Animal Assisted Interventions for Children with Autism Spectrum Disorder: A Systematic Review

Tonya N. Davis, Rachel Scalzo, Erin Butler, Megan Stauffer, Yara N. Farah, Scott Perez, Kristen Mainor, Cathryn Clark, Stacy Miller, Alicia Kobylecky, and Laura Coviello
Baylor University

Abstract: Animal assisted intervention (AAI), which has been defined as the use of an animal to provide therapeutic benefit based on a positive relationship between the client and the animal, is a therapy option for children with autism spectrum disorder (ASD); therefore, it is beneficial to review studies that evaluated its effectiveness. A systematic search identified 20 studies that were assessed in terms of (a) participant characteristics, (b) independent variables, (c) dependent variables, (d) study outcomes, and (e) certainty of evidence. Although AAI studies reported either positive or mixed results, multiple methodological flaws were identified across the literature, which is cause for concern when determining intervention efficacy. Because of these contradictory findings and research design limitations, additional inquiry is needed. As such, caregivers and practitioners should exercise caution in selecting AAI as part of an intervention package for children with ASD.

The diagnosis of autism spectrum disorder (ASD) has steadily increased in recent years, with estimates indicating that one in every 88 children is on the spectrum (Centers for Disease Control and Prevention [CDC], 2014). ASD is characterized by deficits in social communication and restricted, repetitive behaviors (American Psychiatric Association, 2013). Most experts agree that with early behavioral intervention, children can make exceptional gains in functioning (CDC, 2014). However, the etiology of ASD remains unknown.

Perhaps influenced by this, there are a multitude of intervention choices available for children with ASD. In a survey conducted by Green and colleagues (2006), over 100 different interventions for ASD were identified. Unfortunately, not all available interventions have demonstrated empirical evidence of effectiveness, but continue to be used (Davis, et al., 2013; Green et al., 2006; Helflin & Simpson, 1998; Mulloy et al., 2010). Families of children with autism often pursue these interventions in the hope of ameliorating particular aspects associated with ASD (Bowker, D’Angelo, Hicks, & Wells, 2011). Unfortunately, the implementation of interventions lacking empirical support often result in families of children with autism wasting precious time, money, and resources when those could have been allocated toward interventions fitting the evidence-based practice guidelines outlined in the National Standards Report by the National Autism Center (2009).

Animal assisted intervention (AAI) is an alternative intervention that has developed into a diverse field with practitioners in occupational, speech, behavioral, and cognitive therapies, treating individuals with a range of medical issues and developmental disabilities (e.g., Sams, Fortney, & Willenbring 2006; Silva et al., 2011; Solomon, 2010). AAI is an umbrella term that includes animal assisted therapy (AAT) and animal-assisted activities (AAA). AAT is an intervention in which the animal is an essential part of reaching a specified goal. On the other hand, AAA refers to activities in which animals are involved for potential benefit, but specific goals are not identified and the activities do not have to be conducted by trained personnel. Given the broad scope of the terms, the practice and implementation of AAI is not standardized.

Correspondence concerning this article should be addressed to Tonya N. Davis, Baylor University, One Bear Place #97031, Waco, Texas 76798-3701. E-mail: Tonya_Davis@baylor.edu
and difficult to evaluate (Palley, O’Rourke, & Niemi, 2010).

The human-animal interaction theory suggests that the relationship between humans and animals results in positive physical and psychological benefits. Specifically, this theory postulates that humans view animals as sources of non-judgmental social interaction (Esposito et al., 2011; Kruger & Serpell, 2010). There may be other mechanisms at work, such as the animal serving as a mediator or translational object for social needs (Kruger & Serpell, 2010). Many physiological benefits, such as reductions in blood pressure and heart rate, have been established in cases where individuals are in the presence of an animal (Bass, Duchowny, & Llabre, 2009; Viau et al., 2010). Even so, AAI as a field lacks a unified, empirically supported theoretical framework from which practices are derived (Kruger & Serpell, 2010).

Families of children with ASD may select AAI as an intervention so that their child can be in close proximity to and interact with trained, therapeutic animals, yet evidence supporting the efficacy of these programs is limited (Breitenbach, Stumpf, Fersen, & Ebert, 2009). AAI have become increasingly popular for individuals with developmental disabilities, giving rise to programs with dogs, horses, dolphins, and more, both nationally and internationally (Bass et al., 2009; Breitenbach et al., 2009; Burrows, Adams, & Millman, 2008; Dingman, 2008; Martin & Farnum, 2002; Memishevikj & Hodzhikj, 2010; Pawlik-Popielarska, 2010; Prothmann, Ettrick, & Prothmann, 2009). These programs focus on a variety of goals and are utilized throughout varying disciplines (Maurer, Delfour, Wolff, & Adrien, 2010). As an intervention gains popularity, it is imperative that evidence supporting its therapeutic benefits, or lack thereof, be identified so that families and practitioners can make informed decisions regarding intervention selection.

A systematic literature review on the effects of AAI on symptoms associated with ASD is warranted. The purpose of the review is to describe the characteristics of interventions involving animals as well as evaluate the results on symptoms associated with ASD. To date, one review exists (O’Haire, 2013); however, the current review differs from the previous literature synthesis by specifically selecting and reviewing the studies that measured changes associated with ASD symptoms (i.e., social communication and stereotyped or challenging behavior). The previous review included additional components unrelated to core ASD symptoms (e.g. stress, well-being) as well as discussing the reviewed studies as evidence for AAI as a psychosocial intervention for ASD. With AAI being promoted as an ASD intervention, it is imperative that the effectiveness to improve symptoms specific to ASD is known. The information summarized in this review should assist caregivers and practitioners in making informed decisions regarding the use of AAI as an ASD intervention.

Method

This review consisted of a systematic search and analysis of studies that utilized animals in the treatment of symptoms associated with ASD. The results of the analysis are summarized in the following categories: (a) participant characteristics, (b) dependent variables, (c) independent variables, (d) study outcomes, and (e) certainty of evidence. Due to the paucity of research available on AAI, the intent of this review was to include all available studies. As a result, the quality and type of research designs varied.

Inclusion and Exclusion Criteria

To be included in this review, studies must have been published in English in peer-reviewed journals, but no restrictions on publication date were set. Additionally, the study had to evaluate the effects of animal interaction with at least one child, under the age of 18, with ASD. As diagnostic criteria have changed recently (American Psychiatric Association, 2013) any participants with diagnoses of autism, Asperger’s Disorder, or Pervasive Developmental Disorder, Not Otherwise Specified were included. The study design had to include measurement of at least one dependent variable related to a core symptom of ASD, that is, social communication skills or repetitive and stereotyped patterns of behavior and/or challenging behavior. Among the studies in which some participants, but not all, met this criterion, only those in which the
results for the participants meeting the criterion were extracted for review.

Because very few guidelines exist regarding the procedures that define AAI, a broad inclusion criterion was employed. Specifically, any study incorporating a non-human mammal as the independent variable (i.e., intervention), or component of the independent variable, was included. As a result, broad uses of animals are represented across these studies. However, studies were excluded if the inclusion of the animal was strictly considered pet ownership with no specifically defined activities taking place with the animals in order to maintain the focus of this review specifically on AAI. This criterion resulted in excluding studies such as that conducted by Grandgeorge and colleagues (2012) who evaluated the effects of the presence or arrival of a family pet on social behaviors of children with autism. Research addressing the use of service dogs was considered distinct from pet ownership as service dogs were highly trained to provide assistance to children with ASD and therefore studies were included for analysis.

Other studies were also excluded from this review if the purpose of the research was to eliminate the abuse of animals or to reduce animal phobias. These criteria resulted in excluding a study by Bergstrom, Tarbox, and Gutshall (2011) that used applied behavior analysis techniques to decrease the mistreatment of a family pet. Additionally, a study by Chok, Demanche, Kennedy, and Studer (2010) who utilized a behavior analytic approach to decrease a severe dog phobia was excluded as well.

Search Procedures

A systematic search was conducted in the following databases: PsycINFO, Psychology and Behavioral Sciences Collection, PsycARTICLES, Educational Resources Information Clearing House (ERIC), Education Research Complete and MEDLINE. On all databases, the following free-text terms were inserted into the keyword fields in pairs utilizing Boolean operators and truncation: “animal assisted,” “animal,” “dolphin,” “canine,” “dog,” “equine,” “horse,” “pet,” “kyotherapy” and “hippotherapy” paired with “disability,” “autism,” “Asperger,” “mental retardation,” and “intellectual disability” (e.g., “animal assisted” paired with “disability” and “canine” paired with “autism”). All possible combinations of the listed terms were applied; specifically 50 search term pairs were utilized. Although participants were PDD-NOS were included in this study, “pervasive developmental disorder-not otherwise specified” was not utilized as a search term in lieu of the use of the broader term “disability”.

The abstracts of the resulting articles were reviewed to identify studies for inclusion. A total of 329 studies were identified via the electronic data base search; 20 of these met inclusion criteria. An ancestry search was then completed on all studies in order to identify additional articles, but no additional articles that met inclusion criteria were identified. Finally, hand searches covering January 2012 – December 2013 were conducted within all of the journals that had published the studies already selected for inclusion, but no additional articles that met inclusion criteria were identified.

Inter-rater agreement. To assess the reliability of our application in using the inclusion criteria, the first and second authors independently conducted the searches and then applied the inclusion and the exclusion criteria to studies identified by the search procedures. Agreement was 98.7% and the disputed studies were reviewed to reach a consensus.

Data Extraction

Each potential study was assessed against the inclusion criteria and data extracted. Participant characteristics were coded according to total number of study participants, gender, age, and diagnosis. Dependent variables were coded based on the core symptom of ASD addressed (i.e., social communication or restricted, repetitive behaviors) and how these variables were measured. Independent variables were coded according to the animal used, duration of intervention, activities taking place, person responsible for implementing AAI, any additional intervention components, and treatment fidelity.

Study outcomes were coded as (a) positive, (b) negative, or (c) mixed, based on criteria outlined by previous literature (Davis et al., 2013; Lang et al., 2012; Mulloy et al., 2010).
Accordingly, the studies were coded as having positive results if all participants made improvements on all dependent variables or if statistically significant improvements were found for all dependent variables in a group design (using the alpha levels stated in the reviewed study). Studies were coded as having negative results if none of the dependent variables improved for any participant or if a group design failed to find statistically significant improvement. Studies were coded as having mixed results if some participants improved and others did not or if improvement was found in some dependent variables, but not in others. Mixed results for group design studies applied if some improvements among dependent variables were statistically significant, but others failed to reach statistical significance (using alpha levels stated in the reviewed study).

Certainty of evidence was rated as “insufficient,” “preponderant,” or “conclusive” based upon definitions utilized in other works (e.g., Davis et al., 2013; Lang et al., 2012; Mulloy et al., 2010). The studies were classified at the insufficient level of certainty if they did not utilize a true experimental design (e.g., case studies, AB designs, and group designs without a control group) and/or did not meet the criteria of the next level of certainty. In order to be classified at the preponderance level of certainty, a study had to (a) demonstrate experimental control in a single case research design or use an experimental group design, (b) provide adequate inter-observer agreement (IOA), when applicable (i.e., 20% or more of sessions with mean agreement 80% or higher), (c) operationally define dependent variables, and (d) provide enough detail to enable replication. The studies classified at the preponderance level could contain limitations regarding alternative explanations for results (e.g., concurrent intervention or multi-component interventions). The final level of certainty (i.e., conclusive) was reserved for the studies that met the first four requirements of preponderance of evidence, and also included an additional attempt to control for confounding variables (e.g., double-blind, placebo controlled) and reported treatment fidelity.

Inter-rater agreement. To assess reliability of data extraction, one article was jointly summarized by the first four authors. An additional nine studies (45%) were then independently summarized by two authors to assess agreement. This process yielded 171 items in which there could be agreement or disagreement (i.e., nine studies with 19 items per study). Agreement for the summarized items was 93% and all disagreements were resolved by discussion until consensus was reached.

Results

A total of 20 studies met the criteria for inclusion in this review. Table 1 summarizes these studies in terms of participant characteristics, dependent variables, independent variables, study outcomes, and certainty of evidence.

Participants

A total of 330 participants received some form of AAI across the 20 studies. The sample size per study ranged from one to 64 participants. The ages ranged from 3 to 16 years old. Of the 330 participants, 242 participants were male (73%) and 62 were female (19%). The gender was not reported for 26 (8%) participants. Among the participants, 130 (39%) were diagnosed with autism, 31 (9%) with Asperger syndrome, and 32 (10%) with PDD-NOS. An additional 137 participants (42%) were diagnosed with autism, 31 (9%) with Asperger syndrome, and 32 (10%) with PDD-NOS. An additional 137 participants (42%) were reported as having ASD. In addition to ASD diagnoses, 15 participants (5%) were reported to have an additional diagnosis. This most frequently included an intellectual disability.

Dependent Variables

Although a variety of dependent variables were reported in the studies, the purpose of this review was to summarize the effects of AAI on ASD symptoms. In 16 studies (80%) included in the review the effects on social skills (e.g., sharing, eye contact, interactive play, interactions with others) were reported. In 13 studies (65%) effects on repetitive and stereotyped patterns of behavior and/or challenging behavior (e.g., stereotypy, tantrums) were reported. Another 10 studies (50%) reported on the effects of AAI on communication skills (e.g., spontaneity of speech, grammatical aspects of speech, etc.). One final study (Kern et al., 2011) did not report individual dependent...
<table>
<thead>
<tr>
<th>Citation</th>
<th>Participants</th>
<th>Animal</th>
<th>Dependent Variables</th>
<th>Measurement</th>
<th>Study Outcomes</th>
<th>Certainty of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bass et al. (2009)</td>
<td>29 male, 5 female</td>
<td>Horse</td>
<td>Social Skills</td>
<td>SRS</td>
<td>Preponderant: Raters were not blinded to treatment purposes; insufficient detail to replicate activities</td>
<td>Insufficient: Data consists solely of anecdotal reports from parents and does not provide enough detail regarding improvements in communication, IOA was not reported; insufficient detail to replicate activities</td>
</tr>
<tr>
<td>Burrows et al. (2008)</td>
<td>10 male, 3 female</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Parent interview</td>
<td>Positive Insufficient: Data consists solely of anecdotal reports from parents and does not provide enough detail to replicate service dog experience.</td>
<td></td>
</tr>
<tr>
<td>Funahashi et al. (2013)</td>
<td>1 male</td>
<td>Dog</td>
<td>Communication</td>
<td>Direct observation</td>
<td>Positive Insufficient: No experimental control regarding improvements in communication, IOA was not reported; insufficient detail to replicate activities</td>
<td></td>
</tr>
<tr>
<td>Gabriels et al. (2012)</td>
<td>36 male, 6 female</td>
<td>Horse</td>
<td>Social Skills, Communication</td>
<td>VABS, ABC, CARS, SP-CQ</td>
<td>Mixed Preponderant: Raters were not blind to treatment purposes; insufficient detail to replicate activities</td>
<td>Insufficient: No experimental ABA design; research design compared different frequencies of therapeutic horseback riding activities; although described (e.g., put on helmet, mount horse, etc.), specific horseback riding activities were not detailed.</td>
</tr>
<tr>
<td>Holm et al. (2013)</td>
<td>3 male</td>
<td>Horse</td>
<td>Social Skills</td>
<td>SRS, ABC, CARS, SP-CQ</td>
<td>Mixed Insufficient: Non-experimental ABA design used; research design compared different frequencies of therapeutic horseback riding activities; although described (e.g., put on helmet, mount horse, etc.), specific horseback riding activities were not detailed.</td>
<td></td>
</tr>
<tr>
<td>Kern et al. (2011)</td>
<td>18 male, 6 female</td>
<td>Horse</td>
<td>Overall autism rating on CARS</td>
<td>Social Skills, Direct observation of social contacts</td>
<td>Mixed Preponderant: Raters were not blind to treatment purposes; insufficient detail to replicate activities</td>
<td>Insufficient: No experimental ABA design used; research design compared different frequencies of therapeutic horseback riding activities; although described (e.g., put on helmet, mount horse, etc.), specific horseback riding activities were not detailed.</td>
</tr>
<tr>
<td>Kršková et al. (2010)</td>
<td>5 male, 4 female</td>
<td>Guinea Pig</td>
<td>Social Skills</td>
<td>Direct observation of social contacts</td>
<td>Mixed Preponderant: Raters were not blind to treatment purposes; insufficient detail to replicate activities</td>
<td>Insufficient: No experimental ABA design used; research design compared different frequencies of therapeutic horseback riding activities; although described (e.g., put on helmet, mount horse, etc.), specific horseback riding activities were not detailed.</td>
</tr>
<tr>
<td>Citation</td>
<td>Participants</td>
<td>Animal</td>
<td>Dependent Variables</td>
<td>Measurement</td>
<td>Study Outcomes</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------</td>
<td>--------</td>
<td>---------------------</td>
<td>-------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>Martin &amp; Farnum (2002)</td>
<td>8 male, 2 female</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 -- 13 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 -- 13 years</td>
<td>Behavior</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td>Memishkivj &amp; Hodzhikj (2010)</td>
<td>2 male, 2 female</td>
<td>Horse</td>
<td>Social Skills</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 -- 12 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 -- 12 years</td>
<td>Behavior</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td>Obrusnikova et al. (2012)</td>
<td>1 male, 3 not reported</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 -- 12 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 -- 12 years</td>
<td>Behavior</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td>O’Haire et al. (2013)</td>
<td>50 male, 14 female</td>
<td>Guinea pig</td>
<td>Social Skills</td>
<td>PDDBI SSRS</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 - 12 years</td>
<td></td>
<td></td>
<td>Mixed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 - 12 years</td>
<td>Behavior</td>
<td>PDDBI SSRS</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Pawlik-Popielarska et al. (2010)</td>
<td>1 participant</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 years</td>
<td>Behavior</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td>Prothman et al. (2009)</td>
<td>11 male, 3 female</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 -- 14 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 -- 14 years</td>
<td>Behavior</td>
<td>Direct observation</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td>Rederfer &amp; Goodman (1989)</td>
<td>9 male, 3 female</td>
<td>Dog</td>
<td>Social Skills</td>
<td>Direct observation</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 -- 10 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 -- 10 years</td>
<td>Behavior</td>
<td>Direct observation</td>
<td>Positive</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 1—(Continued)
<table>
<thead>
<tr>
<th>Citation</th>
<th>Participants</th>
<th>Animal</th>
<th>Dependent Variables</th>
<th>Measurement</th>
<th>Study Outcomes</th>
<th>Certainty of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salgueiro et al. (2012)</td>
<td>8 male, 2 female</td>
<td>Dolphin</td>
<td>Social Skills Communication Behavior</td>
<td>ATEC, CARS</td>
<td>Mixed</td>
<td>Insufficient: Pre- and post-assessment with no control group; insufficient detail to enable replication.</td>
</tr>
<tr>
<td>Sams et al. (2006)</td>
<td>22 participants</td>
<td>Dog, Rabbit, Llama</td>
<td>Social Skills Communication</td>
<td>Researcher-created observation forms</td>
<td>Positive</td>
<td>Insufficient: Raters not blind to the purpose of the study; IOA appears insufficient as authors reported 13 sessions independently rated, but did not report total number of sessions; however, reported 22 participants received an average of 2 sessions per week for 15 weeks (660 sessions).</td>
</tr>
<tr>
<td>Silva et al. (2011)</td>
<td>1 male</td>
<td>Dog</td>
<td>Social Skills Behavior</td>
<td>Direct observation</td>
<td>Mixed</td>
<td>Insufficient: Case study using statistical analysis with one participant; although authors report use of a structured protocol, insufficient detail was given to replicate as the protocol was never defined; raters not blind to purpose of treatment.</td>
</tr>
<tr>
<td>Solomon (2010)</td>
<td>1 male, 1 female</td>
<td>Dog</td>
<td>Social Skills Behavior</td>
<td>Anecdotal reports</td>
<td>Positive</td>
<td>Insufficient: Case study with no experimental design, DV measured using anecdotal reports; insufficient detail to replicate activities with dog.</td>
</tr>
<tr>
<td>Viau et al. (2010)</td>
<td>37 male, 5 female</td>
<td>Dog</td>
<td>Behavior</td>
<td>Researcher-created questionnaire</td>
<td>Positive</td>
<td>Insufficient: DV measured using researcher-created tool collecting anecdotal parent report; insufficient detail to replicate activities with dog; no control group.</td>
</tr>
<tr>
<td>Ward et al. (2013)</td>
<td>15 male, 6 female</td>
<td>Horse</td>
<td>Social Skills Communication Behavior</td>
<td>GARS</td>
<td>Mixed</td>
<td>Insufficient: Pre- and post-assessment with no control group; participant simultaneously received other services during the study (e.g., speech therapy, occupational therapy, physical therapy); respondents not blind to purpose of study.</td>
</tr>
</tbody>
</table>

**Abbreviations:** ASD, autism spectrum disorder; SRS, Social Responsiveness Scale; VABS, Vineland Adaptive Behavior Scales; ABC, Aberrant Behavior Checklist; CARS, Childhood Autism Rating Scales; SP-OQ, Sensory Profile-Caregiver Questionnaire; CARS, Childhood Autism Rating Scale; IOA, interobserver agreement; TEACCH, Treatment and Education of Autistic and related Communication Handicapped Children; PDD-NOS, Pervasive Developmental Disorder-Not Otherwise Specified; ATEC, Autism Treatment Evaluation Checklist; DV, dependent variable; PDDBI, Pervasive Developmental Disorder Behavior Inventory; SSRS, Social Skills Rating System; GARS, Gilliam Autism Rating Scales.
variables, but instead reported changes in the *Childhood Autism Rating Scale* (Schopler, Reichler, & Renner, 1988) score, which incorporates all three variables.

An assortment of measurement techniques were employed across studies. In eight studies (40%) standardized questionnaires, checklists, and rating scales were used to measure dependent variable changes. Various measures were used including: *Social Responsiveness Scale* (Constantino, 2002), *Vineland Adaptive Behavior Scales* (Sparrow, Cicchetti, & Balla, 2005; e.g. Gabriels et al., 2012), *Aberrant Behavior Checklist* (Aman, Singh, Stewart, & Field, 1985; e.g. Gabriels et al., 2012), *Autism Treatment Evaluation Checklist* (Rimland & Edelson, 2000; e.g., Bass et al., 2009; Gabriels et al., 2012), *Gilliam Autism Rating Scale* (Gilliam, 2006; e.g., Ward, Whalon, Rusnak, Wendell, & Pschall, 2013), *Childhood Autism Rating Scale* (Schopler et al., 1988; e.g., Holm et al., 2013), *Sensory Profile-Caregiver Questionnaire* (Dunn, 1999; e.g., Holm et al., 2013), *Social Skills Rating System* (Gresham & Elliot, 1990; e.g., O’Haire, 2013), and *Pervasive Developmental Disorder Behavior Inventory* (Cohen, Schmidt-Lackner, Romanycz, & Sudhalter, 2003; e.g., O’Haire, 2013).

Six studies (30%) employed direct observation and another four studies (20%) reported anecdotal data. Two studies (10%) utilized researcher-created questionnaires or measures (e.g., Sams et al., 2006) and one study utilized a parent interview (Burrows et al., 2008).

Animal Assisted Intervention

AAI is a broad term encompassing a variety of practices involving animals. The results of this review confirmed the variety among practices of those that incorporate animals for therapeutic benefit for children with ASD.

Animal selection. The studies included in this review incorporate a wide variety of animals. In 11 studies (55%) a dog was included as a component of the independent variable. The second most common animal was a horse (i.e., hippotherapy), implemented in six studies (30%), and followed by a guinea pig, implemented in two studies (10%). Other animals were incorporated in one study each, including a rabbit, llama, and dolphin.

Intervention dimensions. Generally, AAI sessions occurred relatively frequently. In 11 studies (55%) AAI was implemented on a weekly basis, whereas in three studies (15%) AAI was implemented two to five times per week. In another three studies (15%) AAI occurred daily. No interventions occurred on a monthly basis, but three studies did not specifically report frequency of AAI sessions.

The duration of AAI varied across studies as well. In 12 studies (60%) AAI was implemented for one to six months and in another three studies (15%) participants engaged in AAI for less than one month. Only two studies (10%) implemented AAI for seven months to one year, and one study (5%) implemented for over a year. The remaining two studies (10%) did not report total duration of implementation.

AAI varied widely in terms of activities taking place with the animals. Six studies (30%) taught the child a specific skill with the animal, such as mounting and riding a horse. An additional four studies (20%) had preplanned games or activities with the animal, such as feeding the animal, petting the animal, and playing fetch. Four other studies (20%) simply examined the influence of the presence of the animal with no specific interaction activities planned. Three studies (15%) included an animal as a service animal, but the studies varied in regards to the degree of detail regarding what services a service dog was providing. For example, Burrows et al. (2008) explicitly stated that the purpose of the dog was to keep the child safe and respond to his or her emotional and physical needs, but little detail about this protection and responding actually occurred. The remaining three studies (15%) did not describe the specific activities the animal participated in with the child, but rather made general statements.

Though essential to the understanding of AAI as an intervention modality, other aspects of treatment intensity as defined by Codding and Lane (2014) could not be determined from the studies included in this review.

Implementer. Similar to the type of animal incorporated into the independent variable, an array of individuals served to implement the intervention, even within studies. In 11 studies (55%) the implementer was identified as an animal trainer or therapist. The exact terminology varied, but this category contained any indi-
vidual described to have training in managing the animal and/or utilizing the animal for therapeutic purposes. Various terms used by the researchers included professional animal trainer (Solomon, 2010), dog guide (Pawlik-Popielarska, 2010), individuals with a certificate in equine-assisted psychotherapy (Memishevik & Hodzhikj, 2010), riding instructor (Kern et al., 2011) and Professional Association of Therapeutic Horsemanship International certified instructor (Gabriels et al., 2012). In three studies (15%) the implementers included a parent whereas an occupational therapist implemented in two studies (10%), and a psychologist in two studies (10%). Additionally, each of the following implementers was incorporated in one study each: speech language pathologist, teacher, and experimenter. Finally, two studies (15%) simply measured the effects of animal presence without specific implementation guided by a human implementer.

Additional intervention components. The broad inclusion criteria resulted in the review of any research that incorporated a non-human mammal as the independent variable or component of the independent variable; therefore, studies were included that incorporated an animal into an existing intervention model. Of the 20 studies, two (10%) incorporated an animal into a distinct intervention program other than AAI. Sams and colleagues (2006) incorporated several different animals into an occupational therapy program. Similarly, Obrusnikova, Bibik, Cavalier, and Manley (2012) included dogs into an existing sports program for children with and without disabilities.

Additionally, in six studies (30%) participants received multiple interventions as part of the study and/or outside of the study during the duration of the experiment. These included special education, psychiatric services, speech therapy, occupational therapy, physical therapy, and medication.

Treatment fidelity. No studies included in the review explicitly reported the measuring of treatment fidelity.

Study Outcomes

Eight of the 20 studies (40%) found positive results (e.g., Solomon, 2010; Viau et al., 2010). The remaining 12 studies (60%) found mixed results (e.g., Bass et al., 2009; Martin & Farnum, 2002). No studies found strictly negative results.

Certainty of Evidence

The majority of the studies (90%) were classified as insufficient, the lowest level of certainty. The remaining studies (10%) were classified as preponderant. No study was classified as conclusive.

Discussion

This review identified and evaluated 20 studies that examined the effects of AAI on ASD symptomatology. Conflicting conclusions were noted with the majority finding mixed results and the remaining finding positive results. When studies report conflicting results on a similar intervention, it is necessary to take into consideration the methodological rigor of the studies (Chambless & Hollon, 1998). For example, all of the studies reporting positive results were classified as having an insufficient certainty of evidence. However, it should also be noted that studies meeting criteria for having a negative effect would not likely be published and therefore any studies implicating the participants did not improve, or worsened in the presentation of ASD symptoms, therefore cannot be used to compare those studies rated as having positive or mixed results.

Among many of the studies, threats to internal validity compromised the methodological rigor of the study. Threats to internal validity found across the reviewed studies included, but were not limited to, (a) lack of experimental design, (b) use of anecdotal observations, (c) use of researcher-constructed measurement systems, (d) additional interventions serving as confounding variables, (e) lack of detail describing the independent variable, and (f) lack of treatment fidelity reports.

The first threat to internal validity was a lack of experimental design. For example, Pawlik-Popielarska (2010) and Solomon (2010) reported only anecdotal data from case studies with no experimental design. Similarly, Burrows and colleagues (2008) reported parent interview data, but limited inferences about cause-and-effect relation-
ships can be established using this type of research methodology.

Secondly, several studies utilized anecdotal observation. For example, Obrusnikova and colleagues (2012) conducted a case study in which the measurement of changes among participants was informal interviews with parents and instructors after the completion of the program. It is difficult to confirm if such anecdotal reports are accurate, valid, and reliable, particularly with requesting information from parents and instructors only after the completion of the program, and presumably when they are not blind to the purpose of the program.

Similar concerns exist among the studies that utilized researcher-constructed measurements. For example, Sams and colleagues (2006) identified that rating forms were designed specifically for their study and Viau and colleagues (2010) described an 11-item questionnaire designed for their study. Researcher-constructed measurements may not be reliable and valid measures, and in these particular studies, data to support the reliability and validity of the measures were not reported.

Additional measurement procedures may have also biased results, including lack of blind raters and reliance on respondent memory. For example, Bass and colleagues (2009) utilized parents to respond to standardized rating scales, but parents were neither blind to the purpose of the study nor to the fact that their child was participating in therapeutic horseback riding. Holm and colleagues (2013) also used parent respondents who were not blind to the purpose of the study. Parents were asked to respond to standardized measures on three different occasions, once at the end of each phase of the study. Each time they were asked to respond with a look-back at the past 30 days, the duration of their child’s exposure to the previous phase. This reliance on memory increases the likelihood of inaccurate reports; for example, parents may report changes that occurred before the one month window.

An additional concern across several studies was the potential confound of multiple interventions. For example, Sams and colleagues (2006) incorporated animals into occupational therapy activities. As a result, it is impossible to determine if any changes in the dependent variable are a result from occupational therapy, interaction with the animal, or a combination of the two. Similarly, across the course of the study conducted by Kern and colleagues (2011), seven of the 24 participants experienced either a change in medication or therapy (e.g., speech therapy, occupational therapy); therefore, it is impossible to know if experienced changes are a result of medication or therapy changes as opposed to the horseback riding program.

Many studies failed to provide detail sufficient enough to enable replication. Many studies identified in this review provided little to no detail of the exact activities in which the participants engaged with the animals. For example, Martin and Farnum (2002) identified that the participants took part in 15 min sessions three times per week while the therapist followed a research protocol; however, the protocol did not include any more description than the inclusion of sample questions asked to the child. In fact, the responses to the participants’ appropriate and inappropriate behaviors were not described, as well as the specific activities, if any, to prompt interaction with the dog. Generally speaking, it appears there is very little detail about what constitutes AAI across disciplines and applications. As a result, the activities represented across the studies included in this review ranged from a simple exposure to animals to more detailed and sophisticated activities supporting animal interaction.

Finally, no studies reported a measure of treatment fidelity. In order to ensure that the AAI procedures are implemented with consistency over the course of the study, it is critical that authors report a measure of treatment fidelity. This would be particularly true in case studies and single-subject designs in which the independent variable (i.e., intervention) would be implemented multiple times over time (Gresham, Gansel, & Kurtz, 1993). However, no studies included in this review; therefore, it is impossible to determine the accuracy with which any of the AAI were implemented.

In addition to insufficient procedural details, the construct validity supporting AAI seems to be lacking. Many authors reported physical, social, psychological, and cognitive
benefits of animal interaction (e.g., Bass et al., 2009; Gabriels et al., 2012). Other authors reported slightly more detailed theorized benefits of animal interaction. For example, Martin and Farnum (2002) share theories that animals can serve as translational objects, which allow individuals with ASD to develop social bonds with the animal that then generalize to humans (George, 1988; Katcher, 2000; Winnicott, 1986), presumably implying that developing social bonds with animals is either easier or less aversive for individuals with ASD, though it is not explicitly stated. In other words, although some proposed theories of the benefit of AAI are shared by authors in varying degrees of detail, the exact processes in which these benefits are realized remain unclear among studies included in this review.

Aside from the lack of research support or construct validity, other factors should be considered before implementing AAIs. Safety of both the human and the animal could be at risk; in fact, both should be considered vulnerable groups. Williams (2008) made reference to such concerns in regard to dolphin therapy, reminding potential consumers that dolphins are strong, often unpredictable animals, which has led to significant injury to swimmers, such as bites and broken bones. Similar concerns should be shared for all animals, particularly larger animals such as horses and large dogs. However, human safety is not the only concern. Zamir (2006) points out that the animals may also suffer injury from rough handling or aggressive behavior of clients. Considering the high prevalence of stereotyped behavior that may inadvertently lead to injury to the animal (e.g., hand flapping) and aggression among children with ASD (e.g., Hartley, Sikora, & McCoy, 2008; Lord & Pickles, 1996; O’Reilly et al., 2010), this is a valid concern. Moreover, Preziosi (1997) points out that not all animals may want to serve as a therapist and argues that animals should never be forced to work.

The results of this systematic review conclude that the evidence to support AAI as a therapeutic intervention for children with ASD is weak. The mixed findings across studies, the methodological weaknesses in many studies, the insufficient explanation of procedures, the lack of clear construct validity, and the potential risk of harm to the child and animal should be factored into decisions regarding the implementation of AAI for children with ASD. However, there are limitations to this research, not the least of which is the unclear definition of AAI. Some studies may have been inadvertently excluded given the lack of a clear definition for what constitutes AAI. Additionally, studies with negative findings were not available for reasons related to publication, which could have impacted the findings of this review. Future research should address the methodological issues outlined in an effort to better understand the utility and efficacy of AAI. Caregivers and practitioners are cautioned in selecting AAI as it is unclear the impact this may have in treating impairments in social communication and restricted, repetitive behaviors in children with ASD.

References


*Kršková, L., Talarevičová, A., & Olešnová, L. (2010). Guinea pigs the “Small Great” therapist for autistic children, or: Do guinea pigs have positive effects on autistic child social behavior? Society


* Studies included in the review.

Received: 17 April 2014
Initial Acceptance: 20 June 2014
Final Acceptance: 27 October 2014