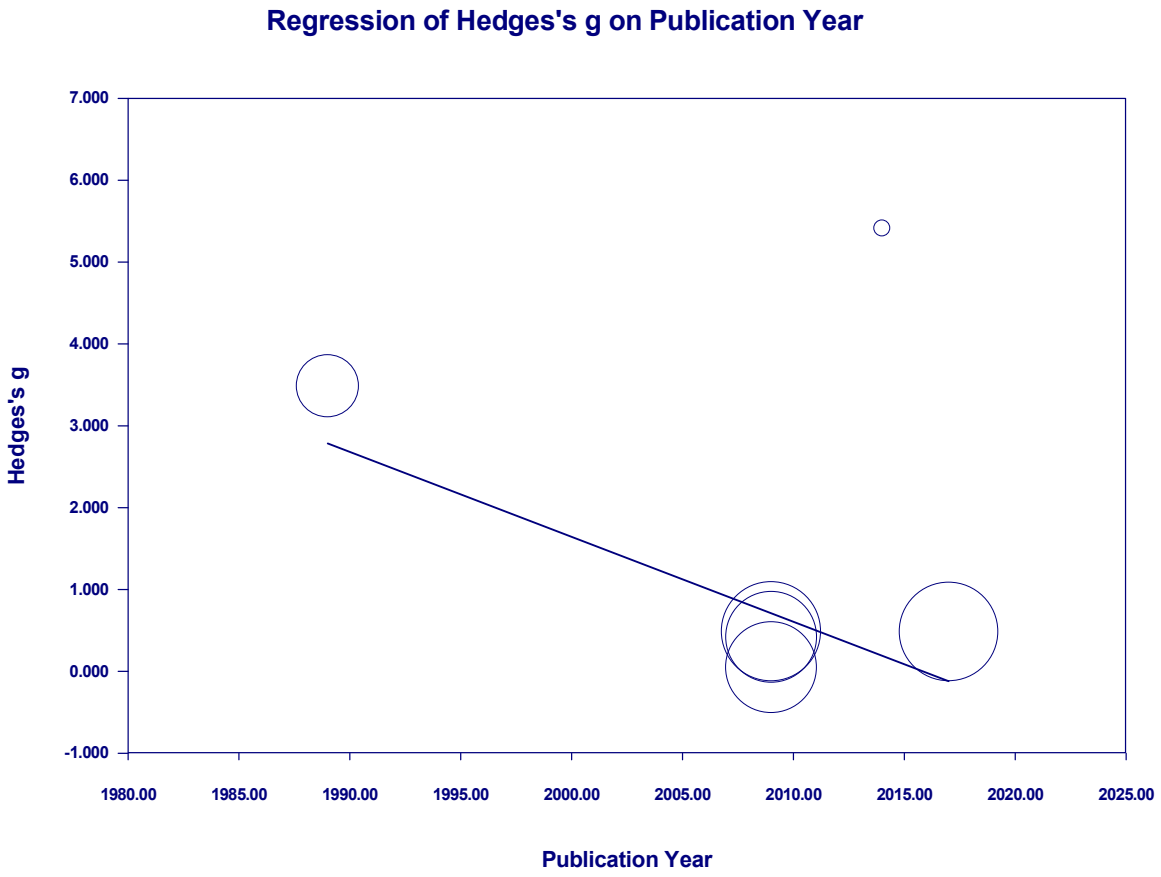


Figure 30. Pre-versus post-comparison scatterplot for autism measures % female total.

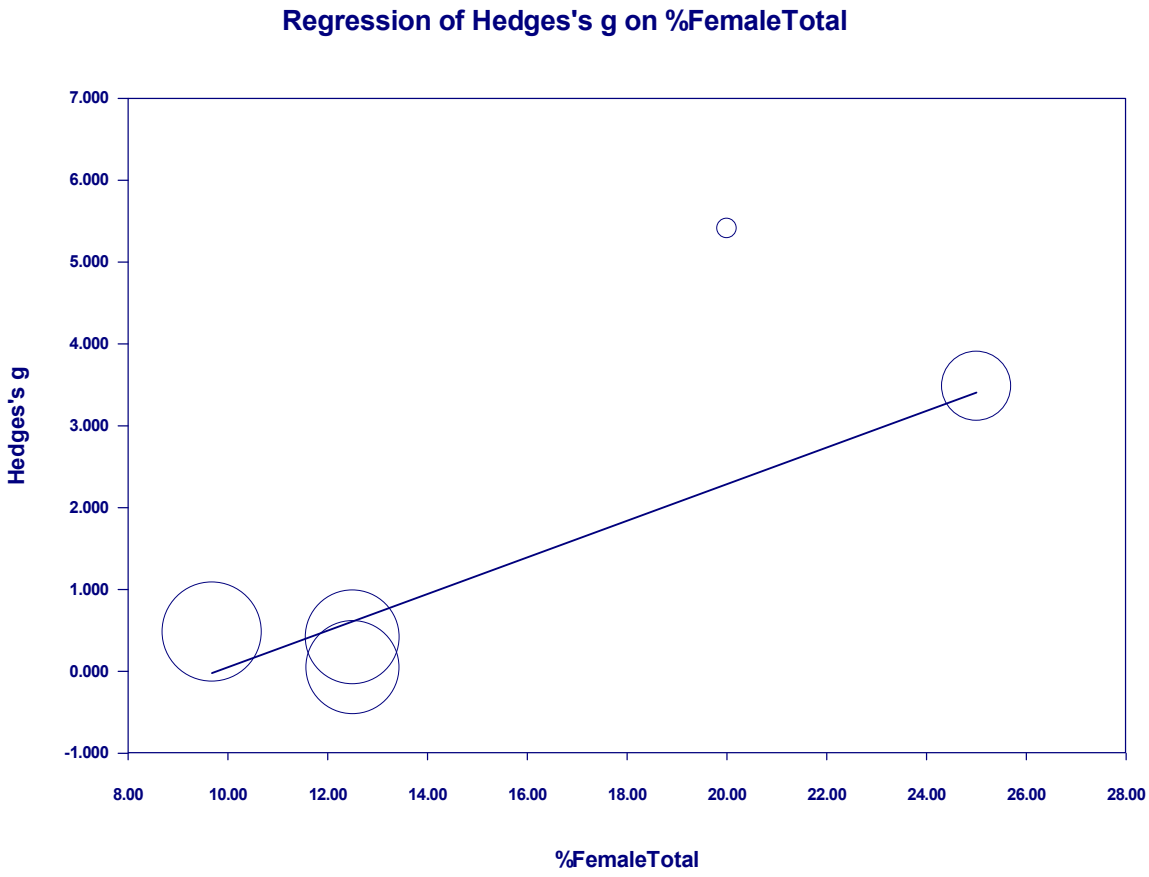


Figure 31. Pre-versus post-comparison scatterplot for autism measures treatment fidelity.

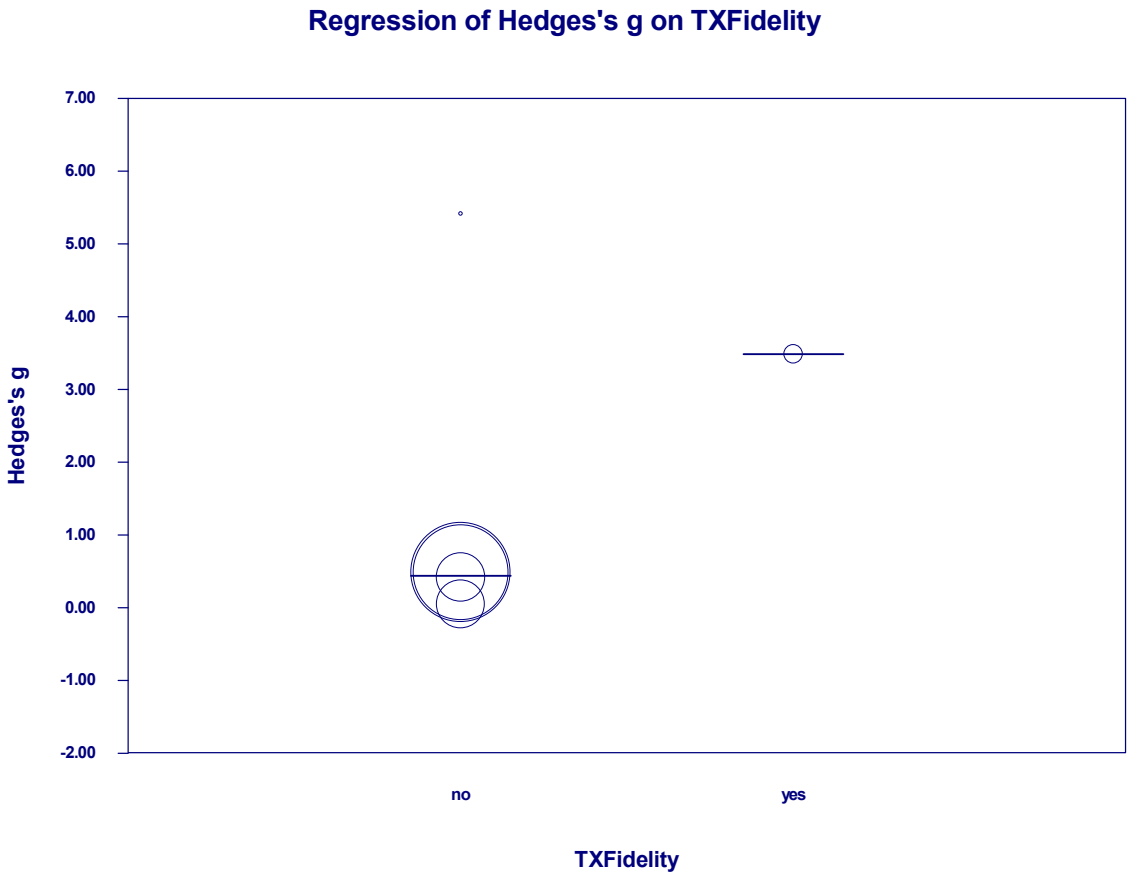


Figure 32. Pre-versus post-comparison scatterplot for autism measures manualized treatment.

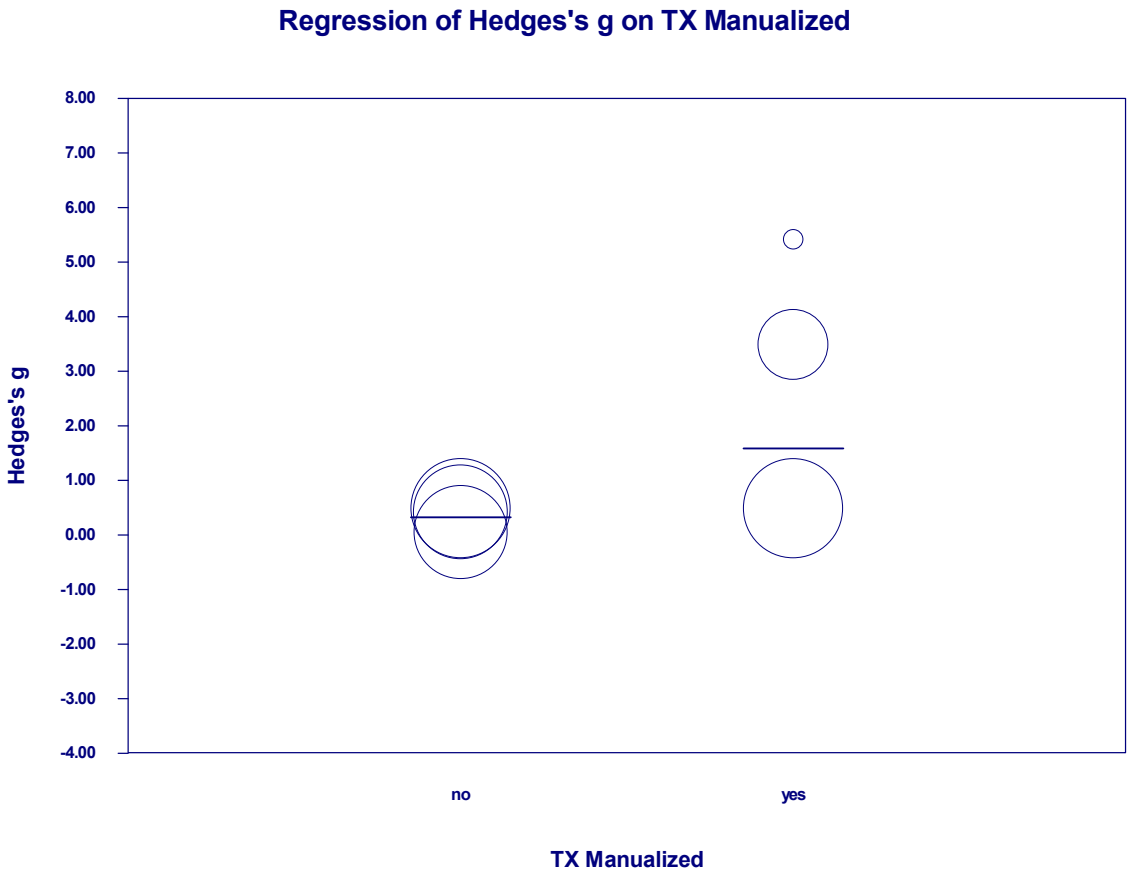


Figure 33. Pre-versus post-comparison scatterplot for autism measures total contact in hours for participants.

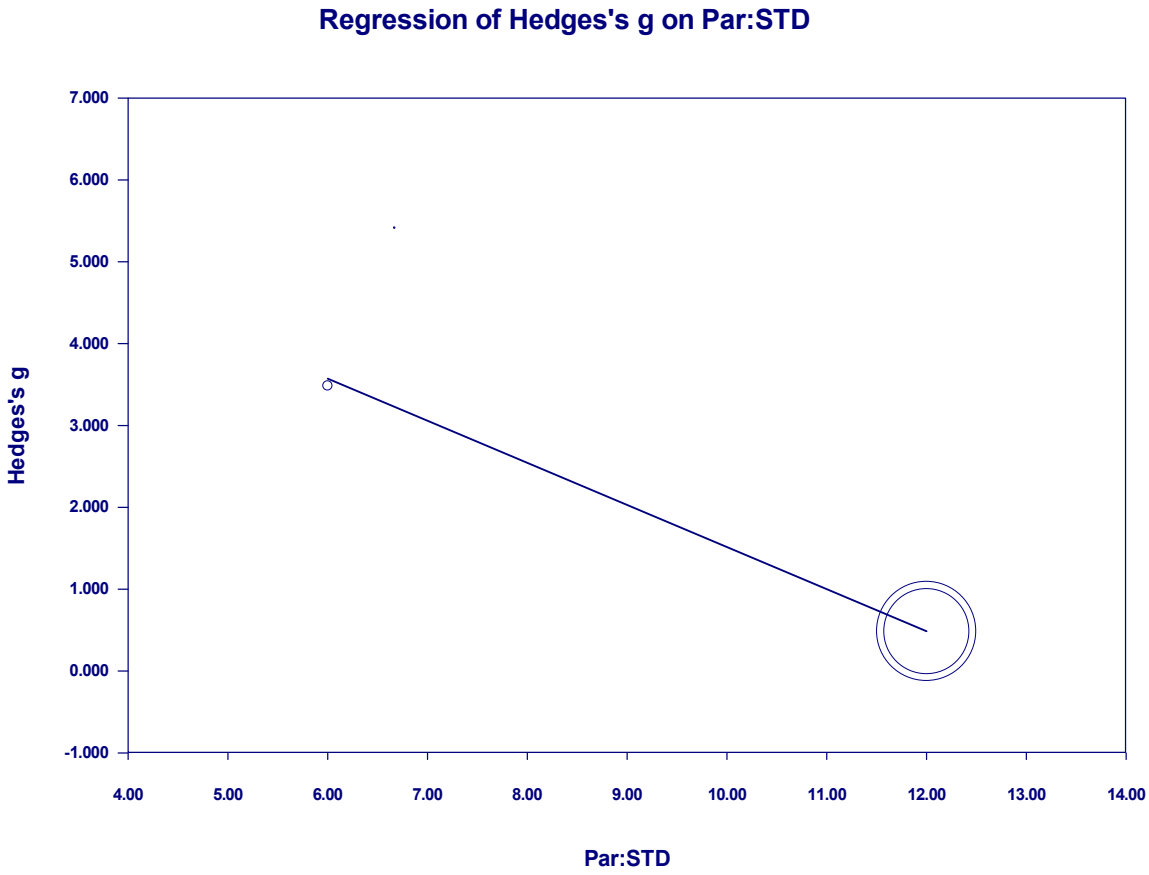


Figure 34. Pre-versus post-comparison scatterplot for autism measures provider of intervention.

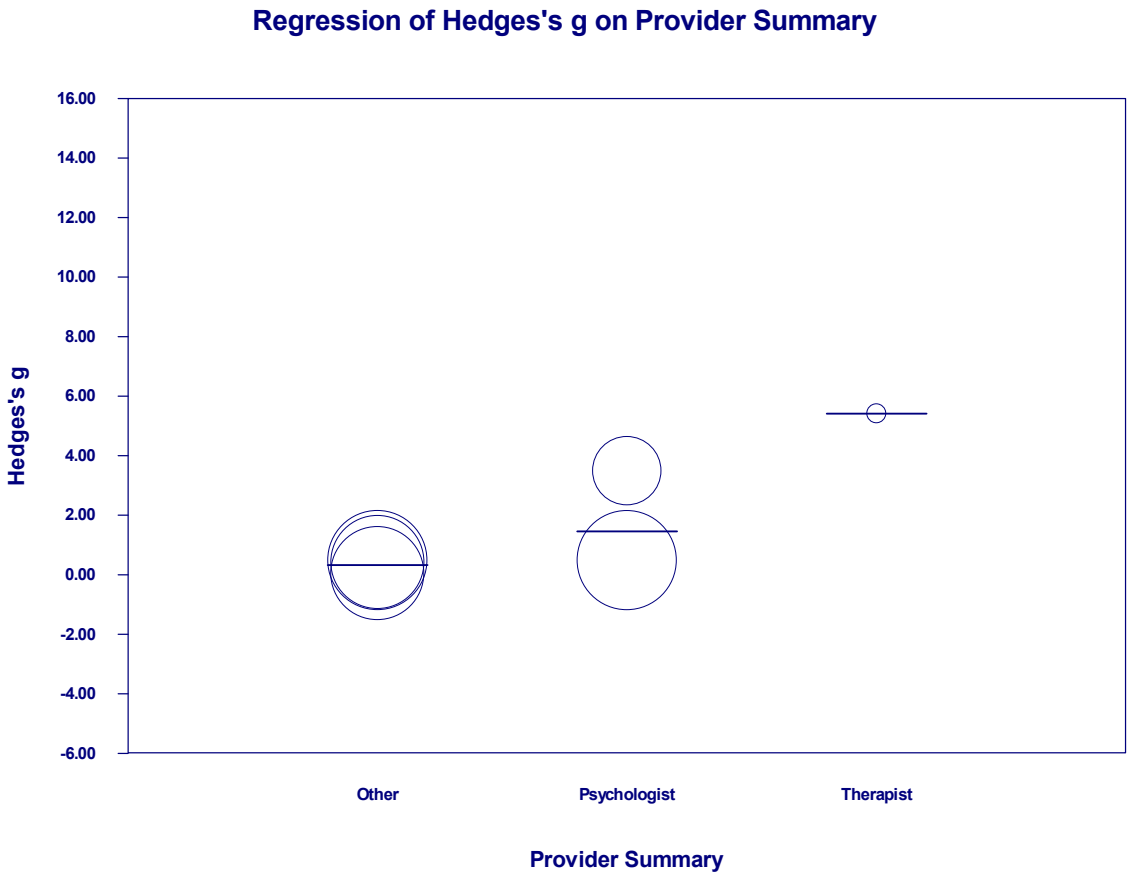


Figure 35. Pre-versus post-comparison scatterplot for autism measures provider's education level.

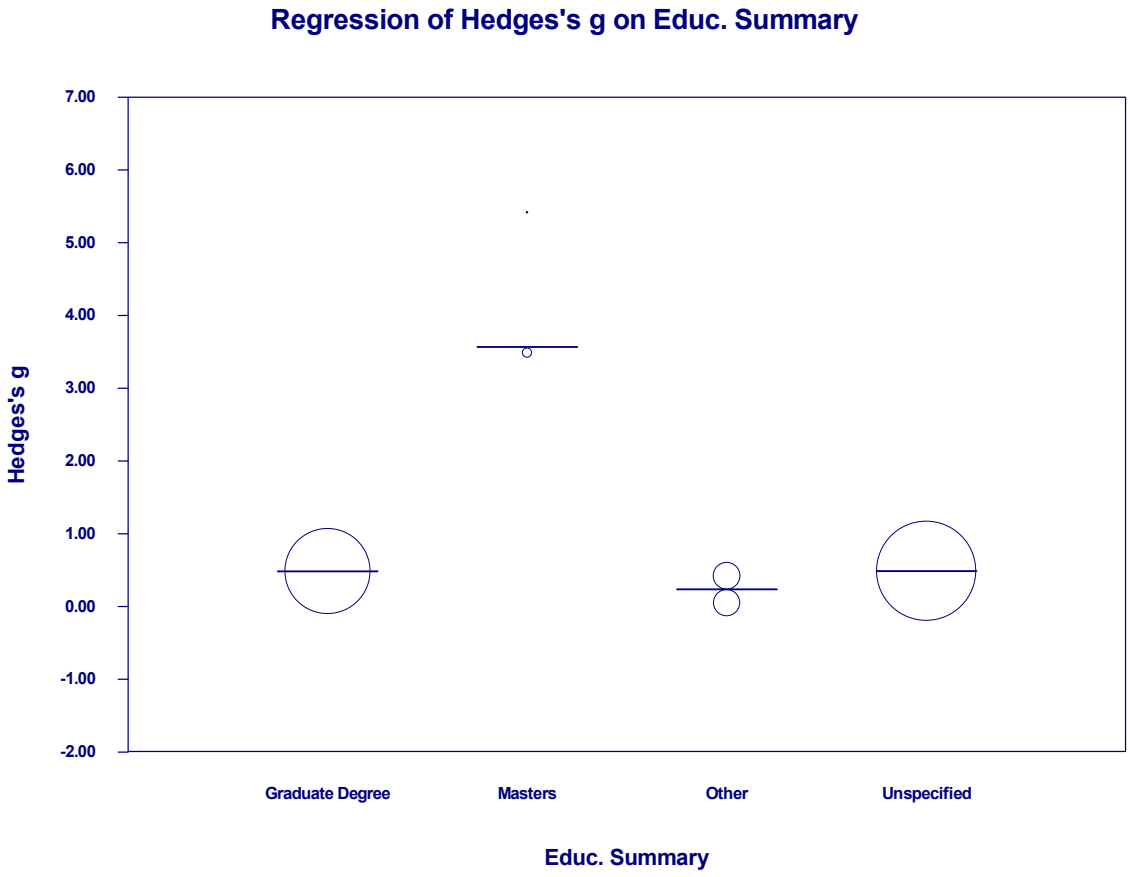


Figure 36. Pre-versus post-comparison scatterplot for trauma/PTSD measures place of study.

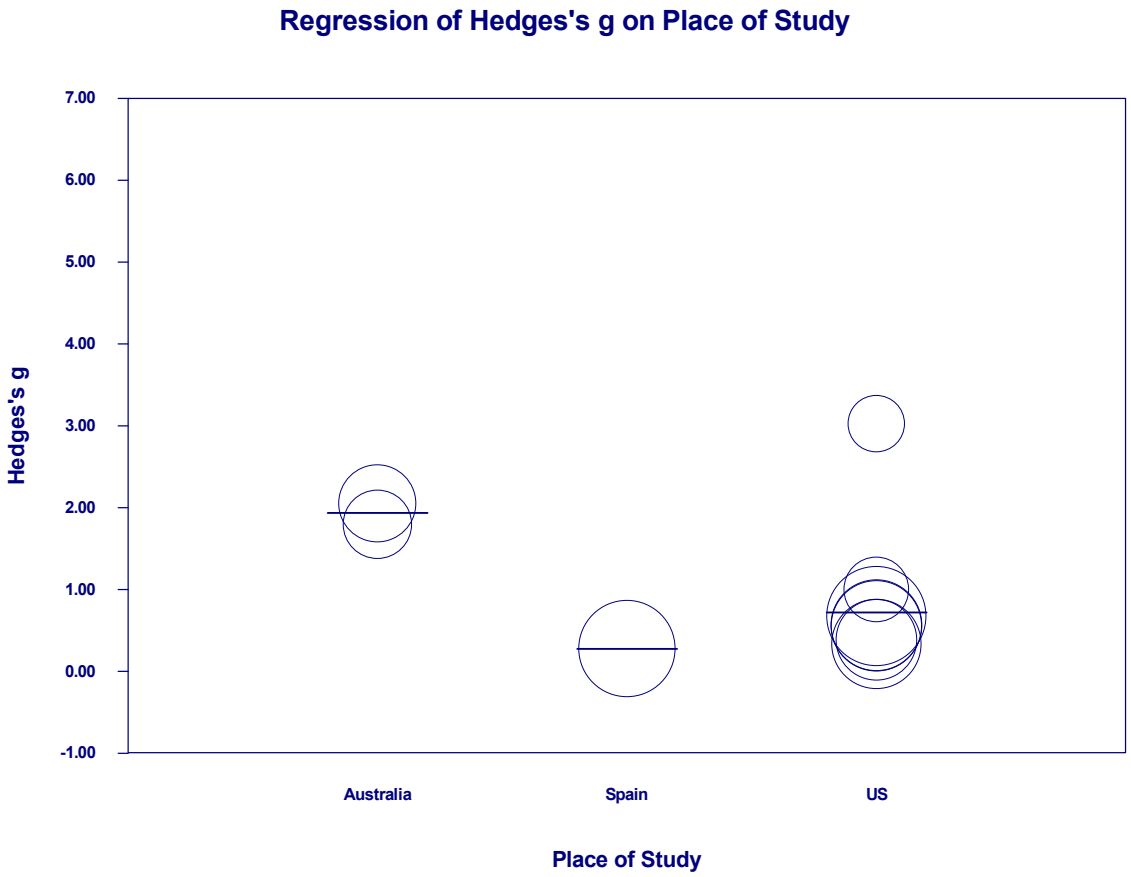


Figure 37. Pre-versus post-comparison scatterplot for trauma/PTSD measures % female total sample.

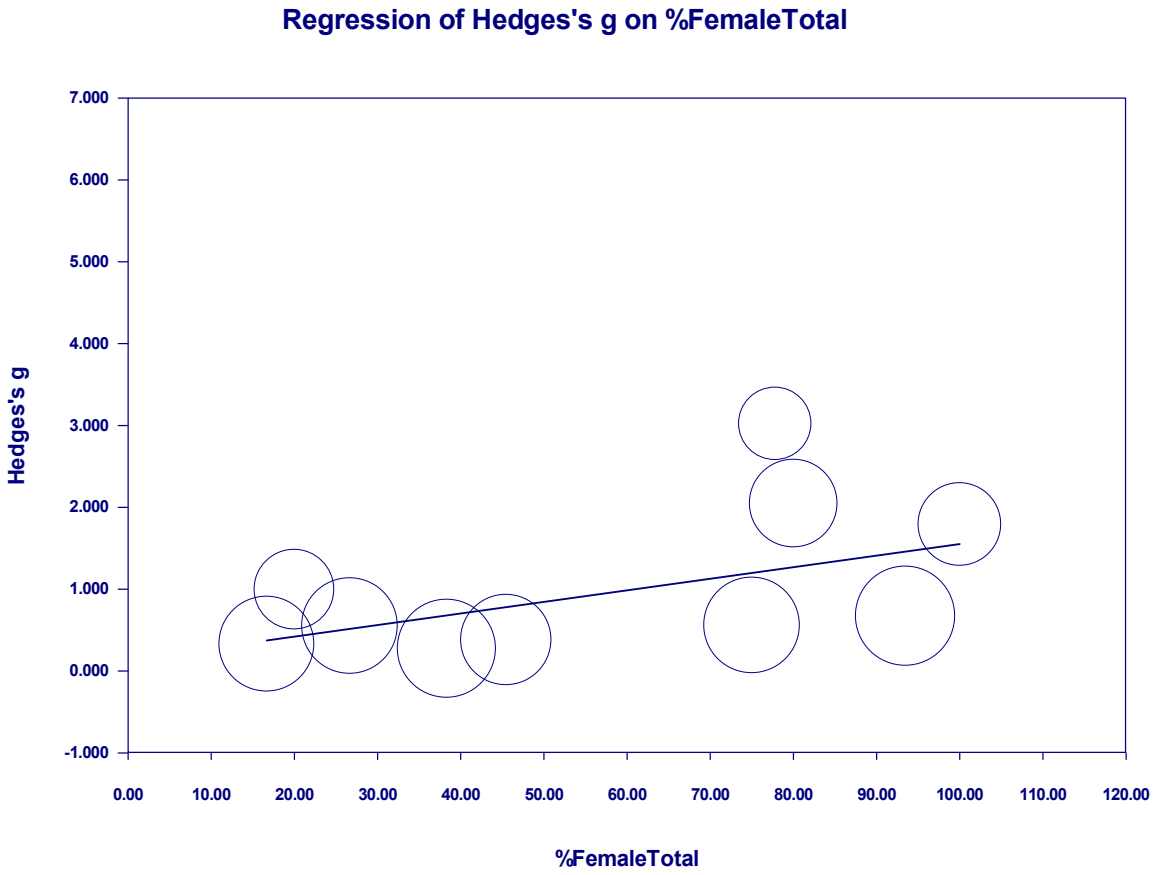


Figure 38. Pre-versus post-comparison scatterplot for trauma/PTSD measures mean age total sample.

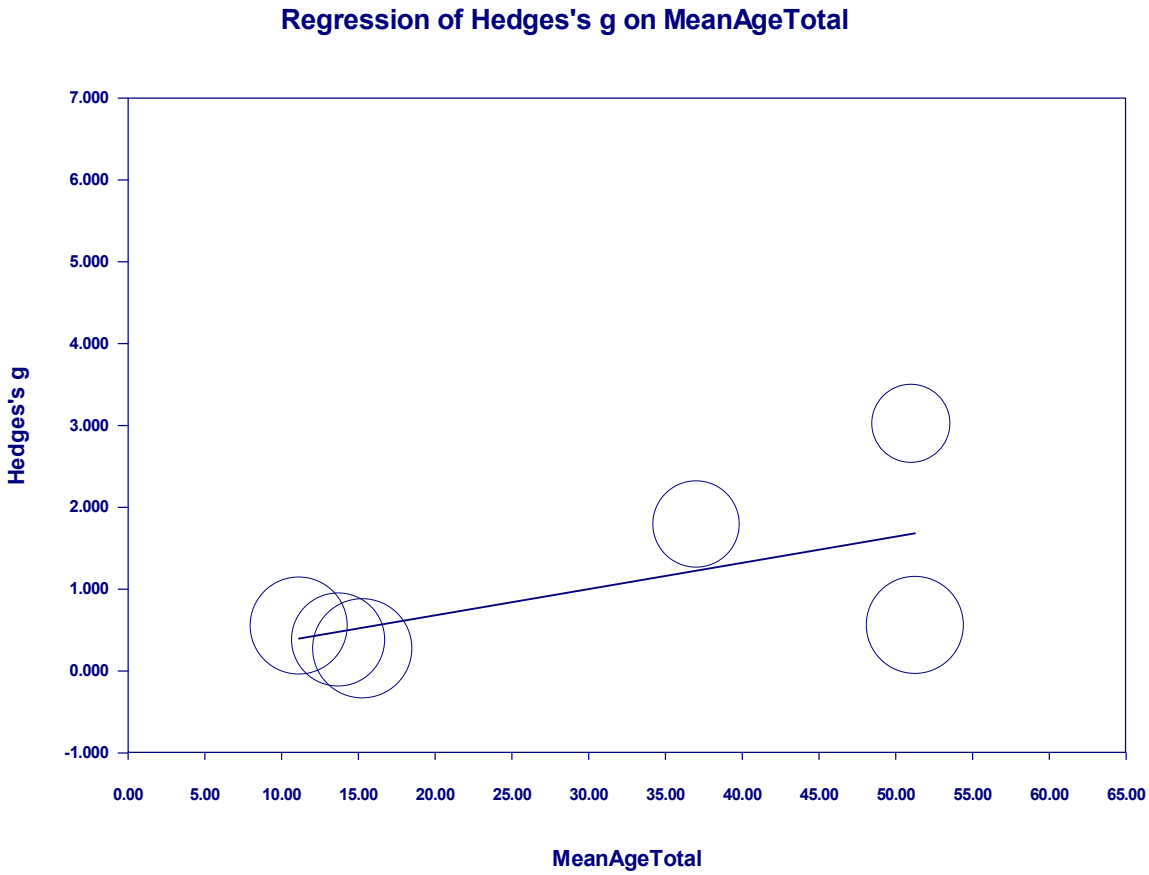


Figure 39. Pre-versus post-comparison scatterplot for trauma/PTSD measures treatment fidelity.

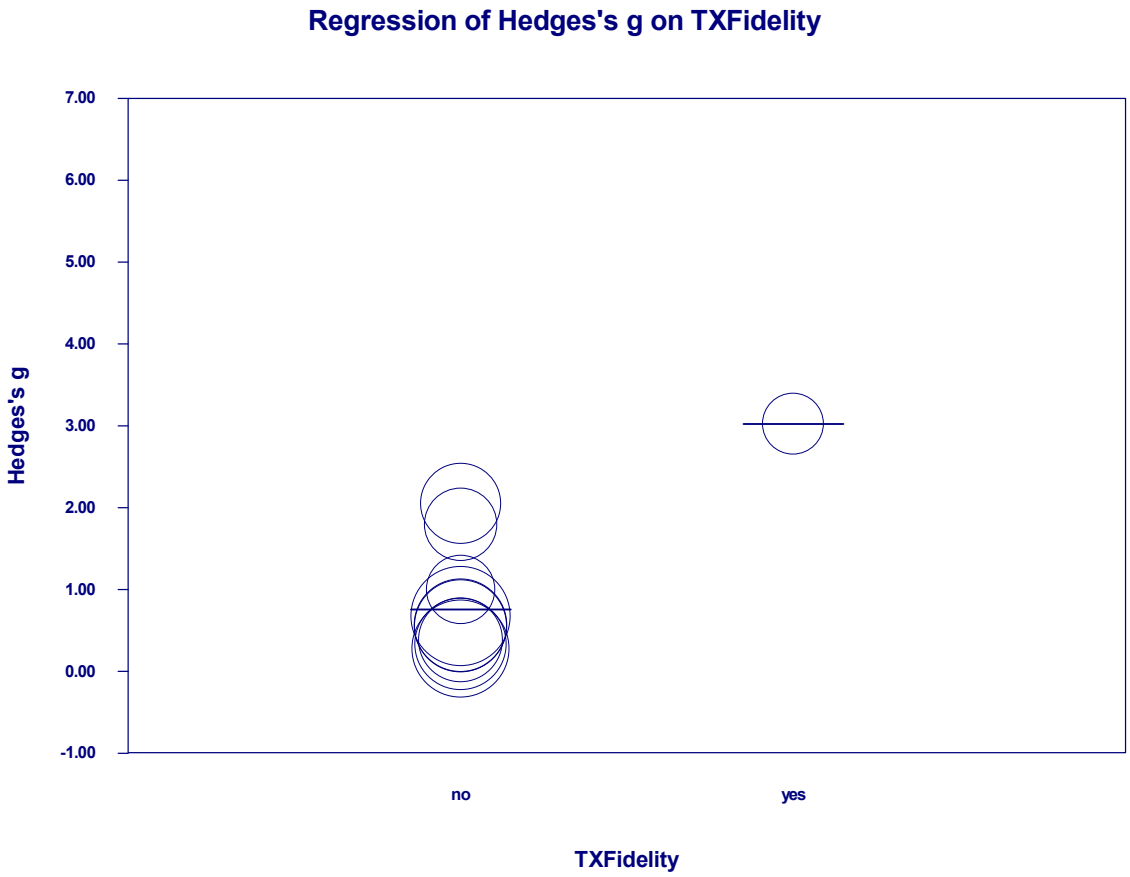


Figure 40. Pre-versus post-comparison scatterplot for trauma/PTSD measures style of intervention.

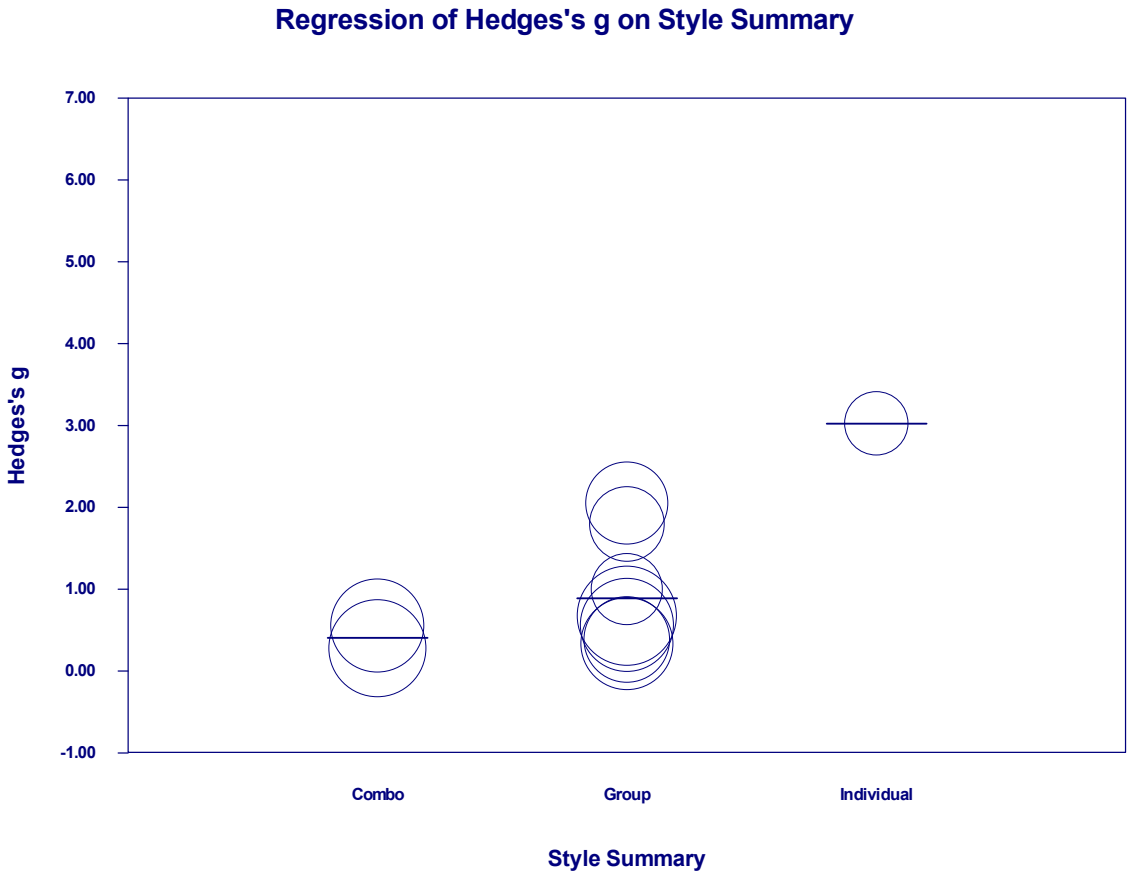


Figure 41. Pre-versus post-comparison scatterplot for trauma/PTSD measures provider education.

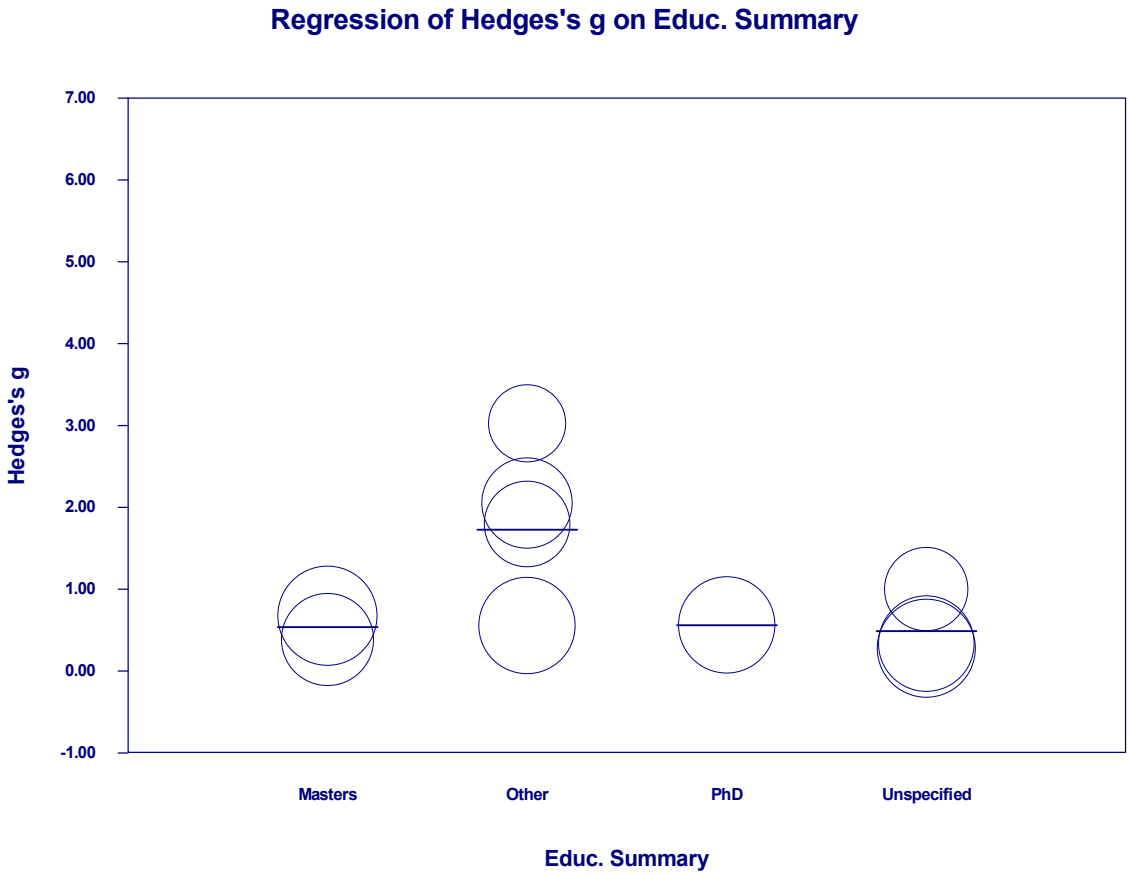


Table 1. Main effects.

Effect	No. Studies	Hedge's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Pre- versus Post Comparison All[3]	26	0.91	<.001	[0.74, 1.09]	265.20	<.001
Treatment versus Control All[4]	17	0.75	<.001	[0.51, 0.98]	75.96	<.001
Pre-versus Post Comparison ADHD[5]	3	0.86	<.001	[0.71, 1.01]	2.58	.28
Pre-versus Post Comparison Reading Disability[6]	2	1.26	.001	[0.50, 2.02]	5.80	.002
Treatment versus Control Comparison Reading Disability[7]	3	0.62	<.001	[0.36, 0.88]	0.18	.92
Treatment versus Control Comparison Anxiety[8]	3	0.83	.032	[0.07, 1.59]	4.28	.12
Pre-versus Post Comparison Autism[9]	5	0.58	<.001	[0.27, 0.89]	33.24	<.001
Treatment versus Control Comparison Autism[10]	3	0.73	<.001	[0.55, 0.91]	2.42	.30
Pre-versus Post Comparison Trauma/PTSD[11]	10	0.92	<.001	[0.65, 1.19]	88.86	<.001
Treatment versus Control Comparison Trauma/PTSD[12]	4	0.44	<.001	[0.20, 0.69]	2.153	.54

[1] *p*-value associated with effect size calculation
[2] *p*-value associated with heterogeneity calculation
[3] Studies included in the pre-versus post-comparison all measures calculation include: Alfonso et al. (2015), Balluerka et al. (2015), Bass et al. (2009), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Earles et al. (2015), Fung & Leung (2014), Jang et al. (2015), Kemp et al. (2014), Kruger (2012), McCullough (2011), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017), Redefer & Goodman (1989), Signal et al. (2013), Smith (2010), Villalta-Gil et al. (2009), Welsh (2009-Group 1), Welsh (2009-Group 2), Wharton et al. (2019), and Yoo et al. (2016).
[4] Studies included in the treatment versus control comparison calculation all measures include: Alfonso et al. (2015), Bass et al. (2009), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Fung & Leung (2014), Henry (2014), Le Roux et al. (2014), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017),Smith (2010), Villalta-Gil et al. (2009), Whittlesey-Jerome (2014), and Zents (2017).
[5] Studies included in the pre-versus post-comparison calculation attention deficit hyperactivity disorder measures include: Jang et al. (2015), Oh et al. (2018), and Yoo et al. (2016).
[6] Studies included in the pre versus post-comparison calculation reading disability measures include: Rector (2016), and Smith (2010)
[7] Studies included in the treatment versus control comparison calculation reading disability measures include: Le Roux et al. (2014), Rector (2016), and Smith (2010).
[8] Studies included in the treatment versus control comparison calculation anxiety measures include: Alfonso et al. (2015), Henry (2014), and Zents (2017).
[9] Studies included in the pre-versus post-comparison calculation autism measures include: Bass et al. (2009), Becker et al. (2017), Fung & Leung (2014), Redefer & Goodman (1989), Welsh (2009-Group 1), and Welsh (2009-Group 2).

[10] Studies included in the treatment versus control calculation autism measures include: Bass et al. (2009), Becker et al. (2017), and Fung & Leung (2014).
[11] Studies included in the pre-versus post-comparison calculation trauma/PTSD measures include: Balluerka et al. (2015), Burton et al. (2019), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014), Kruger (2012), McCullough (2011), Mueller & McCullough (2017), Signal et al. (2013), and Wharton et al. (2019).
[12] Studies included in the treatment versus control comparison calculation trauma/PTSD measures include: Burton et al. (2019), Dietz et al. (2012), Mueller & McCullough (2017), and Whittlesey-Jerome (2014),

Table 2. Pre-Versus Post-Comparison Moderator Analyses All Measures

Moderator	**No. Studies**	***Q***	***p*-value**	**R^2 (%)**
Type of Publication	25	2.54	.11	0
Publication Year	25	1.17	.28	0
Place of study	25	27.30	<.001	.17
Type of Disorder	25	42.36	<.001	.18
Theoretical Orientation	25	52.86	<.001	.21
Style of intervention	24	5.98	.054	.02
Frequency of intervention	23	9.09	.03	0
Duration of intervention	17	3.12	.08	0
Duration of each session	17	4.91	.02	0
Total contact for participants	14	1.10	.29	0
Provider of intervention	25	7.48	.59	0
Education of Provider	25	3.01	.56	0
Recruitment	25	17.06	.11	0
Species used	25	2.63	.27	0
Environment[1]	25	4.08	.54	0
Other therapy offered	24	3.91	.05	0
Treatment Fidelity	24	28.57	<.001	.21
RCT? [2]	25	0.39	.53	0
Manualized	25	5.49	.02	0
% Attrition	24	<0.001	.98	0
% Female total sample	21	9.30	.002	0
% Female tx. group[3]	19	3.87	.05	0
% Female comp. group[4]	13	3.35	.07	0
Mean age total sample	14	31.60	<.001	.16
Mean age tx group[3]	16	1.89	.17	0
Mean age comp group[4]	11	0.23	.63	0

Note. Q is the statistic used to test the significance of the meta-regression. R^2 is the proportion of variance explained by the moderator

[1]Environment refers to the physical environment where the animal-assisted psychotherapy took place
[2]*RCT* refers to randomized control trial
[3]*Tx* refers to treatment group
[4]*comp.* refers to comparison group

Table 3. Studies included in the moderator analyses Pre-Versus Post-Comparison All Measures.

Moderator	Studies Included
Style of intervention	Alfonso et al. (2015), Balluerka et al. (2015), Bass et al. (2009), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Earles et al. (2015), Fung & Leung (2014), Jang et al. (2015), Kemp et al. (2014), Kruger (2012), McCullough (2011), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017), Redefer & Goodman (1989), Signal et al. (2013), Smith (2010), Villalta-Gil et al. (2009), Welsh (2009-Group 1), Welsh (2009-Group 2), and Wharton et al. (2019)
Frequency of intervention	Alfonso et al. (2015), Balluerka et al. (2015), Bass et al. (2009), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Earles et al. (2015), Fung & Leung (2014), Jang et al. (2015), Kemp et al. (2014), Kruger (2012), McCullough (2011), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017), Signal et al. (2013), Smith (2010), Villalta-Gil et al. (2009), Welsh (2009-Group 1), Welsh (2009-Group 2), Wharton et al. (2019), and Yoo et al. (2016).
Duration of intervention	Alfonso et al. (2015), Balluerka et al. (2015), Bass et al. (2009), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Earles et al. (2015), Fung & Leung (2014), Kruger (2012), McCullough (2011), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017), Smith, (2010), Wharton et al. (2019), and Yoo et al. (2016).
Duration of each session	Bass et al. (2009), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Earles et al. (2015), Fung & Leung (2014), Jang et al. (2015), Kemp et al. (2014), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017), Redefer & Goodman (1989), Signal et al. (2013), Smith (2010), Villalta-Gil et al. (2009), and Yoo et al. (2016).
Total contact for participants	Bass et al. (2009), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Earles et al. (2015), Fung & Leung (2014), Jang et al. (2015), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Redefer & Goodman (1989), Smith (2010), Villalta-Gil et al. (2009), and Yoo et al. (2016).
Other therapy offered	Alfonso et al. (2015), Balluerka et al. (2015), Bass et al. (2009), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Earles et al. (2015), Fung & Leung (2014), Jang et al. (2015), Kemp et al. (2014), Kruger (2012), McCullough (2011), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017), Redefer & Goodman (1989), Signal et al. (2013), Smith (2010), Villalta-Gil et al. (2009), Welsh (2009-Group 1), Welsh (2009-Group 2), Wharton et al. (2019), and Yoo et al. (2016).
% Female total sample	Alfonso et al. (2015), Balluerka et al. (2015), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Earles et al. (2015), Fung & Leung (2014), Jang et al. (2015), Kemp et

	al. (2014), Kruger (2012), McCullough (2011), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Redefer & Goodman (1989), Signal et al. (2013), Welsh (2009-Group 1), Welsh (2009-Group 2), Wharton et al. (2019), and Yoo et al. (2016).
% Female tx. group[1]	Alfonso et al. (2015), Balluerka et al. (2015), Bass et al. (2009), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Earles et al. (2015), Fung & Leung (2014), Jang et al. (2015), Kemp et al. (2014), McCullough (2011), Menna et al. (2016), Oh et al. (2018), Redefer & Goodman (1989), Villalta-Gil et al. (2009), Welsh (2009-Group 1), Welsh (2009-Group 2), Wharton et al. (2019), and Yoo et al. (2016).
% Female comp. group[2]	Alfonso et al. (2015), Balluerka et al. (2015), Bass et al. (2009), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Fung & Leung (2014), McCullough (2011), Menna et al. (2016), Oh et al. (2018), Villalta-Gil et al. (2009), Welsh (2009-Group 1), and Welsh (2009-Group 2),
Mean age	Alfonso et al. (2015), Balluerka et al. (2015), Becker et al. (2017), Earles et al. (2015), Fung & Leung (2014), Jang et al. (2015), Kruger (2012), McCullough (2011), Menna et al. (2016), Signal et al. (2013), Welsh (2009-Group 1), Welsh (2009-Group 2), Wharton et al. (2019), and Yoo et al. (2016).
Mean age tx group[1]	Alfonso et al. (2015), Balluerka et al. (2015), Bass et al. (2009), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Earles et al. (2015), Fung & Leung (2014), Kemp et al. (2014), McCullough (2011), Oh et al. (2018), Redefer & Goodman (1989), Villalta-Gil et al. (2009), Welsh (2009-Group 1), Welsh (2009-Group 2), Wharton et al. (2019), and Yoo et al. (2016).
Mean age comp group[2]	Alfonso et al. (2015), Balluerka et al. (2015), Bass et al. (2009), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Fung & Leung (2014), Oh et al. (2018), Villalta-Gil et al. (2009), Welsh (2009-Group 1), Welsh (2009-Group 2).

Note. Table only displays moderator variables that did not have data from all of the studies (i.e., those that had a $k < 25$).
[1]*Tx* refers to treatment group
[2]*comp.* refers to comparison group

Table 4. Moderator effect sizes for pre-versus post comparison all measures location of study.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Australia	2	1.95	<.001	[1.56, 2.35]	7.80	<.001
Hong Kong	1	5.41	.053	[-0.08, 10.91]	<0.001	1.0
Italy	2	2.38	.19	[-1.19, 5.96]	56.33	<.001
Korea	3	0.86	<.001	[0.71, 1.01]	2.58	.28
Spain	1	0.41	.002	[0.15, 0.66]	4.91	.03
United States	15	0.75	<.001	[0.55, 0.94]	115.11	<.001

Table 5. Moderator effect sizes for pre-versus post-comparison all measures population.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Alzheimer's diesease	1	.4.23	<.001	[3.38, 5.07]	<0.001	1.00
Substance Abuse	1	0.58	.01	[0.13, 102]	<0.001	1.00
ADHD	3	0.86	<.001	[0.71, 1.01]	2.58	.28
Anxiety	1	0.68	.04	[0.05, 1.31]	<0.001	1.00
Autism	6	0.58	<.001	[0.27, 0.89]	33.24	<.001
Reading Disability	2	1.26	.001	[0.50, 2.02]	5.80	.02
Schizophrenia	1	0.53	<.001	[0.38, 0.69]	<0.001	1.00
Trauma/PTSD	10	0.91	<.001	[0.62, 1.20]	96.54	<.001

Table 6. Moderator effect sizes for pre-versus post-comparison all measures theoretical orientation.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Attachment	1	0.28	.001	[0.11, 0.44]	<0.001	1.00
Behavioural	6	0.59	<.001	[0.33, 0.85]	36.83	<.001
Bilateral Stimulation	1	0.55	<.001	[0.27, 0.84]	<0.001	1.00
Cognitive Behavioural	4	0.92	<.001	[0.54, 1.30]	29.87	<.001
Combo	1	0.38	.09	[-0.06, 0.82]	<0.001	1.0
Mindfulness	1	0.56	<.001	[0.28, 0.84]	<0.001	1.00
Psychoanalytic and Experiential	5	1.13	.002	[0.42, 1.84]	43.14	<.001
Psychoexercise	2	.93	<.001	[0.76, 1.11]	.89	.35
Play Therapy	1	5.41	.053	[-0.08, 10.91]	<0.001	1.00
Reality Orientation	1	4.23	<.001	[3.38, 5.07]	<0.001	1.00
Reading Strategies Training	1	0.84	.003	[0.29, 1.39]	<0.001	1.00
Whole Word Reading	1	1.62	<.001	[1.30, 1.93]	<0.001	1.00

Table 7. Moderator effect sizes for pre-versus post-comparison all measures treatment fidelity.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
No	22	0.81	<.001	[0.64, 0.98]	25.82	<.001
Yes	2	3.20	<.001	[2.49, 3.90]	8.91	<.001

Table 8. Moderator effect sizes for pre-versus post-comparison all measures treatment manualized.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
No	10	0.66	<.001	[0.40, 0.92]	67.05	<.001
Yes	15	1.11	<.001	[0.87, 1.35]	175.29	<.001

Table 9. Moderator effect sizes for pre-versus post-comparison all measures intervention frequency.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Biweekly	4	0.64	<.001	[0.35, 0.92]	30.01	<.001
Blank	2	2.02	.15	[-0.74, 4.77]	22.67	<.001
Once	2	0.24	.20	[-0.13, 0.60]	1.51	.22
Triweekly	1	5.41	.053	[-0.08, 10.92]	<0.001	1.00
Weekly	16	1.09	<.001	[0.81, 1.37]	198.13	<.001

Table 10. Moderator effect sizes for pre-versus post-comparison all measures other therapy.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
No	15	.1.18	<.001	[0.87, 1.49]	167.10	<.001
Yes	9	0.69	<.001	[0.47, 0.91]	61.15	<.001

Table 11. Treatment versus control comparison moderator analyses all measures

Moderator	**No. Studies**	***Q***	***p*-value**	**R^2 (%)**
Type of Publication	17	0.73	.39	0
Publication Year	17	0.26	.61	0
Place of study	17	14.67	.01	.05
Type of Disorder	17	52.70	<.001	.84
Theoretical Orientation	17	62.07	<.001	.96
Style of intervention	17	2.53	.11	0
Frequency of intervention	16	4.89	.09	.08
Duration of intervention	14	7.52	.006	.05
Duration of each session	17	0.87	.35	0
Total contact for participants	13	0.03	.87	0
Provider of intervention	17	1.99	.96	0
Education of Provider	17	1.04	.79	0
Recruitment	17	11.19	.26	0
Species used	17	0.05	.83	0
Environment[1]	17	4.28	.37	0
Other therapy offered	17	0.34	.56	0
Treatment Fidelity	17	1.25	.26	0
RCT?[2]	17	1.90	.17	0
Manualized	17	0.18	.67	0
% Attrition	17	1.32	.25	0
% Female total sample	11	2.55	.11	0
% Female tx. group[3]	12	0.74	.39	0
% Female comp. group[4]	12	2.31	.13	0
Mean age total sample	7	14.61	<.001	.43
Mean age tx. group[3]	10	7.23	.007	0
Mean age comp. group[4]	10	6.98	.008	0

Note. Q is the statistic used to test the significance of the meta-regression. R^2 is the proportion of variance explained by the moderator

[1]Environment refers to the physical environment where the animal-assisted psychotherapy took place
[2]*RCT* refers to randomized control trial
[3]*Tx* refers to treatment group
[4]*comp.* refers to comparison group

Table 12. Studies included in the moderator analyses treatment versus control comparisons all measures.

Moderator	Studies Included
Frequency of intervention	Alfonso et al. (2015), Bass et al. (2009), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Fung & Leung (2014), Henry (2014), Le Roux et al. (2014), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017),Smith (2010), Villalta-Gil et al. (2009), Whittlesey-Jerome (2014), and Zents (2017).
Duration of intervention	Alfonso et al. (2015), Bass et al. (2009), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Fung & Leung (2014), Henry (2014), Le Roux et al. (2014), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017),Smith (2010), Whittlesey-Jerome (2014), and Zents (2017).
% Female total sample	Alfonso et al. (2015), Becker et al. (2017), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Fung & Leung (2014), Henry (2014), Menna et al. (2016), Mueller & McCullough (2017), Oh et al. (2018), Rector (2017), Whittlesey-Jerome (2014).
% Female tx. group[1]	Alfonso et al. (2015), Bass et al. (2009), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Fung & Leung (2014), Henry (2014), Menna et al. (2016), Oh et al. (2018), Villalta-Gil et al. (2009), Whittlesey-Jerome (2014), and Zents (2017).
% Female comp. group[2]	Alfonso et al. (2015), Bass et al. (2009), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Fung & Leung (2014), Henry (2014), Menna et al. (2016), Oh et al. (2018), Villalta-Gil et al. (2009), Whittlesey-Jerome (2014), and Zents (2017).
Mean age total sample	Alfonso et al. (2015), Becker et al. (2017), Fung & Leung (2014), Henry (2014), Le Roux et al. (2014), Menna et al. (2016), and Whittlesey-Jerome (2014).
Mean age tx group[1]	Alfonso et al. (2015), Bass et al. (2009), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Fung & Leung (2014), Menna et al. (2016), Oh et al. (2018), Villalta-Gil et al. (2009), Whittlesey-Jerome (2014),
Mean age comp group$_2$	Alfonso et al. (2015), Bass et al. (2009), Burton et al. (2019), Contralbrigo et al. (2017), Dietz et al. (2012), Fung & Leung (2014), Menna et al. (2016), Oh et al. (2018), Villalta-Gil et al. (2009), Whittlesey-Jerome (2014),

Note. Table only displays moderator variables that did not have data from all of the studies (i.e., those that had a $k < 17$).
[1]*Tx* refers to treatment group
[2]*comp.* refers to comparison group

Table 13. Moderator effect sizes for treatment versus control comparison all measures location of study.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Africa	1	0.68	.001	[0.29, 1.07]	<0.001	1.00
Hong Kong	1	2.40	.03	[0.26, 4.54]	<0.001	1.00
Italy	2	2.61	.24	[-1.69, 6.91]	36.71	<.001
Korean	1	0.16	.37	[-0.19, 0.50]	<0.001	1.0
Spain	1	0.39	.01	[0.09, 0.70]	<0.001	1.00
United States	11	0.64	<.001	[0.49, 0.79]	13.18	.21

Table 14. Moderator effect sizes for treatment versus control comparison all measures population.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Alzheimer's Diesease	1	4.82	<.001	[3.66, 5.98]	<0.001	1.00
ADHD	1	0.16	.37	[-0.19, 0.50]	<0.001	1.00
Anxiety	3	0.83	.03	[0.07, 1.59]	4.28	.12
Autism	3	0.73	<.001	[0.55, 0.91]	2.42	.30
Reading Disability	3	0.62	<.001	[0.36, 0.88]	0.18	.92
Schizophrenia	1	0.39	.01	[0.09, 0.70]	<0.001	1.00
Substance Use Disorder	1	0.43	.30	[-0.39, 1.25]	<0.001	1.00
trauma/PTSD	4	0.63	.002	[0.23, 1.03]	6.49	.09

Table 15. Moderator effect sizes for treatment versus control-comparison all measures theoretical orientation.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Behavioural	3	0.72	<.001	[0.57, 0.86]	0.10	.95
Cognitive Behavioural	4	0.49	.004	[0.16, 0.83]	5.27	.15
Humanistic	1	2.4	.03	[0.26, 4.54]	<0.001	1.00
Mindfulness	1	0.43	.04	[0.02, 0.85]	<0.001	1.00
Psychoexercise	4	0.16	.37	[-0.19, 0.50]	4.04	.26
Psychoanalytic and Experiential	1	0.72	<.001	[0.32, 1.12]	<0.001	1.00
Reality Orientation	1	4.82	<.001	[3.66, 5.98]	<0.001	1.00
Reading Strategies Training	1	0.55	.23	[-0.34, 1.45]	<0.001	1.00
Whole Word Reading	1	0.57	.003	[0.19, 0.96]	<0.001	1.00

Table 16. Pre-versus post-comparison moderator analyses autism measures

Moderator	**No. Studies**	***Q***	***p*-value**	**R^2 (%)**
Type of Publication	6	2.92	.09	0
Publication Year	6	10.69	.001	0
Place of study	6	2.96	.09	.07
Theoretical Orientation	6	2.96	.09	.07
Style of intervention	6	0.53	.47	0
Frequency of intervention	5	5.61	.06	1.00
Total contact for participants	4	28.23	<.001	1.00
Provider of intervention	6	6.58	.04	0
Education of Provider	6	31.27	<.001	1.00
Recruitment	6	4.79	.19	0
Species used	6	0.32	.57	0
Environment[1]	6	2.25	.13	0
Other therapy offered	6	0.77	.68	0
Treatment Fidelity	6	25.61	<.001	.89
Manualized	6	4.65	.03	0
% Attrition	6	0.32	.57	0
% Female total sample	5	12.68	<.001	.10
% Female tx. group[2]	4	2.05	.15	0
% Female comp. group[3]	4	0.53	.47	0
Mean age total sample	4	0.34	.56	0
Mean age tx. group[2]	4	1.72	.19	0
Mean age comp. group[3]	4	0.98	.32	0

Note. Q is the statistic used to test the significance of the meta-regression. R^2 is the proportion of variance explained by the moderator

[1]Environment refers to the physical environment where the animal-assisted psychotherapy took place

[2]*Tx* refers to treatment group

[3]*comp.* refers to comparison group

Table 17. Studies included in the moderator analyses pre-versus post-comparison autism measures.

Moderator	Studies Included
Frequency of intervention	Bass et al. (2009), Becker et al. (2017), Fung & Leung (2014), Welsh (2009-Group 1), and Welsh (2009-Group 2).
Total contact for participants	Bass et al. (2009), Becker et al. (2017), Fung & Leung (2014), and Redefer & Goodman (1989).
% Female total sample	Becker et al. (2017), Fung & Leung (2014), Redefer & Goodman (1989), Welsh (2009-Group 1), and Welsh (2009-Group 2).
% Female tx. group[1]	Bass et al. (2009), Fung & Leung (2014), Welsh (2009-Group 1), and Welsh (2009-Group 2).
% Female comp. group[2]	Bass et al. (2009), Fung & Leung (2014), Redefer & Goodman (1989), Welsh (2009-Group 1), and Welsh (2009-Group 2).
Mean age total sample	Becker et al. (2017), Fung & Leung (2014), Welsh (2009-Group 1), and Welsh (2009-Group 2).
Mean age tx group[1]	4 Bass et al. (2009), Fung & Leung (2014), Redefer & Goodman (1989), Welsh (2009-Group 1), and Welsh (2009-Group 2)
Mean age comp group[2]	Bass et al. (2009), Fung & Leung (2014), Redefer & Goodman (1989), Welsh (2009-Group 1), and Welsh (2009-Group 2).

Note. Table only displays moderator variables that did not have data from all of the studies (i.e., those that had a $k < 6$).
[1]*Tx* refers to treatment group
[2]*comp.* refers to comparison group

Table 18. Moderator effect sizes for pre-versus post-comparison autism measures treatment fidelity.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
No	5	0.44	<.001	[0.30, 0.59]	7.12	.13
Yes	1	3.49	<.001	[2.33, 4.64]	<0.001	1.00

Table 19. Moderator effect sizes for pre-versus post-comparison autism measures manualization.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
No	3	0.38	.002	[0.14, 0.62]	3.90	.14
Yes	3	2.48	.08	[-0.26, 5.23]	28.68	<.001

Table 20. Moderator effect sizes for pre-versus post-comparison autism measures provider.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Other	3	0.38	.002	[0.14, 0.62]	3.90	.14
Psychologist	2	1.93	.20	[-1.01, 4.87]	25.64	<.001
Therapist	1	5.41	.053	[-0.08, 10.91]	<0.001	1.00

Table 21. Moderator effect sizes for pre-versus post-comparison autism measures provider education.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Graduate	1	0.48	<.001	[0.35, 0.62]	<0.001	1.00
Master's	2	3.57	<.001	[2.44, 4.70]	0.45	.50
Other	2	0.24	.20	[-0.13, 0.60]	1.51	.22
Unspecified	1	0.49	<.001	[0.37, 0.60]	<0.001	1.00

Table 22. Pre-versus post-comparison moderator analyses trauma/PTSD measures

Moderator	**No. Studies**	***Q***	***p*-value**	**R^2 (%)**
Type of Publication	10	2.21	.14	0
Publication Year	10	2.05	.15	0
Place of study	10	17.21	<.001	.45
Theoretical Orientation	10	2.25	.81	0
Style of intervention	10	16.31	<.001	.20
Frequency of intervention	9	1.45	.23	0
Duration of intervention	7	0.03	.87	0
Duration of each session	5	2.25	.13	.45
Provider of intervention	10	7.25	.20	0
Education of Provider	10	9.23	.03	0
Recruitment	10	6.80	.24	0
Species used	10	1.70	.43	0
Environment[1]	10	2.61	.62	0
Other therapy offered	10	0.40	.53	0
Treatment Fidelity	10	15.00	<.001	.30
Manualized	10	0.63	.43	0
% Attrition	10	1.77	.18	0
% Female total sample	10	6.13	.01	0
% Female tx. group[2]	7	0.14	.71	0
% Female comp. group[3]	4	0.75	.39	.32
Mean age total sample	6	4.85	.03	0
Mean age tx. group[2]	7	74.1.67	.20	0

Note. Q is the statistic used to test the significance of the meta-regression. R^2 is the proportion of variance explained by the moderator

[1]Environment refers to the physical environment where the animal-assisted psychotherapy took place

[2]*Tx* refers to treatment group

[3]*comp.* refers to comparison group

Table 23. Studies included in the moderator analyses pre-versus post-comparison trauma/PTSD measures.

Moderator	Studies Included
Frequency of intervention	Balluerka et al. (2015), Burton et al. (2019), Earles et al. (2015), Kemp et al. (2014), Kruger (2012), McCullough (2011), Mueller & McCullough (2017), Signal et al. (2013), and Wharton et al. (2019).
Duration of intervention	Balluerka et al. (2015), Burton et al. (2019), Earles et al. (2015), Kruger (2012), McCullough (2011), Mueller & McCullough (2017), and Wharton et al. (2019).
Duration of each session	Balluerka et al. (2015), Burton et al. (2019), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014), Kruger (2012), McCullough (2011), Mueller & McCullough (2017), Signal et al. (2013), and Wharton et al. (2019).
% Female tx. group[1]	Balluerka et al. (2015), Burton et al. (2019), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014), McCullough (2011), and Wharton et al. (2019).
% Female comp. group[2]	Balluerka et al. (2015), Burton et al. (2019), Dietz et al. (2012), and McCullough (2011).
Mean age	Balluerka et al. (2015), Earles et al. (2015), Kruger (2012), McCullough (2011), Signal et al. (2013), and Wharton et al. (2019).
Mean age tx group[1]	Balluerka et al. (2015), Burton et al. (2019), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014), McCullough (2011), and Wharton et al. (2019).

Note. Table only displays moderator variables that did not have data from all of the studies (i.e., those that had a $k < 10$).
[1]*Tx* refers to treatment group
[2]*comp.* refers to comparison group

Table 24. Moderator effect sizes for pre-versus post comparison trauma/PTSD measures location of study.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Australia	2	2.07	<.001	[1.65, 2.49]	0.34	.55
Spain	1	0.28	.001	[0.11, 0.45]	<0.001	1.00
United States	7	0.76	<.001	[0.47, 1.05]	34.66	<.001

Table 25. Moderator effect sizes for pre-versus post-comparison trauma/PTSD measures treatment fidelity.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
No	9	0.76	<.001	[0.50, 1.02]	68.16	<.001
Yes	1	3.02	<.001	[2.14, 3.91]	<0.001	1.00

Table 26. Moderator effect sizes for pre-versus post comparison trauma/PTSD measures style of intervention.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Combo	2	0.39	.004	[0.12, 0.66]	2.70	.10
Group	7	0.90	<.001	[0.55, 1.25]	48.53	<.001
Individual	1	3.02	<.001	[2.14, 3.91]	<0.001	1.00

Table 27. Moderator effect sizes for pre-versus post-comparison trauma/PTSD measures provider.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Master's	2	0.61	<.001	[0.38, 0.85]	1.62	.20
Other	4	1.81	.001	[0.74, 2.88]	50.09	<.001
PhD	1	0.56	<.001	[0.28, 0.84]	<0.001	1.00
Unspecified	3	0.37	.004	[0.12, 0.62]	3.73	.16

Table 28. Treatment versus control comparison moderator analyses trauma/PTSD measures

Moderator	**No. Studies**	***Q***	***p*-value**	**R^2 (%)**
Theoretical Orientation	4	1.04	.31	0
Frequency of intervention	4	5.1.04	.31	0
Education of Provider	4	0.21	.65	0
Species used	4	.1.04	.31	0
Other therapy offered	4	0.65	.42	0
Treatment Fidelity	4	1.04	.31	0
Manualized	4	1.04	.31	0
% Female total sample	4	0.15	.70	0

Note. Q is the statistic used to test the significance of the meta-regression. R^2 is the proportion of variance explained by the moderator

Appendix B

Eligibility coding manual for interventions for all mental disorder
Study title:
First Author:

1. Is the intervention an Animal-Assisted Psychotherapy? Yes/No
The intervention uses techniques identified as the Animal-Assisted Psychotherapy as defined by the characteristics below:
The intervention must include:

a) *a goal-directed intervention in which an animal is an integral part of the treatment process*
b) *must be directed and/or delivered by a health/human service professional with specialized expertise*
c) *designed to promote improvement in human social functioning [social functioning refers to social skills as defined in #6]*
d) *may be group or individual in nature*

Articles referring to the benefits of Animal-Assisted Activities, Animal-Assisted Therapy companion animals, utility animals/robotic animals/plush surrogates will be excluded.

2. Is there a quantitative comparison? Yes/No
The study must have at least a pre and post-measure of the intervention group and/or a measure of the intervention group and a control group post-intervention

3. Is the intervention a psychotherapeutic intervention? Yes/No
The intervention uses techniques based in psychology (e.g. talk therapy, behavioural observation, psychoeducation, etc.)

4. Is there a measure of mental disorder symptoms, or psychopathology? Yes/No
Psychopathology measures can by continuous or dichotomous. That is they can measure the symptoms on a continuum or they can indicate whether or not the individual meets the diagnostic criteria for a disorder. Post-traumatic stress disorder will be defined as meeting the Diagnostic and Statistical Manual of Mental Disorders diagnostic criteria.

5. Is the minimum number of participants per group met? Yes/No
There must be at minimum 3 participants in the control group and the treatment group.

6. Is the study in English? Yes/No

Did you answer yes to all of questions 1 to 6? Yes/No

Appendix C

Duplicate screening manual
Study 1 title:
Authors:
Study 2 title:
Authors:

1. Are there shared authors? Yes/No

2. Do the studies share similar methodology? Yes/No

3. Do the studies share similar sample characteristics? Yes/No

Did you answer yes to all of questions 1 to 3? Yes/No
If answered yes, then studies are considered to be dependent samples and may not be both used.

Exclusion criteria for dependent samples

1. Does one of the two studies have a proxy measure? Yes/No
If yes, then that study is prioritized

2. Is one of the studies a follow up? Yes/No
If yes, then aggregate follow up data into primary study.

Appendix D

Coding Manual for Meta-Analysis: Animal-Assisted Psychotherapy

General Coding Notes:

Record the Study ID number at the top of every page used to code a given study.
In the case of longitudinal studies only record data from the first time-point.

I. Study Level Descriptors

1. Bibliographic reference: _____
_____
_____
_____

Write out the study reference in APA format. If two or more written reports were prepared on the same data, use the most comprehensive one.

2. Study ID number: _____

The Study ID number can be found in the "meta-analysis tracking file."

3. Type of publication:
   a. Journal article
   b. Book chapter
   c. Conference paper
   d. Thesis or doctoral dissertation
   e. Unpublished data
   f. Other

Please circle the number corresponding to the type of publication of the most comprehensive report consulted for this study.

4a. Publication year: _____
4b. Indicate if only published online to date: Yes/No

5. Continent study conducted in: (pg. _____)
   a. North America
   b. South America
   c. Asia
   d. Europe: _____
   e. Australia
   f. Africa

6. Identified Diagnosis: (pg. _____)

a. Neurodevelopmental Disorders
    i. Type: _____
b. Schizophrenia spectrum and psychotic disorders
    i. Type: _____
c. Bipolar and related Disorders
    i. Type: _____
d. Depressive Disorders
    i. Type: _____
e. Anxiety
    i. Type: _____
f. Obsessive-Compulsive and related disorders
    i. Type: _____
g. Trauma and stressor related disorders
    i. Type: _____
h. Personality disorders
    i. Type: _____
i. Other
    i. Type: _____

This listing of diagnoses is not exhaustive. Specify full diagnosis. Additionally specify if multiple diagnoses are given.

7. Diagnosed/confirmed by (circle all that apply): (pg. _____)
    a. Previous diagnosis by a qualified health professional (e.g., psychologist, family physician, paediatrician, psychiatrist) a condition of participation
    b. Study Clinician interview *(any activity undertaken by a qualified professional involved in the study to establish or confirm a diagnosis)*
    c. Questionnaire (e.g., Conner's, BASC, CBCL, EBCI):
        i. Type: _____
    d. Other: _____
    e. None

The listing of questionnaires in #7 is not exhaustive. Other questionnaires may also be used and would be appropriately included. For the CBCL and BASC, only scales indicating attention problems or similar would be appropriate. If a procedure other than those listed here is indicated, please circle 6, and indicate the procedure.

8. Style of intervention: (pg. _____)
    a. Individual with therapist
    b. Group with therapist
    c. Combination
    d. Other: _____

The listing of style of intervention in #8 is not exhaustive. Other styles of intervention may also be utilized and would be appropriately included. If a style of intervention other than those listed here is indicated, please circle d, and indicate the style.

9a. Frequency of intervention: (pg. _____)

a. Daily
b. Biweekly
c. Weekly
d. Every other week
e. Monthly
f. Other: _____

The listing of frequency of intervention in #9a is not exhaustive. Other frequencies of intervention may also be utilized and would be appropriately included. If a frequency of intervention other than those listed here is indicated, please circle f, and indicate the style.

9b. Frequency of intervention *in days* (pg. _____)

a. Average: _____
b. Min: _____
c. Max: _____
d. Standardized/planned: _____

10. Duration of intervention *in days* (pg. _____)

a. Average: _____
b. Min: _____
c. Max: _____
d. Standardized/planned: _____

11. Duration of direct intervention—each session, *in hours* (pg. _____)

a. Average: _____
b. Min: _____
c. Max: _____
d. Standardized/planned: _____

12. Total direct contact with participants, *in hours* (pg. _____)

a. Average: _____
b. Min: _____
c. Max: _____
d. Standardized/planned: _____

13a. Providers of interventions: (pg. _____)

a. Professionals:
    i. Nurses
    ii. Psychologists
    iii. Psychiatrists
    iv. Pediatricians
    v. Other Physician
    vi. Social Workers
    vii. Occupational Therapists

viii. Teachers/Early childhood educators
ix. Health Visitor(s)
x. Therapist (Not specified)
xi. Other: _____
xii. Not specified

b. Animal Specialists: _____
c. Volunteers. Specify: _____

The listing of providers in #13a is not exhaustive. Other professionals may also be providers of the intervention and would be appropriately included. If a provider other than those listed here is indicated, please circle xi, and indicate the whom.

13b. Provider of interventions educational equivalency:

a. Doctoral level
b. Master's level
c. Bachelor's level
d. Other/Unspecified: _____
e. Additional training: _____

The listing of provider educational equivalency in #13b is not exhaustive. Other type of educational equivalency may also be utilized and would be appropriately included. If a type of educational equivalency other than those listed here is indicated, please circle d, and indicate the type. Multiple answers may be provided.

14. Recruitment: (pg. _____)

a. Mental health clinic
b. Hospital
c. Pre/School
d. Day care centres
e. Pediatricians/Physicians
f. Community postings
g. Referral
h. Residential treatment facilities
i. Other: _____

The listing of recruitment in #14 is not exhaustive. Other recruitment techniques may also be utilized and would be appropriately included. If a provider other than those listed here is indicated, please circle i, and indicate the how. Multiple answers may be provided.

15a. Species used:

a. dog
b. horse
c. cat
d. dolphin
e. small mammal (such as a rabbit or guinea pig)
d. Fish

f. Other: _____

The listing of species in #15a is not exhaustive. Other species may also be utilized in the intervention and would be appropriately included. If a species other than those listed here is indicated, please circle f, and indicate the species.

15b. Participants receiving other form(s) of therapy or counselling: Yes/No _____

16. Treatment fidelity considered: Yes/No (pg. _____)

17. Treatment manualized: Yes/No (pg. _____)

18. Attrition rate (%): _____ (pg. _____)

19. Sample Characteristics (pg. _____)
    a. Random sample
    b. Convenience sample
    c. Other: _____

20. Gender of identified participants (pg. _____)

	n male	n female	% male	% female
Total Sample				
Treatment group				
Comparison group:				
Other Comparison group:				

Indicate whether the sample was restricted males, females, or if both genders were included. If both genders were included. Indicate the percentage of the sample who were female.

21. Age (in Years) (pg. _____)

	Mean	SD	Range	n
Total Sample				
Treatment group				
Comparison group:				
Other Comparison group:				

Indicate the mean age of the sample and any subsamples as appropriate. Also indicate the standard deviation (SD) and sample size (n) where this information is available. Note that most studies will not provide information in all the categories. Record as much information as is available. At times you may need to calculate the mean age from other available data. If no age information is provided please write "Doesn't specify" beside child age.

II. Group Comparisons, Continuous DV

1. Total N (both groups): _____
2. Type of data effect size based on:
    1. Means and SD
    2. *t*-test
    3. One-way ANOVA

Indicate what type of data the effect size will be based on. They are ordered here in order of preference, with means and standard deviations being the most preferred format. Only choose one.

Outcome 1:_____
Measured with:_____

	Mean	SD	n	t	F	df	p
Treatment							
Control							
Treatment at Follow-up 1:							
Control at Follow-up 1:							
Treatment at Follow-up 2:							
Control at Follow-up 2:							

If means, standard deviations (SD) and sample size (n) are available, the other columns (t, F, df, p) do not need to be filled-in. Please note, for ANOVAs, ***only oneway ANOVAs*** *are eligible for effect size calculation. Also, for both t-tests and ANOVAs, record the most specific p value you can locate. If a specific p value is not indicated you may record the alpha level (e.g., $p < .05$) or n.s. for nonsignificant, if appropriate.*

Outcome 2:_____
Measured with:_____

	Mean	SD	n	t	F	df	p
Treatment							
Control							

Treatment at Follow-up 1:							
Control at Follow-up 1:							
Treatment at Follow-up 2:							
Control at Follow-up 2:							

Outcome 3: _____
Measured with: _____

	Mean	SD	n	t	F	df	p
Treatment							
Control							
Treatment at Follow-up 1:							
Control at Follow-up 1:							
Treatment at Follow-up 2:							
Control at Follow-up 2:							

III. Group Comparisons, Categorical DV
Outcome 1: _____
Measured with: _____
Place the appropriate n in each box

	Clinical	Nonclinical
Treatment		
Control		
Treatment at Follow-up 1:		
Control at Follow-up 1:		
Treatment at Follow-up 2:		

Control at Follow-up 2:		

Outcome 2: _____
Measured with: _____
Place the appropriate n in each box

	Clinical	Nonclinical
Treatment		
Control		
Treatment at Follow-up 1:		
Control at Follow-up 1:		
Treatment at Follow-up 2:		
Control at Follow-up 2:		

Outcome 3: _____
Measured with: _____
Place the appropriate n in each box

	Clinical	Nonclinical
Treatment		
Control		
Treatment at Follow-up 1:		
Control at Follow-up 1:		
Treatment at Follow-up 2:		
Control at Follow-up 2:		

Appendix E

Eligibility coding manual for internalizing disorders
Study title:
First Author:

1. Is the intervention an Animal-Assisted Psychotherapy? Yes/No
The intervention uses techniques identified as the Animal-Assisted Psychotherapy as defined by the characteristics below:
The intervention must include:

- *a) a goal-directed intervention in which an animal is an integral part of the treatment process*
- *b) must be directed and/or delivered by a health/human service professional with specialized expertise*
- *c) designed to promote improvement in human emotional functioning [emotional functioning refers to changes in depressive or anxiety symptoms]*
- *d) may be group or individual in nature*
- *e) the therapy must be a psychotherapeutic intervention*

Articles referring to the benefits of Animal-Assisted Activities, companion animals, utility animals/robotic animals/plush surrogates will be excluded.

2. Is there a quantitative comparison? Yes/No
The study must have at least a pre and post-measure of the intervention group and/or a measure of the intervention group and a control group post-intervention

3. Is the intervention a psychotherapeutic intervention? Yes/No
The intervention uses techniques based in psychology (e.g. talk therapy, behavioural observation, psychoeducation, etc.)

4. Is there a measure of internalizing behaviour problems, or psychopathology? Yes/No
Psychopathology measures can by continuous or dichotomous. That is they can measure the symptoms on a continuum or they can indicate whether or not the individual meets the diagnostic criteria for a disorder. Internalizing disorders are disorders which involve disturbances in mood or emotion, such as depression and anxiety (Hughes & Gullone, 2008). Internalizing disorders will include the following Diagnostic and Statistical Manual of Mental Disorder diagnoses: major depression, dysthymia, and any anxiety disorder.

5. Is there comorbid disorders that are targeted? Yes/No
Studies that include other targetted comorbid disorders will be excluded.

6. Is the study in English? Yes/No

Did you answer yes to all of questions 1 to 6? Yes/No

Appendix F

Eligibility coding manual for interventions for trauma and post-traumatic stress disorder
Study title:
First Author:

1. Is the intervention an Animal-Assisted Psychotherapy? Yes/No
The intervention uses techniques identified as the Animal-Assisted Psychotherapy as defined by the characteristics below:
The intervention must include:

a) *a goal-directed intervention in which an animal is an integral part of the treatment process*
b) *must be directed and/or delivered by a health/human service professional with specialized expertise*
c) *designed to promote improvement in human social functioning [social functioning refers to social skills as defined in #6]*
d) *may be group or individual in nature*

Articles referring to the benefits of Animal-Assisted Activities, companion animals, utility animals/robotic animals/plush surrogates will be excluded.

2. Is there a quantitative comparison? Yes/No
The study must have at least a pre and post-measure of the intervention group and/or a measure of the intervention group and a control group post-intervention

3. Is the intervention a psychotherapeutic intervention? Yes/No
The intervention uses techniques based in psychology (e.g. talk therapy, behavioural observation, psychoeducation, etc.)

4. Is there a measure of trauma symptoms, or psychopathology? Yes/No
Psychopathology measures can by continuous or dichotomous. That is they can measure the symptoms on a continuum or they can indicate whether or not the individual meets the diagnostic criteria for a disorder. Post-traumatic stress disorder will be defined as meeting the Diagnostic and Statistical Manual of Mental Disorders diagnostic criteria.

5. Is the minimum number of participants per group met? Yes/No
There must be at minimum 3 participants in the control group and the treatment group.

6. Is the study in English? Yes/No

Did you answer yes to all of questions 1 to 6? Yes/No

Appendix G

From: Cooper, George George.Cooper@tandf.co.uk
Subject: RE: Prior Publication
Date: Apr 8, 2020 at 8:19:58 AM
To: Anthony Podberscek
anthony.podberscek@sydney.edu.au
Cc: Sarah Germain Sarah.Germain@umanitoba.ca

Caution: This message was sent from outside the University of Manitoba.

Dear Sarah,

Thanks for your query. You are welcome to include your article in your dissertation, as long as it contains a full reference to the original place of publication. If the dissertation will be freely available, the article included should be the pre-acceptance version, with details of how to access the final, typeset version in the reference.

I hope that helps.

Best wishes,

George

George Cooper – Portfolio Manager, Journals
Anthropology, Conservation, Museum Studies & Heritage

Phone: +44 (0)20 7017 4370
e-mail: George.Cooper@tandf.co.uk

From: "Sarah.Germain@umanitoba.ca" <Sarah.Germain@umanitoba.ca>
Date: Tuesday, 7 April 2020 at 5:08 am
To: Anthony Podberscek <anthony.podberscek@sydney.edu.au>
Subject: Prior Publication

Hi Dr. Podberscek,

I have an article that has previously been published by Anthrozoos. I am looking to include the article in my dissertation. I'm not sure about the process for obtaining a release from the Journal to be able to do so. I was hoping that you would be able to direct me. The article is:
Sarah M. Germain, Karlene D. Wilkie, Virginia M. K. Milbourne & Jennifer Theule (2018) Animal-assisted Psychotherapy and Trauma: A Meta-analysis, Anthrozoös, 31:2, 141-164, DOI: 10.1080/08927936.2018.1434044

To link to this article: https://doi.org/10.1080/08927936.2018.1434044

Thank you for your time,
Sarah Germain

Appendix H

Figures and Tables from Chapter 4

Figure 1. Pre-versus post-comparison effect size statistics and forest plot – all measures.

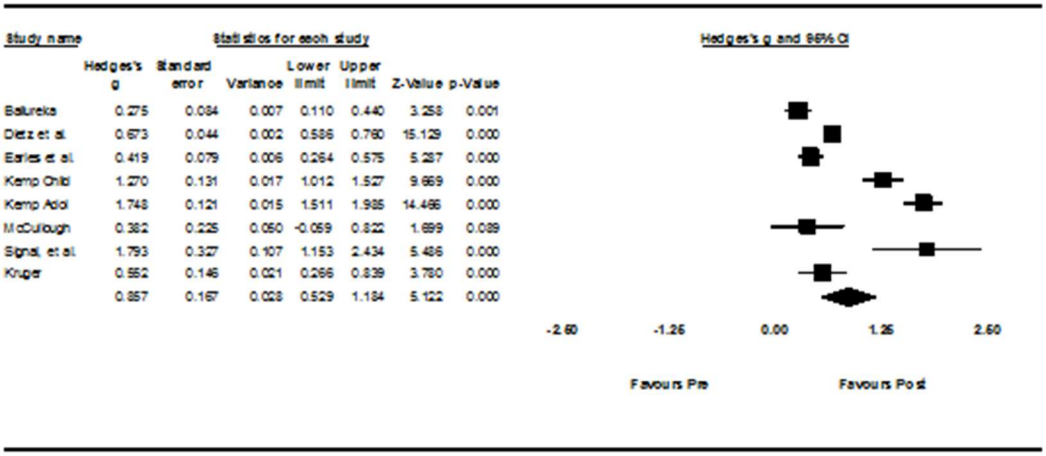


Figure 2. Treatment versus control effect size statistics and forest plot – for all measures.

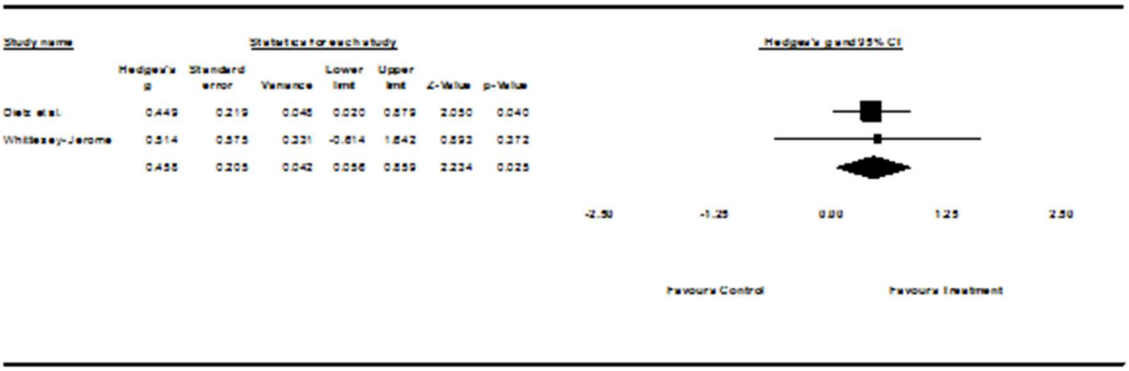


Figure 3. Pre-versus post-comparison effect size statistics and forest plot – trauma measures.

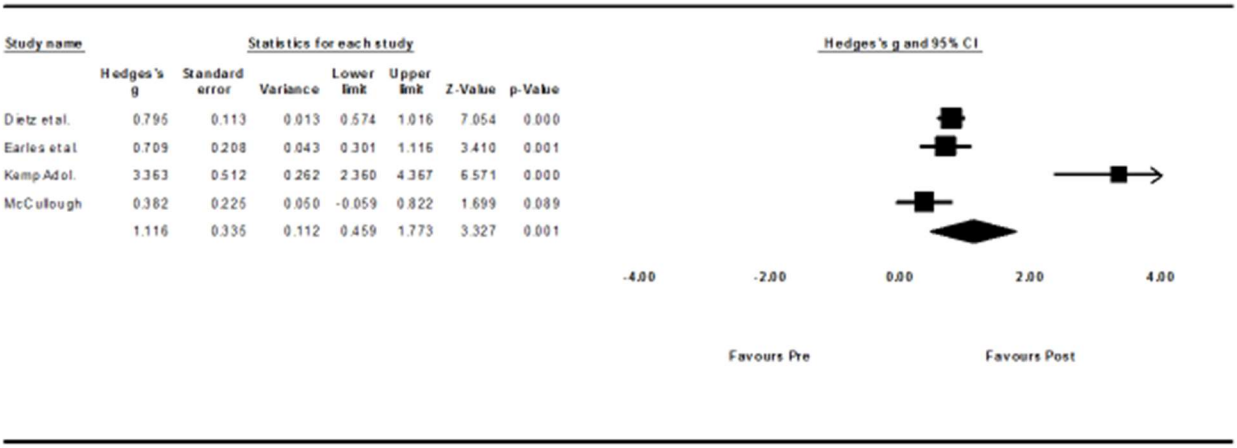


Figure 4. Pre-versus post-comparison effect size statistics and forest plot – depression measures.

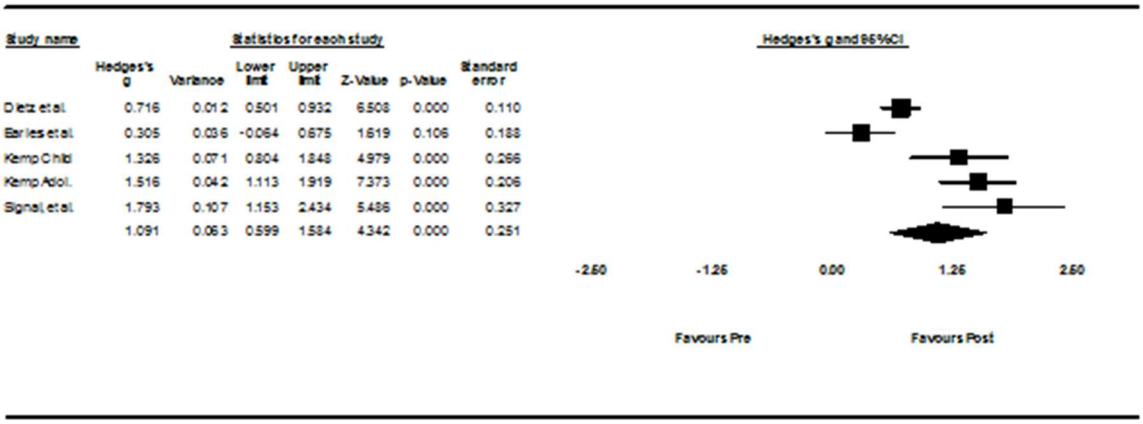


Figure 5. Pre-versus post-comparison effect size statistics and forest plot – anxiety measures.

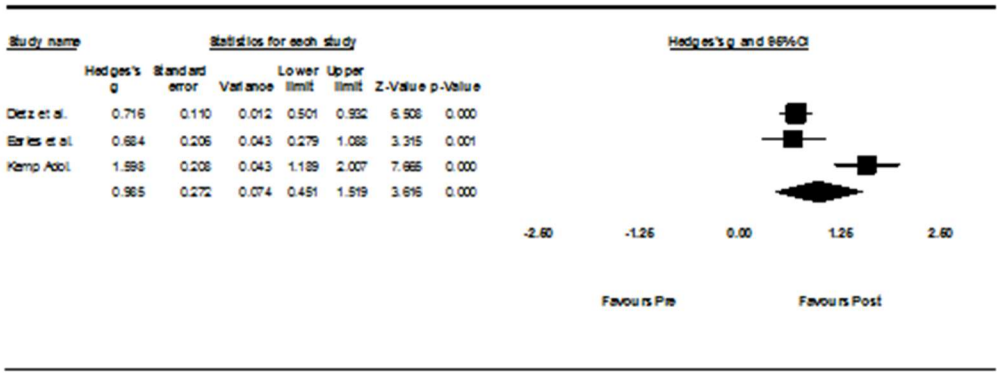


Figure 6. Pre- versus post-comparison scatterplot for place of study – all measures.

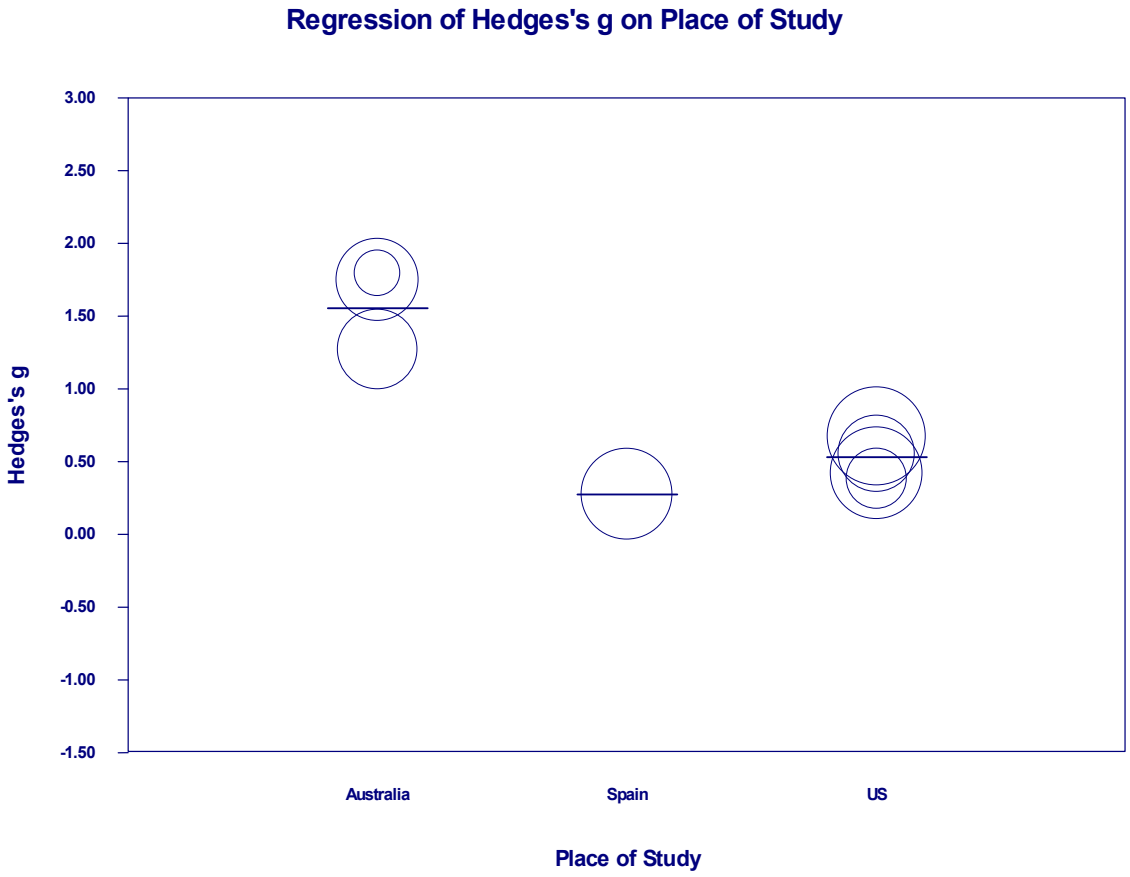


Figure 7. Pre- versus post-comparison scatterplot for provider of intervention.

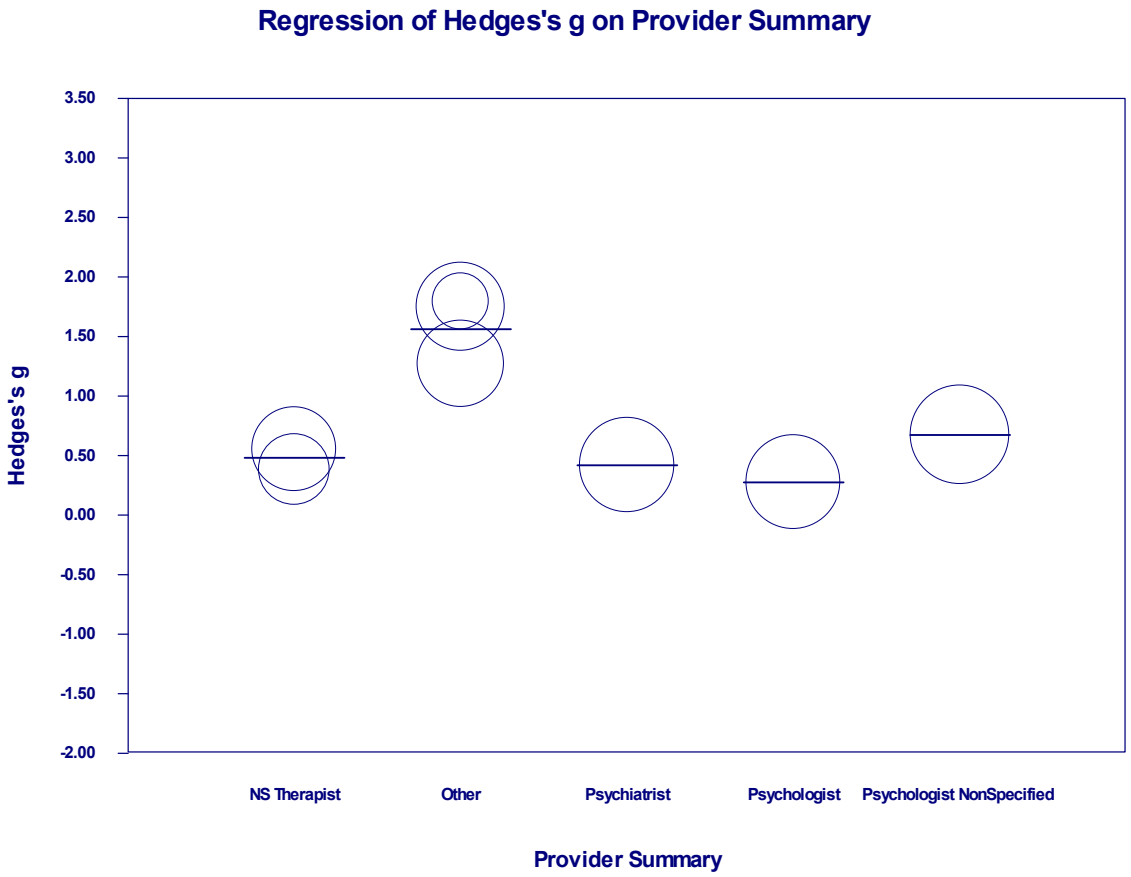


Figure 8. Pre- versus post-comparison scatterplot for other therapy provided.

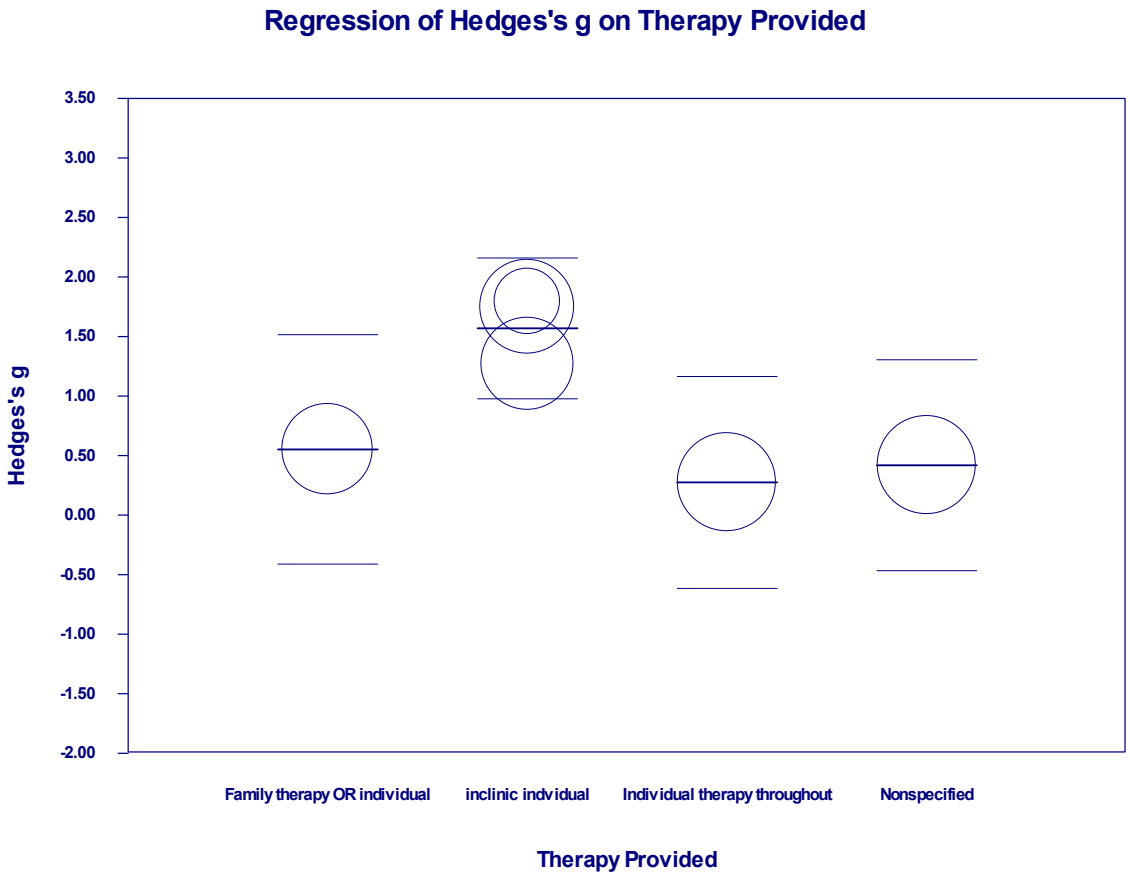


Figure 9. Pre- versus post-comparison scatterplot for % female total.

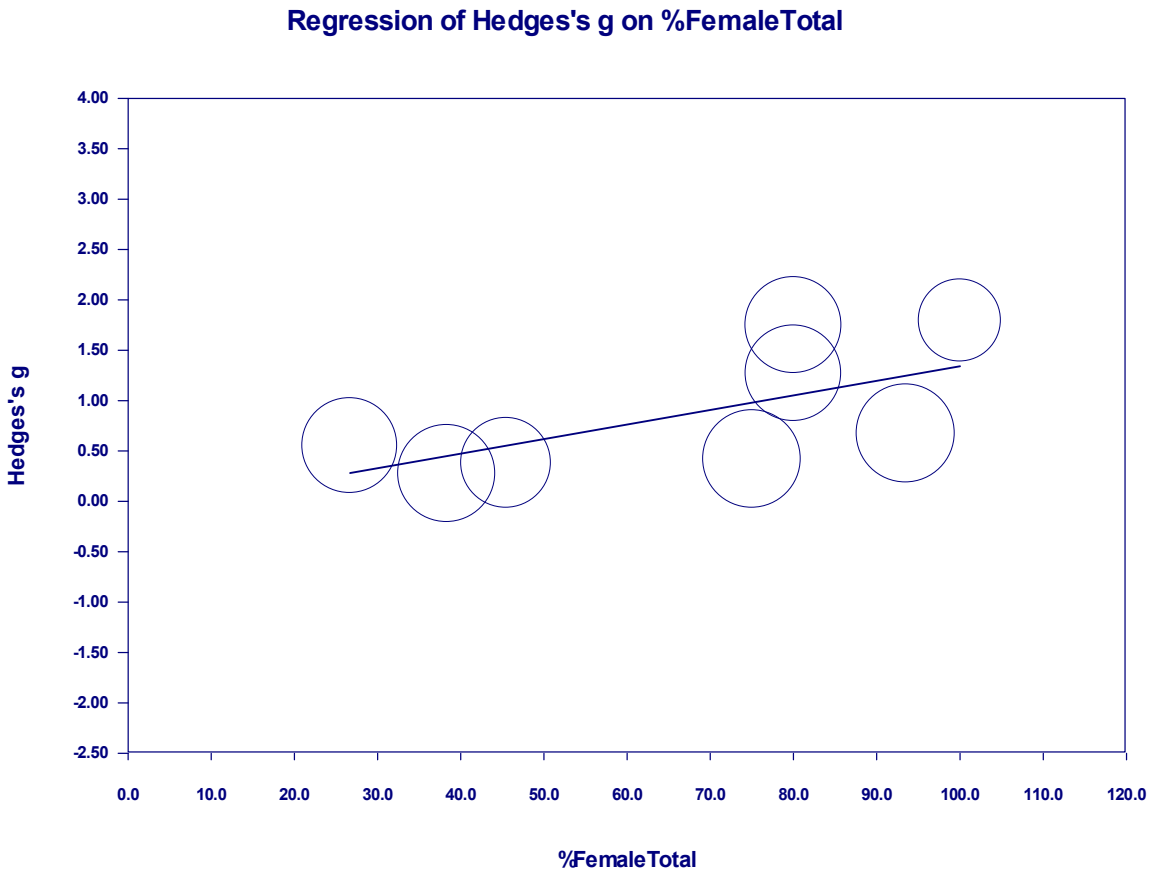


Figure 10. Pre- versus post-comparison scatterplot for style summary.

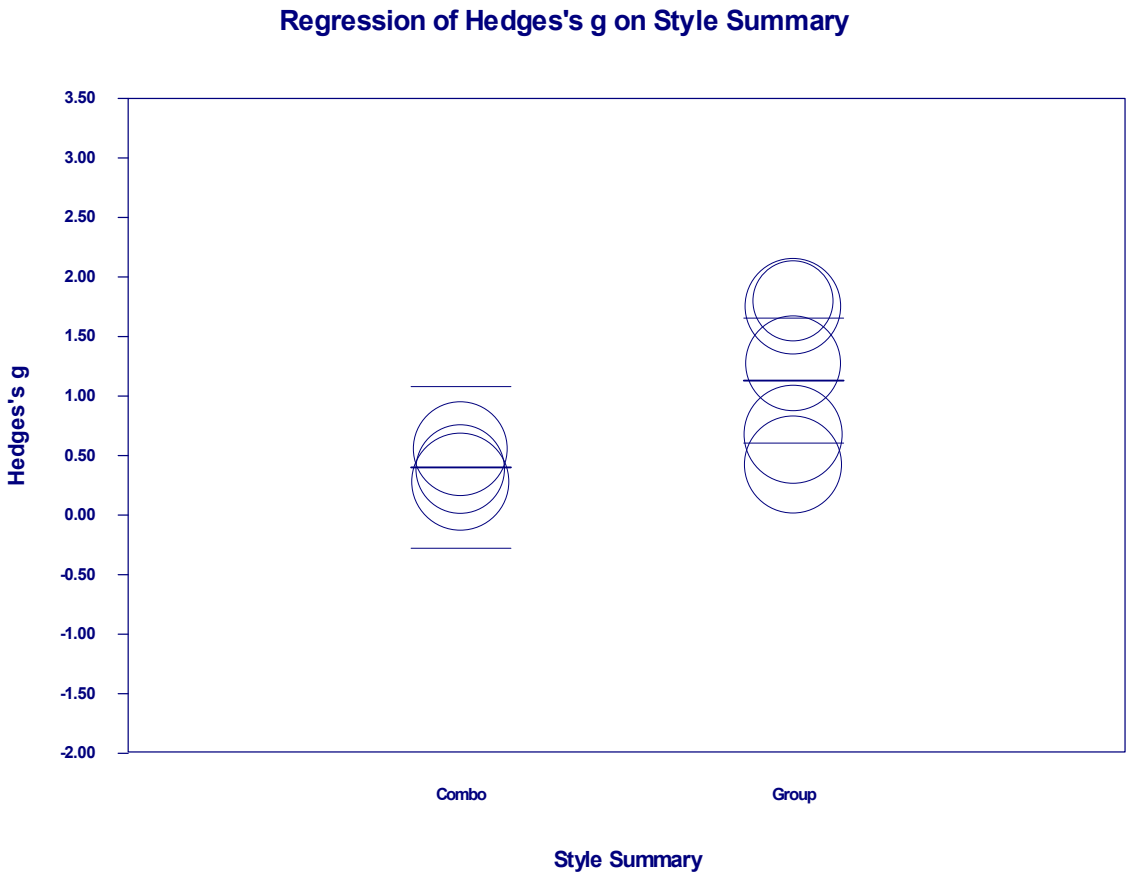


Figure 11. Pre- versus post-comparison scatterplot for environment.

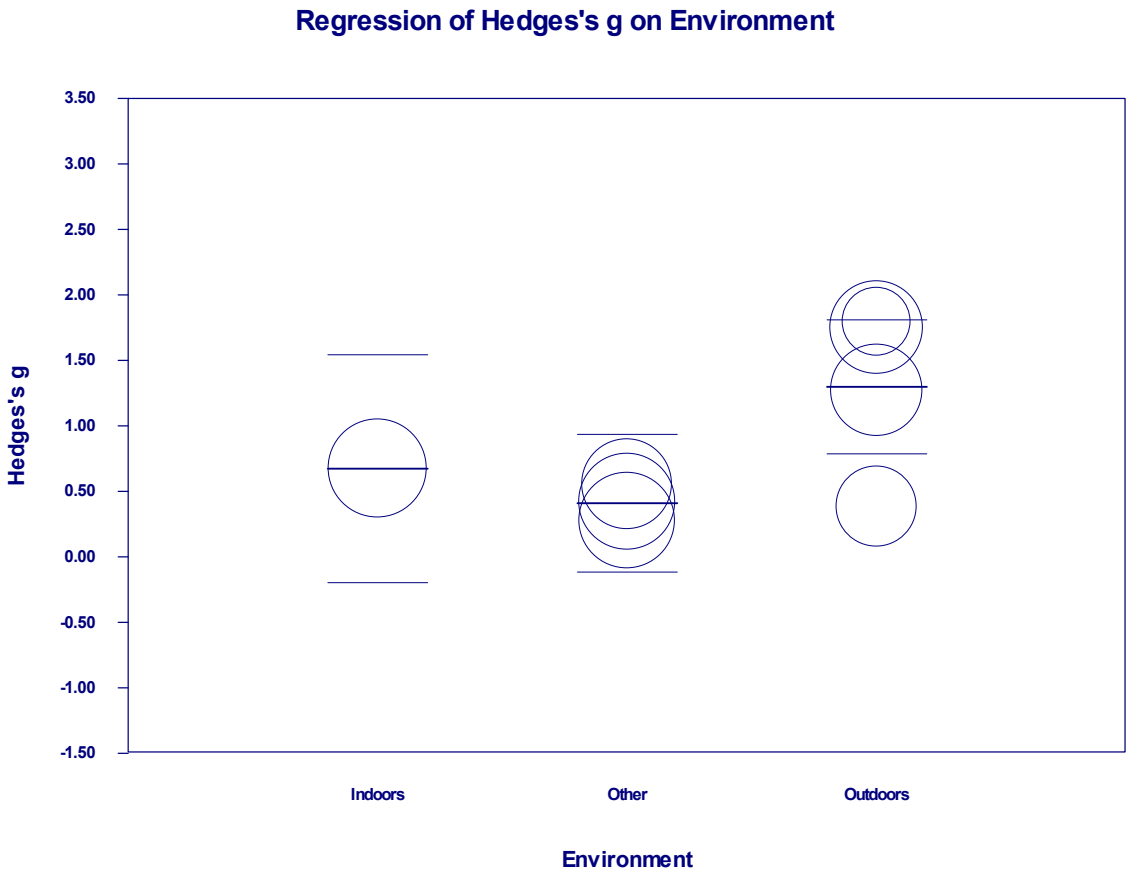


Table 1. Main effects.

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Pre- versus Post Comparison All[3]	8	0.86	<.001	[.53, 1.18]	139.07	<.001
Treatment versus Control All[4]	2	0.46	.03	[.04, .06]	0.01	.917
Pre-versus Post Comparison Trauma	4	1.11	.001	[.47, 1.59]	28.74	<.001
Pre-versus Post Comparison Depression	4	1.09	<.001	[.60, 1.58]	31.64	<.001
Pre-versus Post Comparison Anxiety	3	.99	<.001	[.45, 1.52]	14.96	.001

1 *p*-value associated with effect size calculation
2 *p*-value associated with heterogeneity calculation
3 Studies included in the pre-versus post-comparison calculation include: Balluerka et al. (2015), Dietz et al. (2012) Earles et al. (2015), Kemp et al. (2014) Child Group, Kemp et al. (2014) Adolescent Group, McCullough (2011Kruger (2012), and Signal et al. (2013)
4 Studies included in the treatment versus control comparison calculation include: Dietz et al. (2012) and Whittlesey-Jerome (2014)

Table 2. Pre-versus post-comparison moderator analyses all measures

Moderator	**No. Studies**	***Q***	***p*-value**	**R^2 (%)**
Publication Year	8	0.06	.81	0
Type of Trauma	8	5.13	.16	0
Place of study	8	44.96	<.001	86.00
Type of Publication	8	1.57	.21	0
Style of intervention	8	4.33	.04	0
Frequency of intervention	7	1.11	.29	0
Duration of intervention	4	0.47	.49	0
Provider of intervention	8	31.35	<.001	75.00
Animal Specialist	8	3.58	.17	0
Education of Provider	8	2.46	.65	0
Recruitment	8	5.69	.13	0
Species used	8	1.22	.54	0
Environment[1]	8	11.80	.003	52.00
Other therapy offered	8	0.79	.37	0
Other type of therapy used in addition	6	20.80	<.001	80.00
Manualized	8	1.02	.31	0
% Attrition	8	3.07	.08	0
% Female	8	3.88	.05	0
% Female tx group[2]	6	1.86	.17	0
Mean age	5	.52	.47	0

Note. Q is the statistic used to test the significance of the meta-regression. R^2 is the proportion of variance explained by the moderator

[1]Environment refers to the physical environment where the animal-assisted psychotherapy took place

[2]*Tx* refers to treatment group

Table 3. Studies included in the moderator analyses all measures.

Moderator	Studies Included
Publication Year	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Type of Trauma	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Place of study	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Type of Publication	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Style of intervention	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Frequency of intervention	Balluerka et al. (2015), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Duration of intervention	Balluerka et al. (2015), Earles et al. (2015), Kruger (2012), McCullough (2011)
Provider of intervention	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Animal Specialist	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Education of Provider	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Recruitment	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Species used	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Environment[1]	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Other therapy offered	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
Other type of therapy used in addition	Balluerka et al. (2015), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), Signal et al. (2013)

Manualized	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
% Attrition	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
% Female	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011), Signal et al. (2013)
% Female tx group[2]	Balluerka et al. (2015), Dietz et al. (2012), Earles et al. (2015), Kemp et al. (2014) – Child Group, Kemp et al. (2014) – Adolescent Group, Kruger (2012), McCullough (2011)
Mean age	Balluerka et al. (2015), Earles et al. (2015), Kruger (2012), McCullough (2011), Signal et al. (2013)

Note. Table only displays moderator variables that did not have data from all of the studies (i.e., those that had a $k < 4$).
[1]Environment refers to where the intervention was conducted (indoors, outdoors, or other)
[2]Tx refers to treatment

Table 4. Moderator effect sizes

Effect	No. Studies	Hedges's *g*	*p*-value[1]	95% CI	Q_T	*p*-value[2]
Pre- versus Post Comparison United States	4	.57	<.001	[.37, .71]	8.93	.03
Pre- versus Post Comparison Australia	3	1.57	<.001	[1.19, 1.95]	7.80	.02
Pre- versus Post Comparison Spain	1	.28	.001	[.11, .44]	<.001	1.0

Appendix I

Tables from Chapter 5

Table 1. Quality of evidence summary for GRADE analysis.

Animal-assisted psychotherapy for all disorders

Patient or population: Any person with a mental health disorder
Settings: Community and secondary care
Intervention: Animal-assisted psychotherapy

Outcomes	Relative Effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)
Reading Disability (Le Roux et al., 2014; Rector, 2016; Smith, 2010)	Hedges's *g* = 0.62 (0.36, 0.88)	120 (3 studies)	⊕⊕⊖⊖ **Low**[1, 3, 4]
Anxiety (Alfonso et al. 2015; Henry, 2014; Zents, 2017)	Hedges's *g* = 0.83 (0.07, 1.59)	42 (3 studies)	⊕⊕⊖⊖ **Low**[1, 2, 3, 4]
Autism (Bass et al. 2009; Becker 2017; Fung & Leung, 2014)	Hedges's *g* = 0.73 (0.55, 0.91)	75 (3 studies)	⊕⊕⊖⊖ **Low**[1, 3, 4]
Trauma/PTSD (Burton et al., 2019; Mueller & McCullough, 2017; Whittlesey-Jerome, 2014)	Hedges's *g* = 0.44 (0.20, 0.69)	87 (3 studies)	⊕⊕⊖⊖ **Low**[1, 3, 4]

GRADE Working Group grades of evidence
High quality ⊕⊕⊕⊕**:** Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality ⊕⊕⊕⊖**:** Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality ⊕⊕⊖⊖**:** Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality ⊕⊖⊖⊖**:** We are very uncertain about the estimate.

[1] A number of studies had high risk of bias
[2] Inconsistency concerns
[3] Indirectedness concerns
[4] Imprecision concerns
[5] Publication bias concern

Table 2 GRADE quality of evidence for individual conditions.

Outcomes	Quality of Evidence Factors					
	Risk of bias	**Inconsistency**	**Indirectedness**	**Imprecision**	**Publication bias**	**Overall Quality of evidence**
Reading Disability (Le Roux et al., 2014; Rector, 2016; Smith, 2010)	-lack of concealment -lack of binding Rating: ⊕⊕⊖⊖ **Low**	I^2 statistic was <0.001 Rating: ⊕⊕⊕⊕ **High**	-Differences in population: yes -differences in interventions: yes -Difference in outcome measures: yes -Indirect comparisons: no Rating: ⊕⊕⊖⊖ **Low**	- The Optimal Information Size not met Rating: ⊕⊕⊖⊖ **Low**	-Not present Rating: ⊕⊕⊕⊕ **High**	⊕⊕⊖⊖ **Low**
Anxiety (Alfonso et al. 2015; Henry, 2014; Zents, 2017)	-lack of concealment -lack of binding Rating: ⊕⊕⊖⊖ **Low**	I^2 statistic = 53.31% Rating: ⊕⊕⊖⊖ **Low**	-Differences in population: yes -differences in interventions: yes -Difference in outcome measures: yes -Indirect comparisons: no Rating: ⊕⊕⊖⊖ **Low**	- The Optimal Information Size not met Rating: ⊕⊕⊖⊖ **Low**	-Not present Rating: ⊕⊕⊕⊕ **High**	⊕⊕⊖⊖ **Low**
Autism (Bass et al. 2009; Becker 2017; Fung & Leung, 2014)	-lack of concealment -lack of binding Rating: ⊕⊕⊖⊖ **Low**	I^2 statistic = 17.24% Rating: ⊕⊕⊕⊖ **Moderate**	-Differences in population: yes -differences in interventions: yes -Difference in outcome measures: yes -Indirect comparisons: no Rating: ⊕⊕⊖⊖ **Low**	- The Optimal Information Size not met Rating: ⊕⊕⊖⊖ **Low**	-Not present Rating: ⊕⊕⊕⊕ **High**	⊕⊕⊖⊖ **Low**

Trauma/PTSD (Burton et al., 2019; Mueller & McCullough, 2017; Whittlesey-Jerome, 2014)	-lack of concealment -lack of binding Rating: ⊕⊕⊖⊖ **Low**	I^2 statistic < 0.001% Rating: ⊕⊕⊕⊕ **High**	-Differences in population: yes -differences in interventions: yes -Difference in outcome measures: yes -Indirect comparisons: no Rating: ⊕⊕⊖⊖ **Low**	- The Optimal Information Size not met Rating: ⊕⊕⊖⊖ **Low**	-Not present Rating: ⊕⊕⊕⊕ **High**	⊕⊕⊖⊖ **Low**

Appendix J

Study Exclusion Rationale

Table 1. Study exclusion rationale.

Exclusion Rationale **(*n* =)**	**Studies Excluded**
Data not amenable to meta analysis **(*n* = *18*)**	Adams (2010); Arnold (1995); Chappell (2014); Cobaleda-Kegler (2006); Corson, Arnol, Gwynne, & Corson (1977); Corson, Corson, Gwynne, & Arnold (1975); Dell & Poole (2015); Doyle & Kukowski (1989); Duncan, Critchley, & Marland (2014); Hammer (2014); Heimlich (2001); Katsinas (2001); Krob (2015); Lanning & Krenek (2013); Mullen (2010); Nikolskaya (2012); Troutner (2016); Wallis (2009)
Editorial **(*n* = *16*)**	Anonymous (1998); Anonymous (2006); Anonymous (2017); Gee, Fine, Esposito, & McCune (2017); Gertz & Rabinowitz (2017); Hardinghaus (2017); Heron (1963); Levinson (1962); Levinson (1969); Levinson (1984); Koocher & Gill (2015); Martin (2001); McCullough (2019); Miler & Moore (2018); Parlin (1992); Snider (2007)
Grant/Program proposal/guidelines **(*n* = *58*)**	Appel (2012); Arkow (2006); Arriaza (2015); Beale (2006); Casey (2012); Coats-Kendall (2018); Cohen (2010); Coletta (2010); Daifotis (209); Dillon (2013); Drawe (2001); Fredrickson & Howie (2006); Fredrickson-MacNamara & Bulter (2010); Froeschle (2009); Greenbaum (2006); Hines (1985); House (2016); Howell-Newman & Goldman (1993); Jackson, Burski, & Cry (2017); Jorgenson (1997); Karol (1999); Kersten & Thomas (2004); Krankl (2014); Krause-Parello (2014); Lancia (2008); Lang (2015); Ledbetter (2013); Lefkowitz (2005); Lefkowitz, Paharia, Prout, Debiak, & Bleiberg (2005) Longville (2000) Martz (2014); Miele (2016); Miller (2008); Moneymaker & Strimle (1991); Mulen (2013); Nebbe (1991); Nebbe (2006); Obrusnikova, Bibik, Cavalier, & Manley (2012); Osborne & Halliday (*****); Owen (2001); Paharia (2005); Peachey (2014); Petersen (2010); Posas (2013); Proulx (1998); Provencher (2015); Reichert (1994); Sehr, Eisele-Hlubocky, Junker, Johns, Birk, & Gaehle (2013); Smith (2015); Stephans (2012); Struck & Brady (1998); Sutera (2016); Urichuk & Anderson (2003); Valenzuela (2017); VanFleet (2008) Vickery (1998); Wright & Dribben-Gutman (1981); Young (2018)
Letter to the Editor **(*n* = *14*)**	Basil & Mathews (2005); Benda (2014); Bloom (2012); Curran & Miller (2009); Diamond-Jones (2013); Enoch, Karas, Slater, Emery, Kearns, & Farrington (2005); Lima, Silva, Amaral & de Sousa (2012); Mukherjee & Makker (2011); Munoz & Franchignoni (2008); Nilson (2004); Norton (2009); Schienbaum (2011); Venske, Mayhew & Burris (1990); White (1997)
Literary Review **(*n* = *329*)**	Beetz & McCardle (2017); Adams, Sharkin & Bottinelli (2017); Adams, Clark. Corwell, Duffy, & Gree (2017); All, Loving, & Crane (1999);

	Allen (2014); Allen (2007); Allison & Ramaswarny (2016); Altschuler (1999); Amerine (2016); Anderson & Olson (2007); Andreasen, Stella, Wilkinson, Szczech, Hoelzel & Hendricks (2017); Anger & Akins (2014); Anonymous (2011); Ashley (2016); Ashley, Eriksson, & Jeon (2016); Bach (2016); Bachi & Parish-Plass (2017); Bachi (2012); Bachi (2013a); Bachi (2013b); Back & Katcher (2003); Ballarini (2003); Banszki, Kardos, & Rozsa (2012); Barba (1995); Bates (2002); Baumgartner, & Cho (2014); Beauchen (2017); Beck (1985); Beck (2000); Beck (2006); Beck & Katcher (1894); Beetz (2017); Beetz, Uvnas-Mobrg, Julius, & Kotrschal (2012); Bennet (2019); Berg & Vausey (2014); Berget, Bene, Braastad, & Bjarne (2008); Bernabei, Ronchi, Ferla, Moretti, Tonelli, Ferrari, & Atti (2013); Berry, Borgi, Francia, Alleva, & Cirulli (2013); Bickerstaff (2003); Boggs, Tedeschi & Ascione (2010); Borrego, Franco, Perea Mediavilla, Piñero, Roldán, & Picabia (2014); Boucher & Will (1991); Brandt (2013); Breshears (n.d.); Brickel (1980); Brickel (1982); Brickel (1984); Brickel (1986); Briggs (2013); Brodie & Biley (1999); Brooks (2006); Browder (2009): Brumbaugh (1992); Buck, Bean, & Demarco (2017); Buettner, Fitzsimmons, & Barba (2011); Buljan Flander, Stimac, Fridrih, Raguz, Kuculo, & Galic (2018); Burgon Gammage, & Hebden (2018); Burke & Iannuzzi (2014); Carmack (1894); Carmack (1989); Carper, Bartone, & Petty (2016); Casey, Csiernik, Knezevic & Ebear (2018); Chandler (2005); Chandler (2012); Chandler, Portrie-Bethke, Barrio Minton, Fernando, & O'Callaghan (2010); Chandler (2001); Chardonnens (2009); Cherniack & Cheriack (2014); Chur-Hansen, McArthur, Winefield, Hanieh, & Hazel (2014); Chur-Hansen, Zambrano, & Crawford (2014); Cipriani, Cooper, DiGiovanni, Litchkofski, Nichols, & Ramsey (2013); Cirulli (2011); Cole & Howard (2013); Conner & Miller (2000a); Conner & Miller (2000b); Cooper, Heart, & Pola (n.d.); Correctional Services Canada (1998); Creagan, Bauer, Thomley & Borg (2015); Crenshaw & Stella (2015); Crenshaw & Tillman (2015); Cumela (2003); CurHensen, McArthur, Winefeidl, Hanieh & Hazel (2014); Dampsey (2017); D'Arcy (2011); Darnell (n.d.); David (1988); Decoucey, Russell, & Keister (2010); DePompeo (2016); DePrekel & Neznik (2012); Diefenbeck, Bouffard, & Matukaitits (2010); Dimitrijevic (2009); Dossey (1997); Duffy (2018); Dunlap (2010); Eaton-Stull & Williams (2019); Edwards (2012); Endenburg & van Lith (2011); Ernst (2013); Evans &Gray (2011); Faa-Thompson (2012); Fedor (2018); Fiksdal, Houlihan & Barnes (2012); Filan & Llewellyn-Jones (2006); Fine (2006); Fine (20120); Fine, Milo, & Jeffery (2006); Fine & Schuck (2017); Finn-Stevenson (2016); Fisher, Wagner & Newsome (2014); Fitzgerald (1986); Flynn & Walker (2018); Friedmann, Barker, & Allen (2011); Friesen (2010); Friesen & Delisle (2012); Fry (2013); Fung (2016); Fung (2017); Furst (2016); Gallagher (2004); Gallo-Lopez & Rubin (2012); Gamache (2004); Gammonley, Howie, Kirwin, Zapf, Frye, Freeman, & StuartRussell (1996); Gee

	(2011); Geist (2011); Geronimo (2017); Giaquinto & Valentini (2009); Gilmer, Baudino, Tielsch, Goddard, Vickers, & Foster Akard (2016); Goddard & Gilmer (2015); Grado (2011); Graham (2000); Granados & Agis (2011); Grandgeorge & Hausberger (2011); Grandin, Fine & Bowers (2010); Granger & Kogan (2000); Green (2014); Gullone (2003); Haas (1999a); Haas (1999b); Haas (2000a); Haas (2000b); Haas (2001); Haas (2002a); Haas (2002b); Haas (2003a); Haas (2003b); Haas (2004a); Haas (2004b); Haas (2005); Haas (2007a); Haas (2007b); Haas (2008a) Haas (2008b); Haggerty (2015); Hajar (2015); Harkrader, Burke, & Owen (2004); Harris & Levicoff (2003); Hart & Yamamoto (2015); Hediger & Beetz (2015); Hediger, Gee & Griffin (2017); Hemmingway (2018); Hines (2009); Hooker, Freeman, & Stuart (2002); Horowitz (2010); Imber-Black (2009); Irwin & Webber (2001); Jackson (2012); Jalong & Petro (2018); Jalongo (2005); Jalongo, Astorino, & Bomboy (2004); Jalongo, Linder, Rotz, & Schultz (2018); Janssen (1998); Jasperson (2011); Johansen, Grethe, Wang, Binder, Malt (2014); Johnson & Burneau (2016); Johnson, Odendaal, Meadows (2002); Jones (2018); Jones, Rice & Cotton (2018); Joye (2011); Julius, Beetz, Kotrschal, Turner, & Uvnäs-Moberg (2013); Kamioka, Okada, Tsutani, Park, Okuizumi, Handa, ... & Honda (2014); Karol (2007); Katcher & Teumer (2007); Kaufinann (1997); Kazdin (2011); Kehoe (1990); Kelly (2014); Kennedy (2012); Kim, Hong, Lee, Chung, & Lee (2015); Kirnan & Ventresco (2018); Knight & Kerzog (2009); Kinsley, Barker, & Barker (2012); Kohanov (2001); Krol (2012); Kropp & Shupp (2017); Kruger & Serpell (2006); Kruger, Trachtenbert, & Serpell (2004); Krumholz (2016); Lac, Marble, & Boie (2013); Lancia (2008); Lane & Zavada (2013); Lannon & Harrison (2015); Large (2016); Laun (2003); Law & Scott (1995); Lee & Higgins (2010); Lockwood (1983); Loveridge (2017); Maclean (2011); Madsen, Costigan, McNicol, & Turner (2015); Maleske (2004); Manginelli (2018); Marcus (2013); Marino (2012); Marx & Cumella (2003); Masini (2010); Matuszek (2010); May, Seivert, Cano, Casey, & Johnson (2016); McCandless, McCready & Knight (1985); McColloch (1986); McConell (2002); McCowan (1984); McCulloch (2001); McKinney, Dustin, & Wolff (2001); McNicholas & Collis (2006); Mendez Moreno (2017); Messent (1985); Miller & Conner (2000); Miller & Ingram (2000); Mills & De Keuster (2009); Mills & Hall (2014); Mims & Waddell (2016); Mitton (2008); Mockler (2010); Moore (1984); Morell (2009); Morrison (2007); Mueller & Lerner (2017); Murphy (2015); Nelson (2017); Nicholas, Fawcett, & Gullone (2001); Nussen (2012); O'Brien (2016); O'Conner (2006); O'Conner (2014); O'Haire (2010); O'Haire (2013); O'Hair, Guerin & Kirkham (2015); Olmert, Daley, Nordstrom, Peters, St. Laurent, & Yount (2015); Omori & Hasegawa (2009); Palley, Pearl O'Rourke, & Niemi (2010); Pandzic (2017); Parish-Plass (2013); Parshall (2003); Patronek (2000); Pellew (2019); Pendry, Carr, & Vandagriff (2017); Perkins, Bartlett, Travers, & Rand (2008); Pichot &

	Coulter (2007); Pitts (2005); Poleshuck (1997); Prescott (2002); Quiroz Rothe, Jiménez Vega, Mazo Torres, Campos Soler, & Molina Pazos (2005); Rathsam (2002); Ratliffe & Sanekane (2009); Raupp (2002); Reed, Ferrer & Villegas (2012); Reichert (1998); Reichert, Bermel & Sori (2016); Reid (2014); Renzi (2005); Robinson (1999a); Robinson (1999b); Rollins (2011); Root (2000); Rose (2008); Rossetti & King (2010); Rubenstein, Debboun & Burton (2012); Rugari, Sayda, & Kenned (2013); Sachs-Ericsson, Hansen & Fitzgerald (2002); Salmon & Timperio (2011); Saslow (2002); Schuck & Fine (2017); Schulte (2019); Scribner (n.d.); Seggie (2013); Serpell (1999); Shani (2017); Shaw (2013); Sheade & Chandler (2001); Shotwell & Wagner (2019); Shubert (2012a); Shubert (2012b); Smith & Thomasson (2008); Smith (2012); Snipelisky & Burton (2014); Stanley-Hermanns & Miller (2002); Stewart, Bruneau & Elliot (2016); Stoner (1984); Stimple (2003); Tedeschi, Fitchette, & Molidor (2005); Tedeschi,Sisa, Olmert, Parish-Plass, & Yount (2015); Torres, Soler, Rothe, Vega, & Pazos (2005); Thodberg, Berget, & Lidfors (2014); Tramutt (2003); Trivedi & Perl (1995); Trotter (2012); Trotter & Baggerly (2019); Turner (2011); Twiname (1985); Tyler (1994); Urbanski & Lazenby (2012); VanFleet & Faa-Thompson (2015); Vidrine, Owen-Smith, & Faulkner (2002); Vincent & Farkas (2017); Voekler (1995); Weiss (2009); Wermer (2008); Wiley (2010); Willens (2013); Willimson (2008); Wilson (2012); Zamir (2006); ZilchaMano, Milulincer, & Shaver (2011a); Zicha-Mano (2017)
Meta-analysis or systematic review **(*n = 42*)**	Anestis, Anestis, Zawilinski, Hopkins, & Lilienfeld (2014); Cantin & Marshall Lucette (2001); Cempaka (2017); Chandramouleeswaran (2014); Conway (1998); Davidson (2013); Downes, Dean & Bath-Hextall (2013); Durham (2011); Farid (2019); Freund, Brown, & Buff (2011); Halm (2008); Hawkins, Hawkin, Dennis, Williams, & Lawrie (2019); Hicks (2015); Humphries (2003); Johansen (2008); Kendall, Maujean, Pepping, & Wright (2014); Lai, Chang, Ng, Stanaway, Tan, & Chaiyakunapruk (2019); Lajoie (2003); Lentini (2009); Mariano (2007); May, Seivert, Cano, Casey & Johnson (2016); McDaniel (2015); McMillen (2015); Mendoza (2019); Moston (1998); Munoz Lasa, Ferriero, Brigatti, Valero, & Franchignoni (2011); Munoz Lasa, Maximo Bocanegra, Valero Alcaide, Atin Arratibel, Varela Donoso, & Ferriero (2015); O;Callaghan (2008); O'Haire (2017); O'Haire, Gurin, Kirkham, & Daigle (2015); Parker, Roy & Eyers (2003); Peluso, De Rosa, De LuciaAntenora, Illario, Esposito, & De Michele (2018); Peters (2018); Philippe (2018); Platford (1999); Selby (2009); Souter & Miller (2007); Staples (2017); Stapleton (2016); Steed & Smith (2002); Stern & Chur Hansen (2013); Waid Higgins (2018)
Studies with fewer than 2 subjects, $N < 3$ **(*n = 112*)**	Allderidge (1991); Allen (2015); Amuso (2003); Anne-Belle (2015); Aoki, Iwahashi, Ishigooka, Fukamauchi, Numajiri, Ohtani, & Ohta (2012); Bailey (1988); Barld, Bardl, & Kornhuber (2013); Brenda (2011); Bernas (1985); Boe (2007); Brady (2015); Brekke (2008); Brous

	(2010); Burgess (2018); Burton (1995); Carlisle (2012); Chandler (2008); Chavez (1997); Chen, Crews, Mundt, & Ringenbach (2015); Chitic & Rusu (2016); Christian (2005); Christy (2011); Cleveland (1995); Curtright (2000); Daughhetee, Stalls, & Spencer (2006); Dell (2015); DeMilander, Bradley, & Fourie (2016); Dimino (2016); Dorrance (1987); Eggiman (2006); Esteves & Stokes (2008); Fine (1992); Fisher andf Cozens (2014); Fitch (2017); Funahashi, Gruebler, Aoki, Kadone, & Suzuki (2014); Fung (2011); Fung (2015); Fung (2017); George (1989); Ghetie (2011); Gluckman (2005); Goldblatt (2019); Golin (1994); Gregg (2012); Gress (2003); Hammerschlag (2009); Harker (1984); Hennah (1989); Holm, Baird, Kim, Rajora, D'Silva, Podolinsky, Mazefsky, & Minshew (2014); Hundley (1991); Iwachiw (2017); Jasperson (2010); Johansen, Arfwedson Want, & Binder (2016); Kakacek (2017); Karol (2007); Katcher & Wilkins (1998); Klemm, Waddington, Bradley, Bucher, Collins, Lyons, Seckel, & Urban (2010); Kogan, Granger, Fitchett, Helmer, & Young (1999); Lac (2016); Lac (2017a); Lack (2017b); LaFrance, Garcia, ad Labreche (2007); Lamkin (2017); Lehrman & Ross (2001); Levinson (1964); Lieber (2002); Maiorani, Cesa-Bianchi, & Cristini (2012); Maurer (2008); McCullough (2018); McNeil (2017); Mende & Mende (2011); Meyer (1997); Michel (2018); Mourey (2015); Naste, Price, Karol, Martin, Murphy, Miguel, & Spinazzola (2018); Newberry (1985); Niksa (2007); Nordgren & Engström (2012); O'haire, Guérin, & Kirkham (2015); O'Haire, McKenzie, McCune, & Slaughter (2014); Ortiz & Liporace (2005); Parish-Plass (2008); Pence (2005); Peota (2007); Pichel & Hart (1988); Pillow-Price, Yonts, & Stinson (2014); Price (1996); Rice (2018); Roberto (2002); Roberts, Bradberry, & Williams (2004); Robertson (2004); Rosenberg (2016); Roth (2005); Sarlon, Staniloiu, Schontge, & Kordon (2018); Scallion (2010); Scholtz (2010); Sentoo (2003); Sheade (2015); Shelef, Brafman, Rosing, Weizman, Stryjer, & Barak (2019); Silva, Correia, Lima, Magalhaes, & de Sousa (2011); Siviter (2012); Sockalingam, Li, Krishnadev, Hanson, Balaban, Pacione, & Bhalerao (2008); Solomon (2010); Swearingen (2017); Symington (2012); Tilsen (1998); VanFleet & Faa-Thompson (2015); Weimer (1999); Wells, Rosen & Walshaw (1997); Yatvs (1973); Yount, Ritchie, Laurent, Chumley, Olmert (2013)
No mental health measures (***n = 114***)	Adams (2013); Akuna (2005); Bachi, Terkel & Teichman (2012); Bachi (2014); Balluerka, Muela, Amiano, Caldentey (2014); Barak, Savorai, Mavashev, & Beni (2001); Barker & Dawson (2011); Bilinsky (2011); Boshoff, Grobler, & Nienaber (2015); Braun, Strangler, Narveson, & Pettingell (2009); Burger, Stetina, Turner, McElheney, & Handlos (2011); Butt (2017); Button (2010); Caprilli & Messeri (2006); Carey (2016); DeRoe, Cannas, Cantiello (2011); Devine (2009); Enders-Slegers (2014); Feinstein (2015); Ferruolo (2016); Fick (1993); Fields, Bruemmer, Gloeckner, & Wood (2018); Flynn, Roguski, Wolf, Trujillo, Tedeschi, & Morris (2018); Friedmann, Thomas, Cook, Tsai, & Picot

	(2007); Gee, Belcher, Grabski, De, & Riley (2012); Gee, Harris, & Johnson (2007); Gee, Sherlock, Bennett, & Harris (2009); Giagazoglou, Arabatzi, Kellis, Liga, Karra, & Amiridis (2013); Gilger (2007); Goldberg, Gonzalez, Khallouq, & Monroe (2017); Gonzales Ramirex (2013); Grabowska & Ostrowska (2018); Griess (2010); Grubbs, Artese, Schmitt, Cormier, & Panton (2016); Grueneich (2015); Hakanson, Moller, Lindstrom, & Mattsson (2009); Hansing (2014); Harper, Dong, Thornhill, Wright, Ready, Brick, & Dyer (2015); Harris, Rinehart, & Gerstman (1993); Havey, Vlasses, Vlasses, Ludwig-Beymer, & Hackbarth (2014); Heffernan & Heffernan (2017); Heindl (1996); Hill, Zivaiani, Cawdell-Smith, & Discoll (2019); Holocomb & Meacham (1989); Holliday (2007); Homnick, Henning, Swain ,and Homnick (2013); Homnick, Henning, Swaine, & Homnick (2015); Hughes (2010); Iliukhina, Krivoshchapova, & mazhosova (2008); Jenkins (2009); Jenkins, Laux, Ritchie, & Tucker-Gail (2014); Kawamura, Niiyama, & Niiyama (2007); Keino, Funahashi, Keino, Miwa, Hosokawa, Hayashi, & Kawakita (2009); Kendall, & Maujean (2015); Kern-Godal, Arnevik, Walderhaug, & Ravndal (2015); Kim & Lee (2015); Kovács, Kis, Rózsa, & Rózsa (2004); Kovacs, Bulucz, Kis, & Simon (2006); Llambias & Magill (2016); Macauley (2006); Martin & Farnum (2002); Menna, Santaniello, Gerardi, Sansone, Di Maggio, Di Palma, Perruolo, D'Esposito, & Formisano (2019); Miccinello (2011); Miller, Connor, Deal, Duke, Stanley-Hermanns, Varnell, Hartman, & McLarty (2003); Minatrea, & Wesley (2008); Motooka, Koike, Yokoyama, andKennedy (2006); Murphy, Wilson, & Greenberg (2017); Murrow (2013); Nahm, Lubin, Lubin, Bankwitz, Castelaz, Chen,... & Totten (2012); Nathanson, de Castro, Friend, & McMahon (1997); Ngwena & Naidoo (2016); Norbeck (2009); Nordgren, & Engström (2014); Pace (1996); Patterson (2015); Peacock (1984); Pendry, Carr, Smith & Roeter (2014); Pendry & Roeter (2013); Pendry, Roeter, Smith, Jacobson, & Erdman (2013); Perry (2017); Pfeffer (2016); Prothmann, Bienert, & Ettrich (2006); Russell-Martin (2006); Sanchez, Castro, Herrera, & Juanez (2014); Sandhu (2018); Schneider, & Harley (2006); Schultz, Remick-Barlow, & Robbins (2007); Shannon (2007); Silver (2016); Skidmore (2018); Sobo, Eng, & Kassity-Krich (2006); Sola-Perkins (2019); Suber (2008); Surprise (2013); Terpin (2004); Thomas (2014); Tissen, Hergovich & Spiel (2007); Tournier, Vives, & Postal (2017); Trammell (2017); Tuttle (2017); Vagnoli, Caprilli, Vernucci, Zagni, Mugnai, & Messeri (2015); Van Horn (2004); Viehl (1995); Weaver (2015); Weber (2005); Weir (1995); Wesenberg, Mueller, Nestmann, & Holthoff-Detto (2019); Wesley, Minatrea, & Watson (2009); Whittlesey-Jerome, Schultz, & Tomaska (2016); Wohlfarth, Mutschler, Beetz, Kreuser, & Korsten-Reck (2013); Yordy, Pope, & Want (2019); Zasoff & Hart (2003)
Not mental health population	Abrams (2013); Arnskotter, Marcar, Hund-Georgiadis, & Hediger (2017); Badau, Enikö, Flaviu, Macovei, Mălăncrăvean, Ene, Adriana,

(*n = 119*)	Ramona, & Badau (2017); Barker, Barker, McCain, & Schubert (2017); Barker, Barker, McCain, & Schubert (2016); Barker, Barker & Schubert (2017); Battalia (2005); Debout (1994); Berger & Grepperud (2011); Bibbo (2013); Binfet (2017); Binfet, Passmore, Struik, & McKay (2018); Boegel (2018); Bolden, Bentley, Adkins, Jagielski, & Schwebel (2017); Bouchard (2014); Bouchard, Landry, Belles-Isles, & Gagnon (2004); Burgon (2013); Cameron & Robey (2013); Capparelli (2017); Cawley, Cawley, & Retter (1988); Conte (2015); Davison (2105); De Beer (2017); Delgado, Toukonen, & Wheeler (2018); Dell, Chalmers, Gillett, Rohr, Nickel, Campbell, Hanoski, Haguerud, Husband, Stephenson, & Brydges (2015); Dice, Dantaniello, Gerardi, Menna & Freda (2017); DiMarco, Davies, Hargett, Kimberly, Odle, Takeno, … & Scuderi (2015); Dluzynski (2018); Donaldson (2016); Donovan (2017); Ellsworth (2016); Evans, Nicodemus, Irvin, Brunson, Beckman , Memili, & Jousan (2019); Ewing, MacDonald, Taylor & Bowers (2007); Faye (2003); Ficco & Hunse (2017); Foith (2017); Folse, Minder, Aycock, & Santana (1994); Gennadevna (2017); Ginex, Montefusco, Burns, Trocchia, Zecco, See Tan, Kopelman, & Hedal-Siegel (2016); Ginex, Montefusco, Zecco, Trocchia Mattessich, Burns, Hedal-Siegel, Kopelman, & Tan (2018); Giuliani & Jacquemettaz (2017); Gocheva, Hund-Georgiadis, & Hediger (2018); Gonzalez-Ramires, Ortiz-Jimenez, & Landero-Hernande (2013); Grajfoner, Harte, Potter, & McGuigan (2017); Gray (2018); Groninger (2012); Hammer, Bach-Gorman, & Berg (2019); Hanselman (2001); Hediger, Thommen, Wagner, Gaab, & Hund-Georgiadis (2019); Ho, Zhou, Fung, Kua, & Huang (2017); Hoffman (2018); House, Neal, & Backels (2018); Jasperson (2011); Jasperson, (2013); Johnson, Vanden Dolder, Eddy, & Wielinski (2016); Kaiser, Keleski, Cr, & Siegford (2006); Kang, Jung, Park, & Han (2018); Kim, Ko, Choi, Moon, & Km (2018); Kirnan, Ventresco, & Gardner (2018); Kobayashi, Ushiyama, Fakih, Robles, Carneiro, & Carmagnani (2009); Kumasaka, Fujisawa, Hiroko, Hidemi, & Kataoka (2016); Le Henaff & Grandgeorge (2017); Lenihan, McCobb, Diruba, Linder, & Freeman (2016); Levinson, Vogt, Barker, Renck, Jalongo, & Van Zandt (2017); Linder, Meuller, Gibbs, Alper, & Freeman (2018); Loeffler (2016); Machova, Prochazkova, Eretova, Svobodova, & Kotik (2019); Maltseva, Melnikova, Shmonin, Skoromets, Ivanova (2014); McArthur & Syrnyk (2018); McConnell (2016); mcCracken, LaJoie, Polis, Paige Hertweck, & Lovelss (2016); McDonald, McDonald, & Roberts (2017); Meola (2017); Moody, King, & O'Rourke (2002); Moscato, Calabrese, & Moscato (2009); Muckle & Lasikiewicz (2017); Muela, Balluerka, Amiano, Caldentey, & Aliri (2017); Murry & Allen (2012); Nelson, Axtell, Derby, Moug (2011); Nobbe (2016); Park (2014); Peacock (2005); Pentecost (2017); Perkins (2018); Peters (2017); Picard (2015); Porter (2005); Prelewicz (1993); Rames (2016); Ramirez (2019); Rodrigo Claverol, Rodrigo Claverol, Casanova Gonzalvo, Real Gatiu, Solé, & Ortega Bravo (2017); Romaniuk, Evans,

	& Kidd (2018); Rousseau (2018); Ruchman, Ruchman, Jaeger, Durand, & Kelly (2011); Saludes (2018); Schretzmayer, Kotrschal, & Beetz (2017); Shambo, Seely, & Vonderfecht (2008); Silva e Borges, Weneck, Da Silva Mde, Gandolfi, & Pratesi (2011); Silva & Osorio (2018); Stinchi, Cardinale, Pompa, Fania, Di Maio, Palmegiano, & Brignola (2012); Stoner (1969); Strathaus (2017); Taylor (2019); Thew (2017); Thomas (2018); Thrasher (2016); Toro & Valdes (2010); Trotter (2006); Tsantefski, Briggs, Griffiths, & Tidyman (2017); Tuft University School of Veterinary Medicine press release (2011); Ward-Griffin Klaiber, Colins, Owens, & Coren (2018); Wells & Perrine (2001); West (2018); Wohlfarth, Mutschler, & Beetz (2014); Wong, Yu, Li, Lai, Ng, & Fan (2017); Young (2012)
Not AAPT **(*n = 561*)**	Abate, Zucconi, & Boxer (2011); Abbud, Janelle, & Vocos (2014); Acri, Hoagwood, Morrissey & Zhang (2016); Al-Humouz & Arabiat (2015); Alison (2010); Allen & Blascovich (1996); Allen (1998); Ambrosi, Zaiontz, Peragine, Sarchi, & Bona (2019); Anderson (2016a); Anderson (2016b); Anderson (2018); Anderson, Reid, & Jennings(1992); Andrysco (1982); Antonioli (2010); Antonioli & Reveley (2005); Athy (2005); Baker, Grinvalsky, Boat, & Geracioti (1998); Banks (1998); Banks & Banks (2002); Banks & Banks (2005); Banks, Willoughby, & Banks (2008); Bardill (1994); Baremore (2015); Barker & Dawson (1998); Barker, Kinsley, McCain, & Best (2005); Barker, Kinsley, McCain, Schubert, & Panduangi (2010); Barker, Knisely, Schubert, Green, & Ameringer(2015); Barker, Pandurangi, & Best (2003); Barker, Rasmussen, & Best (2003); Barnes (1985); Basile (1996); Bassette (2011); Bassette & Taber-Doughty (2013); Batson, McCabe, Braun & Wilson (1998); Bauducco (1996); Beck & Katcher (1996); Beck, Gonzales, Sells, Jones, Reer & Zhu (2012); Beck, Seraydarian, & Hunter (1986); Becker (2014); Beetz (2013); Beetz, Julius, Turner & Kotrscal (2012); Beetz Kotrschal, Turner, Hediger, Uvnäs-Moberg, & Julius (2011); Beetz, Winkler, Julius, Uvnäs-Moberg, & Kotrschal (2015); Behling (1990); Beinotti, Christofoletti, Correia, & Borges (2013); Belo (2017); Berget, Ekeberg, & Braastad (2008); Bergetm Ekeberg, Penderson, & Braastad (2011); Berget, Pedersen, Enders-Slegers, Beetz, Scholl, & Kovacs (2013); Berget, Skarsaune, Ekeberg, & Braastad (2007); Bernstein, Freidmann, & Malaspina (2000); Berry, borgi, Terranova, Chiarotti, Aleva, & Cirulli (2012); Bexson (2008); Biles, & McColloch (1989); Birke & Lockenhull (2015); Blake (1980); Blender (2009); Bode (2017); Bohlinger (1985); Bono, Benvenuti, Buzzi, Ciatti, Chiarelli, Chiambretto, Morelli, Pinciroli, Pini, Prestigiacomo, Rolleri, & Valena (2015); Bonofiglio (1995); Boonmee, Pongasksri, & Peansukmanee (2016); Booten (2011); Borgi, Loliva, Cerino, Chiarotti, Venerosi, Bramini, Nonnis,Enrico;Marcelli,Marco;Vinti,Claudia;De Santis, Fagerlie, Frascarelli, & Cirulli (2016); Borioni, Marinaro, Celestini, Del Sole, Magro, Zoppi, Mattei, Dall'Armi, Mazzarella, Cesario, & Bonassi

	(2012); Bost (1986); Bowes (1991); Boyer (2006); Boyer & Mundschenk (2014); Bradley (2014); Breitenbach, Stumpf, Fersen, & Ebert (2009); Brensing & Linke (2003); Brickel (1979); Brickel (1984); Brickel (1985); Brock (1987); Brodie, Biley & Shewring (2002); Brouilette (2006); Brown (2015); Brucklacher (1992); Bumsted (1988); Burgess (1997); Burrows, Adams, & Millman (2008); Buttelmann & Römpke (2014); Calcaterra, Veggiotti, Palestrini,De Giorgis, Raschetti, Tumminelli, Mencherini, Papotti, Klersy, Albertini, Ostuni, & Pelizzo (2015); Calvo, Fortuny, Guzmán, Macías, Bowen, García,. . . & Fatjó (2016); Campbell-Begg (2000); Carew-Lyons (2016); Carlisle (2015); Carlson (1983); Cavicchi (2012); Cerulli, Minganti, De Santis, Tranchita, Quaranta, & Parisi (2014); Chamove, Chawley-Hartrick, & Stafford (2002); Chapman, Morabito, & Ladakakos (2001); Chermak (2016); Chia, & Kee (2014); Chianese (2010); Chinner & Dalziel (1991); Chu, Liu, Sun & Lin (2009); Churchill, Safaoui, McCabe, & Baun (1999); Cieslak (2001); Coakley & Mahoney (2009): Cody, Skeiker, & Szymandera (2011); Cole & Gawlinksi (1995); Cole & Gawlinski (2000); Gole, Gawlinski, Steers, & Kotlerman (2007); Colombo, Buono, Smania, Raviola, & De Leo (2006); Conniff, Scarlette, Goodman, & Appel (2005); Conners (2003); Corson & Corson (1987); Counsell, Abram & Gilbert (1997); Cowell (2017); Cox (1999); Craven (2013); Crawford (2018); Crawford (2009); Creary (2017); Crossman & Kazdin (2018); Crowe, Perea-Burns, Sedillo, Hendrix, Winkle, & Deitz (2014); Crowley-Robinson, Fenwick, & Blackshaw (1996); Crowley-Robinson & Blacksahw (1998); Crump & Derting (2015); Cumella, Lutter, Smith-Osborne, & Kally (2014); Cushing & Williams (1995); Cuypers, De Ridder, & Strandheim (2011); Dabelko-Schoeny, Phillips, Darrough, DeAnna, Jarden, Johnson & Lorch (2014); Daltry & Mehr (2015); Damon & May (1986); Darrah (1996); Date (2011); DeSantis, Contralbrigo, Simonato, Ruzza, Toson, & Farina (2018); Deatrick (1983); Deboer (2017); Del Monaco (1985); Del Rosario-Montejo, Molina-Rueda, Munoz-Lasa, & Alguacil-diego (2014); Dell, Chalmers, Gillett, Steeves, Rohr, Fornssler, Husband, Iwajomo, & Nickel 2018); Delong & Gans (2019); Dennehy, Mackenzie & Lovarini (1987); Devault (1987); Dhooper (2003); Dilts (2009); Dilts, Trompisch, & Bergquist (2011); Dinges (2015); Dizon (2008); Donaldson (2002); Donoqitz (2002); Dravsnik, Signal & Canoy (2018); Duffy, Earl, & O'Connor (2017); Duong (2010); Eaglin (2008); earnst (2017); Ebener & Oh (2017); Eddy (1996); Edwards & Beck (2002); Edwards & Beck (2013); Emory (1992); Engel (2009); Every, Smith, Smith, Trigg, & Thompson (215); Ewing, MacDonald, Taylor & Bowers (2007); Fairman, & Huebner (2000); Fallani, Prato Previde, & Valsecchi (2007); Fannin (2015); Fasula (2008); Ferreira, Rodrigues, Santos, Guerra, Miglino, Maria, & Ambrosio (2016); Fiori, Bartoli, Marzi, Galimberti, Palomba, Corsi, Zolferino, Ciceroni, & Matucci (2015); Foreman & Crosson (2012); Fournier, Geller, & Fortney (2007); Frame

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Not available **(*n = 38*)**	Alexandridis, Kupsch, & Voderholzer (2013); Allen (2013); Beiber (1983); Betker (2013); Black (2009); Bowers & Macdonald (2004); Brooks (2001); Bueche (2003); Butler (2009); Carolina Canines for Therapy Paws for READing (2011); Corson & Corson (1978); Crespo (2002); Dickstein (1997); Ensminger (2011); Fenstermaker, McKendree and Swope (2016); Helping Paws International (2011); Holden (2013); Kogna (2002); Luley (2016); McDonald (2004); Monleon, Fons, Ballarin, & Andreu (2017); Mugford & McComisky (1975); Newlin (2003); O'Haire & Gabriels (2017); Pollack, (2009); Public Libraries Online (2011); Re (2002) Scharborough (2010); Sing (2015); Smith (1983); Tamborello (2017); Tarrant (2000); Thomas (2001); Turner (2012); UC Davis study shows dogs can help youngsters read (2010); Williams (1981); Williamson (2011); Zillmer (2014)
Not in English **(*n = 31*)**	Ansorge & Sudres (2011); Barthalot (2001); Bublak (2012); Cozza, Zanangeli, D'Alessandro, & Natoli (1994); De Villiers (2009); Desachy (1996); Doronina (2016); Fernandez Jorge, Roldan Gacimartin, De Gomez Alfageme, Vargas, Lahera Corteza (2013); Ferwerda-van Zonneveld, Rommers, & Oosting (2008); Folch, Torrente, Heredia, & Vicens (2016); Folch, Torrente, Heredia, & Vicens (2016); González-Ramírez, Ortiz-Jiménez, & Landero-Hernández (2013); Hameury, Delavous, & Leroy (2011); Javelot, Antoine-Bernard, Garat, Javelot, Weiner, & Mervelay (2012); Jofre (2005); Le Roux (2013); Le Roux, Swartz, & Swart (2015); Lukina (2001); Luthi (2011); Merle & Saillant (2012); Mudzyk, Bourque, Guilbert, Seguin, & Savoye (2011); Natoli (1997); Ozyurt, Dinsever, Akpinar, Ozcan, Sal, & Ozturk (2017); Perraud (2013); Püllen, Coy, Hunger, Koetter, Spate, & Richter (2013); Park & Kim (2012); Riederle (1999); Rinquest (2005); Satori & Zana (2014); Sung & Pongsaksri (2014); Tribet, Boucharlat, & Myslinski (2008)
Overlapping samples **(*n = 5*)**	Frederick, Ivey Hatz, Lanning (2015); Henry & Crowley (2015); Kruger (2012); McCullough, Risley-Curtiss, & Rorke (2015); Trotter, Chandler, Goodwin-Bond, Casey (2008)
Program Description **(*n = 53*)**	Anonymous (1984); Beder, Sullivan-Sakaeda, & Martin (2012); Bumanis (1991); Canter (2013); Cepeda (2011); Cho (2014); Clark

	(2009); Cloclasure (2004); Eller (2012); Harris & Gellin (1990); Haylock & Cantril (2006); Huebscher (2000); Jacob (2011); Kaldy (2013); Kane (2012); Kavanagh (1994); Kelly & Cozzolino (2015); Krafft (2012); Kronheim & LeDuc (2005); Laughlin (2008); Mallong, Ross, Klee, & Ross (2006); Masters (2010); Moreau (2001); Muscat (2001); Nurenberg & Schleifer (2011); Parelli (2012); Petitto (2010); Polt (1985); Porter-Wenzlaff (2007); Raack (1999); Ritchie & Amaker (2012); Robinson (1986); Roffey, Garland, Bromfield, Abdulla, Hawtrey, Moodley, & Nune (2018); Roy (2012); Siegel (1962); Smith & Meehan (2010); Smith & Meehan (2011); Soutar-Freeman (2002); Spero (2016); Teeter (1997); Tinsley & Jedlicka (2012); Tribulato (2004); Turan (2016); VanFleet (2016); Vanfleet & Faa-Thompson (2010); Vidrine, Owen-Smith, & Faulkner (2001); Weston-Thompson (2012); Whittington (2008); Wiesinger, Neuhauser, & Putz (2006); Yount, Olmert, & Lee (2012)
Qualitative **(*n = 174*)**	Allen-Miller (2014); Anderson (2004); Anderson & Olson (2006); Aslanian (2015); Bach-Gorman (2015); Banman (1995); Bardill & Hutchinson (1997); Beck (2014); Bizub, Ann & Davidson (2003); Born (2008); Bos (2016); Bradberry, Roberts, & Meinersmann (2006); Bradley (2006); Broberg, Stempien, Dell, Smith, Steeves, & Jurke (2017); Burgon (2003); Burgon (2011a); Burgon (2011b); Burgon (2011c) Burgon (2014); Burrows, Adams, & Spiers (2008); Cable & Pulcini (2018); Campbell-Begg (1998); Cangelosi & Embrey (2006); Carlsson (2017); Carlsson (2018); Carlsson, Nilsson Ranta, & Traeen (2014); Carlsson, Nilsson Ranta, & Traeen (2015); Chace (2019); Chronister (1993); Cohen (2011); Coleman (2016); Comartin (2018); Copley (1982); Corring, Lundberg, & Rudnick (2013); Currie (2008); Darling (2014); Delgadillo (2011); Dell, Chalmers, Bresette, Swain, Rankin, & Hopkins (2011); DePompei (2017); Devon (2011); Dunlop & Tsantefski (2018); Eller (2019); Elmacı, & Cevizci (2015); Engelman (2013); Esbjorn (2006); Fick (2015); Fields (1977); Filippides (2016); Flaherty (2017); Foley (2008); Ford (2013); Fredrich (2019): Fredrich (2019); Galonski (2014); Gammonley, & Yates (1991); Garland (2012); Garland (2013); Geist (2014); Glazer, Clark, & Stein (2004); Gomez (2015); Goodwin (2015); Goodwin, Hawkings, & Townstead (2017); Graham (2007); Grimm (2015); Hawkridge (2017); Hayden (2005); Hayden (2018); Held (2006); Helm (2009); Hemenway (2006); Hemingway, Meek & Hill (2015); Hess (1987); Ho (2018); Horn (2015); Hurwitz (2013); Hutton (n.d.); Johnson (2001); Johnson (2013); Kalkoske (2018); Kappelman (2014); Kaymen (2005); Kendziorski (1999); Kern-Godal, Brenna, Arnevik, & Ravndal (2016); Keshishian (2013); Koch (2008); Koekemoer (2016); Kongable, Stolley, & Buckwater (1990); Kreiviniene (2011); Kruger (2018); Krumholtz (2016); Lac (2016); Lacambra (2018); LaFleur (2015); Lange, Cox, Bernert, & Jenkins (2007); Lee Davis, Maurstad, & Dean (2014); Legge (2016); Lemke, Rothwell, Newcomb, & Swoboda (2014); Leonardi,

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Appendix K

Appendix J Table References

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