Outcomes of Dog-Assisted Therapy for Children and Adolescents with Autism Spectrum Disorder

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Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

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Statement of Authenticity

I, Brianna Clark, certify that this submission is my own work and contains no material previously published or written by another person except where acknowledged in the text.

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Thesis Abstract

**Background:** Recent research indicates animal-assisted therapy (AAT) as a treatment for Autism Spectrum Disorder (ASD). However, there is a shortage of rigorous evidence on outcomes of AAT and detailed description of therapy.

**Objectives:** This thesis aimed to evaluate the outcomes of dog-assisted therapy. Secondary aims were to describe the previous dog exposure, interests and difficulties of young people with ASD and to determine and evaluate the activities used in dog-assisted therapy.

**Method:** Firstly, a literature review was conducted which provides background information on ASD, explores the current evidence for interventions for ASD, in particular the evidence and theoretical basis for AAT, and describes the limitations of the evidence. Secondly, this thesis presents a manuscript. The study uses one group pre-post design and recruited thirty-four individuals with ASD aged between 4 and 19 engaged in 5 weekly sessions of dog-assisted therapy with an occupational therapist. The Autism Treatment Evaluation Checklist (ATEC) and Social-Responsiveness Scale 2 (SRS-2) were used to evaluate changes in autistic behaviour and social impairment, respectively. Frequency of activities were recorded and the degree of dog involvement, participant independence and engagement were rated for each activity during final sessions.

**Results:** There was no significant difference found over the course of therapy on ATEC or SRS-2. Key parent-reported goals of therapy were to address anxiety, social skills and communication. Primary participant difficulties included: fine motor skills, appropriate play, and auditory regulation. The activity that scored the highest on all scales was “animal hospital”, with “tug of war” and “direct dog interaction” scoring highly in both engagement and dog involvement.

**Conclusion:** This study is globally the largest study to investigate outcomes of dog-assisted therapy. Further studies with experimental designs and longer treatment duration are warranted to clarify the efficacy of AAT for ASD.
LITERATURE REVIEW

Search strategy to identify relevant studies.

The electronic databases Medline, Embase, and PsychINFO were searched between March and October 2017 to identify relevant peer reviews for this literature review. Key search terms used were pet therapy, animal assisted, animal assisted therapy, dogs, canine assisted therapy, animal assisted, pet therapy, play therapy, therap* dog*, autism, autistic, autistic disorder, autism spectrum disorder and ASD. Searches were limited to the classification “all child (0 to 18 years)” and studies published in English. No limit was placed on publication dates. Additional studies were identified from reference lists of the studies identified through these database searches.

Autism Spectrum Disorder

Autism spectrum disorder (ASD) is a spectrum of related, neurodevelopmental disorders ranging from mild to severe, and includes autism and atypical autism (American Psychological Society [APA], 2013). ASD is characterised by difficulties in social interaction and restricted, repetitive behaviours (APA, 2013). Individuals with ASD frequently struggle to express their thoughts and feelings through both verbal and non-verbal communication (Funahashi, Gruebler, Aoki, Kadone, & Suzuki, 2014). Autism was initially identified by Kanner (1943) however research into the disorder and associated therapies has only begun to grow since mid 1990s (Lai, Lombardo & Baron-Cohen, 2014).

The Australian Bureau of Statistics has estimated that ASD affected one in 200 people in 2012 (ABS.gov.au, 2014). Prevalence is relatively higher in the United States (US), affecting one in 68 children (Christensen et al., 2016). This prevalence in the US has risen from one in 150 in the year 2000. This rise in prevalence is probably due to increased awareness of ASD amongst teachers, parents and health professionals (McConachie & Diggle, 2007) and changes in diagnostic criteria (Fombonne, Quirke, Hagen, 2011).

The aetiology of ASD is still unknown (Davis, et al., 2015). Strong evidence based on recent studies of twins and families suggest that ASD has over 80% heritability (Amaral,
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Geschwind, Dawson, 2014). Environmental risk factors include maternal or paternal reproductive age (Sandin, Hultman, Kolevzon, Gross, MacCabe, Reichenberg, 2012), and complications during pregnancy, such as infections and exposure to toxins or pesticides (Gardener, Spiegelman, Buka, 2009). Whatever the mechanisms at play, a disruption in central nervous system development is evident in people with ASD (Amaral, et al., 2014).

There are two main cognitive domains that are deemed to be affected to varying degrees in ASD. First, deficits in social cognition and social perception generally result in difficulty with eye contact, emotion perception, non-verbal communication, social motivation, joint attention and pretend play (Boucher, 2012). At the core of these social deficits is a weak ‘theory of mind’ which impairs one’s ability to understand the mental states of others (Lai et al., 2014). Secondly, weak global sensory processing is common in people with ASD. This cognitive deficit is proposed to contribute to repetitive, stereotyped behaviour along with attention to detail, and sensory processing difficulties (Wiggins, Robins, Bakeman, Adamson, 2009).

These cognitive deficits impact the individual’s ability to function in everyday life. Majority of studies have investigated the difficulties of children with ASD (Howlin & Moss, 2012). Studies into adolescent and adult difficulties are less abundant and warrant further research. Although the cognitive impairments underlying ASD are relatively well established, further research is needed to determine functional difficulties to guide intervention.

Impact of ASD over the lifespan

ASD is a lifelong, non-curable, condition, with only a small percentage of individuals with ASD achieving independence in everyday function in adulthood (White, Hayes, Livesey, 2010). ASD has widespread effects on the individual’s function, limiting attainment of education, employment, independent living and social relationships (Seltzer, Shattuck, Abbeduto, Greenberg, 2004). A meta-analysis by Woolfenden, Sarkozy, Ridley, Coory, and Williams (2012) revealed that ASD also increases mortality risk by 2.8 compared to age matched unaffected individuals. This is likely due to a higher rate of comorbidities seen in people with ASD (Gilberg, 1991).
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*Employment and Education*

Unemployment is a major issue for individuals with ASD, with over 60% of affected adults unable to secure competitive or sheltered employment (Howlin, Goode, Hutton, Rutter, 2004). Difficulty in completing education may contribute to unemployment. A longitudinal study by Howlin, Moss, Savage, & Rutter (2013) tracked a cohort of 60 people with ASD and found that the majority (72%) had not obtained an educational qualification.

*Independence and Living support*

Economic exclusion of those with ASD, through lack of employment, is a significant issue. This is likely to be contributing to dependent living. The longitudinal study by Howlin et al. (2013) found that only eight of 60 adults with ASD in the study lived independently. Another longitudinal study conducted by Farley et al. (2009) conducted with 42 adults found that 46% required a ‘high level’ of parental support, including assistance with social contact, employment, finances and housing. Approximately half of participants were still living at home.

*Social relationships*

Social deficits in children with ASD can result in bullying, victimisation and isolation by their peers (Little, 2001; Rowley, Chandler, Baird, Simonoff, Pickles, Loucas, & Charman, 2012). Functioning in social environments is often an aversive experience for children, with both mental and emotional challenges (O'Haire, McKenzie, Beck & Slaughter, 2015). Consequently, children with ASD experience higher rates of social anxiety than their typically developing peers (Kuusikko et al., 2008). It is theorised by Bellini (2006) that children with ASD increasingly withdraw from social situations, due to associated anxiety. This social withdrawal increasingly limits opportunities to develop important social skills required for lifelong independence.

In adulthood, social isolation remains a significant issue, affecting a large proportion of individuals with ASD (Howlin, et al., 2013; Pilling, Baron-Cohen, Megnin-Viggars, Lee, Taylor, 2012). Social isolation has been seen to increase over time resulting in reductions in friendships and close relationships (Howlin, et al., 2013). Longitudinal studies have found
that, by adulthood, only 15% of individuals with ASD had been in a long-term romantic relationship and that majority of individuals had no close relationships (Howlin, Good, Hutton, 2004; Howlin et al., 2013; Howlin & Moss, 2012). Social isolation has substantial effects on the health of individuals with ASD, heightening the risk of depression, stress and lowered immunity (Fine, 2000).

The high support needs of individuals with ASD can result in significant strain on their families. Parents of children with ASD are subject to a higher degree of stress and demands than parents of children with other developmental disorders (Seltzer, et al., 2004) and face greater risk of psychological distress, depression impaired quality of life and increased physical and mental health problems (Howlin & Moss, 2012).

**Treatments for children with ASD**

To minimise these lifelong negative impacts on both the individual and their families, the symptoms of ASD require addressing and managing from an early age (Maglione et al., 2012). Alongside the rise in awareness of ASD, research into treatments has been growing rapidly (Lai et al., 2014). All treatments aim to minimise deficits and family distress and maximise independence and quality of life (Myers & Johnson, 2007). However, no treatment to date has been successful in eliminating the symptoms of autism altogether.

Treatments shown to be the most effective are behavioural and educational in focus (Lai et al., 2014). These treatments are termed comprehensive as they target a range of core deficits, including cognitive, language, and sensory-motor (Myers & Johnson, 2007). Other treatments include “targeted approaches”, which tend to focus on specific cognitive domains. Amongst these, the most effective appear to be social skills training and joint attention or engagement training (Myers & Johnson, 2007). Lastly, occupational therapy is also widely used to treat ASD.

Comprehensive behavioural treatments occupy the majority of the recent rigorous studies (Rogers, 1998). Despite this, there remains a shortage of randomized controlled trials evaluating the efficacy of behavioural treatments (Lai et al., 2014). The two main behavioural treatment models used are applied behavioural analysis, known as ABA (Smith, Eikeseth, Ivar Lovaas, 2011) and, a further development of the ABA approach, the Early Start Denver
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Model. ABA employs precise measurement of behaviours and learning theory to teach behaviours and apply it to different environments (Myers & Johnson, 2007). ABA has been shown to effectively improve communication, social skills and reduce maladaptive behaviours (Vismara & Rogers, 2010). The Denver model differs from ABA in that it focuses on repeated interactions while engaging in sensory rich activities (Rogers, 1998). Despite their frequent use in practice, ABA and the Denver model have failed to demonstrate consistent improvement in social behaviour (Myers & Johnson, 2007). Social impairment is a core deficit and affecting, not only independence, but mental and physical wellbeing. Further research is evidently needed to address social impairment in individuals with ASD.

Comprehensive structured teaching approaches are based on the TEACCH (Treatment and Education of Autistic and related Communication-handicapped Children) model (Mesibov, Shea, Schopler, 2005). This is a method of teaching that creates an organised environment and structured, predictable schedules and activities conducive to optimum learning of a range of skills (Mesibov et al., 2005).

Occupational therapy (OT) for ASD has traditionally focused on promoting self-care, social skills and academic skills, such as writing. OT specifically focuses on sensory integration, language use, sensory skills, and motor skills (Sams, Fortney, Willenbring, 2006). Despite its wide use, minimal evidence is available supporting the effectiveness of OT. The occupational therapist often adopts sensory integration theory into practice. This framework was developed by Dr A. Jean Ayers (Ayers, 1972) and targets sensory integration deficits. Similarly, rigorous studies evaluating sensory integration therapy are lacking, with the majority possessing methodological flaws (Rogers, Ozonoff, 2005).

The majority of research into interventions for ASD has focused on children, with minimal literature reporting the effectiveness of interventions for adolescents (Maglione et al., 2012; Myers & Johnson, 2007). A systematic review of social skills interventions for individuals with ASD of all ages found that, amongst 66 studies between 2001 and 2008, only three studies had a majority of participants aged over 13 years (Matson, J.L Matson, M.L. Rivet, 2007). It is crucial to further determine the needs and characteristics of adolescents to support smooth transition to social, physical and financial independence and access to the workforce in adulthood (Matson et al., 2007). Further research is needed to determine the
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intensity, duration and content of effective interventions for adolescents with ASD (Maglione et al., 2012).

Therefore, given the limitations of current therapy, along with the lifelong impairments affecting all aspects of life for the individual and the family, it is imperative that investigation continues to develop and evaluate innovative therapies.

**Animals and ASD**

The use of animals as a form of therapy has gained momentum in recent years and their value in addressing social skill deficits has been highlighted (Christon, Mackintosh, Myers, 2010). There are several theories which suggest ways in which this may occur.

*Anxiolytic effect of animals*

The mere presence of animals has been shown to have an anxiolytic effect on humans. This calming effect could benefit individuals with ASD who experience higher rates of social anxiety and view social situations as a threat (Kuusikko et al., 2008). A study by Lockwood (1983) found that adults, when asked to rate pictures of social scenes, reported pictures containing animals as less threatening and the people as friendlier. Individuals with ASD find social situations cognitively challenging due to the impaired capacity to read and interpret social cues (O’Haire et al., 2015). One study subjected adults with ASD to a stressful cognitively demanding activity. It found that the presence of an animal reduced cardiovascular reactivity, when compared to a human companion and being alone (Allen, Blascovich & Mendes, 2002). This calming effect has also been demonstrated in a school social setting with children with ASD engaging in social play. The study found a 43% reduction in skin conductance (a physiological product of anxiety) in the presence of an animal, when compared to in the presence of toys (O’Haire et al., 2015). Taken together, animals appear to have a calming effect in threatening and cognitively demanding social settings. This is perhaps due to their non-judgemental nature and their unconditional positive regard (McNicholas & Collis, 2001).

This anxiolytic effect extends to situations involving direct interaction with animals. There has been an array of studies demonstrating a consistent calming effect on humans after
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patting an animal measured through reductions in blood pressure (Baun, Oetting, Bergstrom, 1991; Budge, Spicer, Jones, St. George, 1998; Jenkins, 1986; Odendaal, 2000). This effect has been confirmed to be heightened in children with ASD (King, 2008).

Through this anxiolytic effect, animals may promote therapist-client social engagement by altering perceived authority and changing power dynamics (Pichot & Coulter, 2007). A study by Schneider & Harley (2006) found that participants were more satisfied and willing to disclose information to a therapist who was accompanied by a dog than one that was not. This suggests that the animal, by reducing any perceived threat, enabled individuals with ASD to “open up” due to reduced anxiety-induced inhibition.

Similarly, through reducing social anxiety, animals are likely to promote social engagement between individuals with ASD and their peers. A study by Marr et al. (2000) compared group interaction, with and without an animal, amongst 69 psychiatric patients over four weeks of group therapy. Those in the animal group were found to be significantly more interactive with other patients than those in the control group. They were also more helpful and actively engaged. This animal-induced social engagement has been shown to translate to children with ASD in a study by O’Haire, McKenzie, McCune, and Slaughter (2014). The study measured parent and teacher reported child behaviour and social functioning in response to eight weeks of animal exposure in the classroom and 16x20-minute animal interaction sessions. The same group of participants also acted as their own control. The study found significantly greater social functioning and reduced social withdrawal behaviours in the intervention group both in the classroom and the home environment. This suggests that social skills were acquired and even transferred to environments where animals were not present.

Animals as sensory regulators

Individuals with ASD often experience difficulty regulating sensory input and emotional states (Kuusikko et al., 2008; Lai et al., 2014; Russo et al., 2010). Sensory impairments involve both over- and under-responsiveness to stimuli (Minshew, Goldstein, Siegel, 1997). The presence or interaction with animals may serve as a regulation tool. Redefer and Goodman (1989) demonstrated this effect by finding that quiet play with a dog, such as touching and brushing, calmed over-aroused children with ASD. Similarly, a more recent study by Anderson and Olsen (2006) found the presence of a dog in the classroom was
used as a tool to prevent “meltdowns” in children with behavioural and emotional problems. Emotional stability was also found to translate to the home environment. Both studies are, however, limited by small sample size (12 and 6 respectively) and lack of a control group. Animals have also been shown to be stimulating. For example, a study by Martin & Farnum (2002) found an increase in hand-flapping (indicative of excitement) in children with ASD in the presence of a dog. Therefore, animals may also act as sensory tools for sensory seeking individuals through offering a range of sensory stimulation. Animals possess a distinctive smell, they are stimulating to touch, unique sounds, and alluring visual qualities. Given that sensory regulation promotes an optimal arousal state for engagement in activities and social interaction, animals offer potential to enhance therapeutic outcomes.

*Animals as objects of shared attention*

Animals have also been proposed to promote social skill development by acting as a subject of shared attention and conversation (Fontaine, 2005; Prothmann et al., 2006; Wesley et al., 2009). It is theorised that the allure of animals may attract individuals with ASD away from solitary play towards social play through a natural common interest. This effect was evident in a study by Stevenson, Jarred, Hinchcliffe, and Roberts (2015). The study involved coding the social behaviours of three students with ASD over five sessions with a dog and teacher. Coded observations revealed increased frequency of vocalisation and interactions with the teacher and reduced isolated play, when compared to alone time with the teacher. Social behaviours such as verbal interaction and shared attention behaviours also increased over the course of the study. Interestingly, coded observations showed a transition from interaction directly with the dog to interaction with the teacher. This suggests a ‘transitional’ role of the dog in providing a simpler form of social interaction as a “stepping stone” to humans. Although the low sample size limits generalizability, the study does suggest potential for animals to promote social engagement between children with ASD and humans.

It is important to recognise that intrinsic interest and motivation of the individual with ASD is key to the animal acting as a subject of joint attention. Recent research has, in fact, emphasised the importance of motivation in the efficacy of therapy for ASD (Sams, et al., 2006). Theories associated with human-animal interaction (HAI) suggest that a human-animal bond is innate to all humans based on a natural affinity with nature, termed biophilia (Wilson, 1986). Animals likewise show continual interest in the humans, further serving to
motivate engagement (Chandler, 2005). Given this, children with ASD are likely to be intrinsically interested in animals, thus promoting spontaneous and natural social behaviours and motivating active engagement in therapy. Therefore, through capturing the attention of individuals with ASD animals may act as a catalyst for interaction with others.

**Animals and families of individuals with ASD**

Animals have also been highlighted as potential candidates for reducing family stress associated with support and management of a child with ASD. Stress relieving effects of domestic dogs in parents of children with ASD are found to be relatively immediate and long-lasting (Wright, Hall, Hames, Hardiman, Mills, & Mills, 2015). A qualitative study exploring the impact of domestic assistance dogs on children with ASD and their family found an improvement in family freedom and quality of life (Burrows, Adams & Spiers, 2008). Parents reported that the assistance dog helped in managing behaviour by calming the child, monitoring for challenging behaviour and distracting the child. Assistance dogs therefore may alleviate parent stress and contribute to greater independence in youth with ASD. The transfer of animals to the home environment should also be further explored as a means of addressing family stress and involving parents in the therapeutic process.

**Animal-assisted therapy**

The term animal-assisted therapy (AAT; Johnson, 2010) has been devised to describe a series of interactions between the client, animal handler and the animal with the purpose of achieving therapeutic goals (LaJoie, 2003). The term animal-assisted activities (AAA) is also widely used and differs from AAT in that it involves an animal and handler briefly visiting a client who engages in more undirected activities (LaJoie, 2003). Terms describing the use of animals in therapy in the literature are numerous and lack consistency. This has led to confusion regarding the precise content of therapy and creates difficulty in comparing literature on AAT (Palley, O’Rourke, & Niemi, 2010). Other terms include animal-assisted intervention, pet therapy, pet-facilitated therapy, pet mediated therapy, and companion animal therapy, all with similar definitions to AAT (LaJoie, 2003). This literature review from hereon will use the term animal assisted therapy. It should be noted that AAT is distinct from service animal ownership which involves an animal living at the client’s home on a long-term basis (Johnson, 2011).
AAT is rapidly growing in its clinical use, however the literature to support its effectiveness lacks methodological rigour (Johnson, 2010). AAT has been conducted with people of all ages – children, adolescents, adults and the elderly (Nimer & Lundahl, 2007). It has been implemented in a variety of settings including inpatient or outpatient settings, short and long-term facilities, psychiatric centres, developmental centres and medical clinics by a range of health-care professionals (Janssen, 1997; Nimer & Lundahl, 2007; Velde, Cipriani, & Fisher, 2005). AAT has been used in both group and individual settings, depending on the goals and structure of therapy (LaJoie, 2013).

**AAT: a treatment for ASD**

The use of animals as a therapeutic tool appears to offer potential to address intervention limitations for ASD – namely insufficient therapy addressing social impairment. Research into AAT for ASD has gained momentum over the past two decades with the majority of research occurring since 2008 (Berry, Borgi, Francia, Alleva, & Cirulli, 2013; O’Haire, 2013). Majority of evidence is anecdotal and rigorous studies are lacking (O’Haire, 2013).

Two systematic reviews have been recently conducted to assess evidence of effectiveness of AAT for ASD. O’Haire (2013) conducted a systematic review on empirical research on AAT for ASD. The review included all peer-reviewed studies evaluating an intervention for ASD that had intentionally incorporated an animal. 14 empirical studies on AAT were included. The majority of those studies had been published since 2008. Sample sizes were found to be small, ranging from 1 to 42 participants. Study designs varied, with the most common design being single subject or within-participant design. Outcomes of AAT from this review included: increased social interaction, language, social behaviours, playfulness, focus, quality of life and reduced social isolation, stress, problem behaviours, and autism severity (Kern, et al., 2011; Martin, & Farnum, 2002; Silva, Correia, Lima, Magalhaes, & de Sousa, 2011; Redefer & Goodman, 1989; Sams, et al., 2006). The most common outcome was social interaction, supporting the theory that animals provide particular value in addressing social deficits. A more recent review by Davis, et al. (2015) found 20 empirical studies on AAT for ASD, with 8 reporting positive results, 12 reporting mixed results and zero reporting negative results. However, amongst the studies in these systematic
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reviews, only five of the nine that involved dogs used experimental designs. The evidence for AAT for ASD, although encouraging, is preliminary. Further rigorous evidence is needed to establish the efficacy of AAT for ASD.

Occupational therapy and AAT for ASD

Occupational therapists (OTs) appear well suited to providing AAT for individuals with ASD given their expertise in selecting and grading activities to achieve functional outcomes. Occupational therapists are particularly concerned with meaningful, engaging activity as a means of skill building with their clients. AAT, therefore has the potential to enrich OT practice by adding a key client motivator – the animal – and by providing the client with a potentially meaningful role, for example, that of companion or carer. Secondly, OTs are skilled in sensory-based intervention. An animal provides a suitable sensory tool that OTs can use to aid with sensory regulation in children with ASD. Thirdly, OTs often work to develop social skills in individuals with ASD (Mailloux & Roley, 2001).

Based on conference proceedings and anecdotal evidence, there has been recent growth in the provision of AAT by OTs (Velde, et al., 2005). Studies on occupational therapy-facilitated AAT refer to the use of activities such as petting, brushing, walking, playing fetch, and feeding (Velde et al., 2005). Each activity serves a purpose. For example, the use of brushing may also develop self-care skills and build motor skills (Fontaine, 2005; Witt, 2002). Feeding of the dog may involve preparing food, promoting self-care skills. In a qualitative study by Witt (2002), occupational therapists use animals as an object of shared attention to facilitate communication with the client and build verbal skills. The animal may therefore act as a useful means of engaging children with ASD in purposeful activities to achieve functional outcomes.

There is limited literature reporting on OTs using AAT for individuals with ASD. In the systematic reviews conducted by O’Haire (2013) and Davis et al. (2015) on AAT for ASD, final samples were 14 and 20 articles (respectively). Between them, only two studies were found using an OT as the interventionist.

One study was conducted by Sams et al. (2006) in Virginia, USA, comparing the outcomes of standard occupational therapy to occupational therapy using animals (llamas,
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rabbits and dogs) for 22 children with ASD. Therapy sessions were run once per week over 15 weeks for approximately 30 minutes. Activities with the animals included riding on the backs of llamas, guiding llamas through obstacles, brushing, feeding, petting, playing fetch, and talking to animals. Based on ratings from a behavioural rating form developed by the authors, significantly greater language use and social interaction was found in the sessions that involved the animal. This lends support to the theory that animals enrich occupational therapy through encouraging social interaction. This study is however limited by the fact that OTs were not blind to the purpose of the study, potential resulting in treatment bias. It is also unclear whether increased social interaction was observed with the human or whether interactions were predominantly with the animal.

The second study was conducted by Memishevikj and Hodzhikj (2010) in Bosnia and Herzegovina with four children with ASD. Occupational therapists developed the protocol which included grooming, riding and walking a horse. Ten weekly 30 minute sessions were conducted. The study found mixed results, with two of the four children significantly improving in three areas of autistic symptomology, as reported by parents. These were: speech, socialisation, and sensory-cognitive. These two studies provide important preliminary support for use of AAT in OT for individuals with ASD.

**Dog-assisted therapy**

A variety of animals have been used in AAT. A meta-analysis of AAT by Nimer and Lundahl (2007) found the main animals used in quantitative studies were dogs, horses and aquatic animals, with dogs being the most common. The use of dogs in AAT is termed dog-assisted therapy (LaJoie, 2003). Other animals included cats, birds, fish, rodents, and farm animals such as cows, llamas, sheep and pigs. (Marshall 2012; LaJoie, 2013).

In considering which animal is best suited to intervention for ASD, dogs offer a range of qualities that position them as ideal candidates for use in AAT for ASD. Firstly, dogs possess highly developed non-verbal communication skills, particularly in interaction with humans (Prothmann, A., Ettricht, & Prothmann, S., 2009). Furthermore, they are easily trained to respond to verbal commands. Secondly, dogs are ideal companions, as they are loyal, enjoy company and offer unconditional love. These attributes suit them well to reducing anxiety and loneliness in individuals with ASD (McNicholas & Collins, 2000).
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Thirdly, given their size and playful, interactive nature, dogs are brilliant playmates, offering a wide array of possible activities to use in therapy (McNicholas & Collins, 2000). Finally, dogs are practical in an urban setting, socially acceptable and have the potential to integrate into the home environment during or after AAT. Dogs can, however, be dangerous and unpredictable. It is therefore important that dogs used in AAT are well trained and are directed by a dog trainer.

Limitations of literature on AAT for ASD

Although the literature on AAT for ASD offers encouraging findings, majority of studies that have been conducted are qualitative or anecdotal. Only seven of the 20 studies included in the literature review on AAT for ASD by Davis et al. (2015) had an experimental design and no studies were classified as conclusive. Similarly, in the literature review by O’Haire (2013), only eight studies included a control condition. Amongst both reviews, sample sizes were small, ranging from 12 to 42. This limits the generalisability of the results. Many studies are also limited by failing to exclude participants that are receiving other therapies or special education (Davis et al., 2015; O’Haire, 2013). Additionally, there is a lack of clarity and consistency regarding therapy protocol. Activities involved in AAT vary from simply exposing participants to animals to engaging participants in interactive activities (Davis et al., 2015). involvement of the animal in activities and the content of activities is variable and often unreported.

The dosage of therapy and the intensity also varies. For example, several studies measure effects of having a dog in the home, in which cases frequency of dog exposure is high, however duration varies from 4 weeks (Viau, Arsenault-Lapierre, Fecteau, Champagne, Walker, Lupien, 2010) to 48 weeks (Burrows, et al., 2008). Other studies implemented finite sessions in schools or treatment centres ranging from 15 minutes over 15 weeks (Martin & Farnum 2002) to 120 minutes over 4-6 weeks (Solomon, 2010).

It is therefore imperative that rigorous studies into the effectiveness of AAT, in particular, dog-assisted therapy, be conducted in order to establish it as an evidence-based intervention for ASD. There is also a need for procedures to be reported in sufficient detail and with consistency. This should include details on the activities, and the frequency and intensity of dog involvement. It would equally be important to know which components of
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therapy produce the effects. Insight into these details of therapy would enable replication, validation and would act as a guide for future therapy.

**Conclusion**

There exists exciting potential for AAT to act as a therapy for ASD. This review argued for the use of occupational therapists as a therapy providers and dogs as the animal of choice. Given the deficiency of interventions effectively targeting social impairment in individuals with ASD and the profound effects this impairment has on independence and health of the individual and their family over the lifespan, AAT offers itself as a logical solution to this problem. Furthermore, rigorous research studies are indeed needed to determine the outcomes of AAT for ASD. Particular insight into the needs of adolescent population is warranted given the deficiency of literature on this population. Finally, there is a need for more in depth reporting of the activities involved in therapy and an understanding of the effectiveness of each activity.

Therefore, this study aims to answer the following research questions:

1. What are the interest, difficulties and experiences of children and adolescents seeking dog-assisted therapy for ASD?
2. What is the change in outcomes over the course of dog-assisted therapy in children and adolescents with ASD?
3. What activities does dog-assisted therapy involve?
4. What is the degree of the dog’s involvement in the activities?
5. Which activities promote the most engagement and independence in clients?
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REFERENCES


Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder


Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder


Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

smiles of a child with autism spectrum disorder during an animal-assisted activity may facilitate social positive behaviors-quantitative analysis with smile-detecting interface. *Journal of Autism and Developmental Disorders, 44*(3), 685-693.


Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

*Reports, 58*(1), 21-22. doi:10.2466/pr0.1986.58.1.21


Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder


Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

*Psychosomatic Research, 49:*275–280.


Rogers, S.J. (1998). Empirically supported comprehensive treatments for young children with
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder


Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder


Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

*Disorders, 45*(8), 2531-2540. doi:10.1007/s10803-015-2418-5


Outcomes of Dog-Assisted Therapy for Children and Adolescents with Autism Spectrum Disorder

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**ABSTRACT**

This study evaluated the outcomes of dog-assisted therapy for children and adolescents with Autism Spectrum Disorder (ASD). Secondary aims were to understand needs of youth with ASD and to evaluate therapy procedures. This study used a one group pre-post design. Thirty-four individuals with ASD aged between 4 and 19 attended five weekly sessions of dog-assisted therapy. The Autism Treatment Evaluation Checklist (ATEC) and Social-Responsiveness Scale 2 (SRS-2) assessment tools were used to evaluate changes in autistic behaviour and social impairment, respectively. Final sessions were rated on activity-specific dog involvement, participant independence and engagement. Findings indicated no significant difference between ATEC or SRS-2 pre- and post-test scores. Further studies with experimental designs and longer treatment duration are warranted to clarify efficacy of dog-assisted therapy for ASD.

**Key terms:** Animal-assisted therapy, dog, occupational therapy, assistance dog, therapy dog, autism

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Autism spectrum disorder is a neurodevelopmental condition affecting one in 160 people (World Health Organisation 2017). It is characterised by difficulties in social interaction and restricted, repetitive behaviours (APA 2013). Social impairment has a particularly significant impact across the lifespan. It puts children at risk of bullying, victimisation and isolation from peers (Little 2001; Rowley, Chandler, Baird, Simonoff, Pickles, Loucas and Charman 2012). Social isolation extends into adulthood, heightening the risk of depression, stress and lowered immunity (Fine 2000).

There are a diverse range of treatments available for ASD, with research into treatments continuing to rise (Lai et al. 2014). There is, however, a shortage of evidence-based interventions for adolescents with ASD, with majority focusing on children (Maglione et al. 2012) and no intervention has been found to produce consistent improvement in social impairment (Lai et al. 2014). It is therefore important to continue the search for innovative interventions that may alleviate the impact of ASD, with particular focus on reducing social impairment.

Animals and Autism Spectrum Disorder

A number of theories have developed that support the use of animals in therapy for ASD, in particular, for addressing social impairment. Firstly, the mere presence of animals has been found to relieve anxiety in situations perceived as threatening or cognitively demanding (Allen, Blascovich and Mendes 2002). Social anxiety, common in individuals with ASD (Kuusikko et al. 2008), is likely to limit social engagement. Animals have been found to promote social engagement in children with ASD with both peers and therapists (O'Haire, McKenzie, McCune, and Slaughter 2014; Silva et al. 2011). It is theorised that animals, through calming individuals with ASD, reduce inhibition and promote social experimentation.

Animals also act as objects of shared attention and excellent social catalysts, further promoting social skill development (Martin and Farnum 2002). Humans have a natural affinity to nature, termed biophilia (Wilson 1986). Research confirms a natural affinity to animals in children with ASD (Martin and Farnum 2002; Redefer and Goodman 1989). This
intrinsic interest is likely to promote the use of animals as tools for human engagement by capturing the attention of children with ASD.

Finally, animals have been posed as tools for sensory regulation. Animals possess an array of sensory qualities such as a distinctive smell, soft fur, clear, unique sounds, and alluring visual qualities. Animals not only exhibit a calming effect that can assist children in regulating sensory and emotional states (Anderson and Olsen 2006; Redefer and Goodman 1989), but can also have a stimulatory effect (Martin and Farnum 2002). Animals may therefore be used to address sensory processing issues, common in ASD (Lai et al. 2014).

**Animal-assisted therapy (AAT)**

The use of animals in therapy to achieve therapeutic goals is termed animal-assisted therapy (AAT; Johnson 2010). It consists of a series of interactions between the client, animal handler and the animal (LaJoie 2003). Research into AAT has gained momentum over the past two decades (Berry, Borgi, Francia, Alleva, and Cirull 2013; O’Haire 2013) and it is rapidly growing in its clinical use (Johnson 2010).

Despite promising evidence on the benefits of AAT for children with ASD, studies with strong methodological rigour are lacking (Johnson 2010). The large majority of research is anecdotal, or use small sample sizes, and few studies include control conditions (Davis et al. 2015; O’Haire 2013). In addition, there is a lack of clarity and consistency regarding therapy protocol and the degree of animal involvement reported in the literature.

**Dog-assisted therapy**

Commonly used animals in quantitative studies on AAT are dogs, horses and aquatic animals (Nimer and Lundahl 2007). Dogs are used most frequently and are particularly well suited to AAT for ASD given their simple, yet well-developed non-verbal communication skills (Prothmann, A., Ettricht, and Prothmann, S. 2009). In addition, given their size and playful, interactive nature, dogs are brilliant playmates, offering numerous possible activities to use in therapy (McNicholas and Collins 2000). The use of dogs in AAT is termed dog-assisted therapy (LaJoie 2003). Dog-assisted therapy for children with ASD has been shown to increase positive social behaviours (Funahashi, Gruebler, Aoki, Kadone and Suzuk 2014;
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Stevenson, Jarred, Hinchcliffe and Roberts (2015), increase social awareness and focus (Martin and Farnum 2002) and reduce autistic behaviours (Redefer and Goodman 1989; Silva et al. 2011).

**Dog-assisted therapy in occupational therapy**

The evidence base behind the use of dog-assisted therapy in occupational therapy is limited, however findings are promising (O’Haire 2013; Davis et al. 2015). A study by Sams et al. (2006) implemented 15 weekly sessions of dog-assisted therapy for 22 children with ASD. The study found significantly greater language use and social interaction in the sessions that involved the animal, than those that did not.

The aim of this current study is to determine the outcomes of dog-assisted therapy, for children and adolescents with ASD. In particular, whether therapy improves autistic behaviours and social skills. Secondary aims are to determine the interests and difficulties of youth with ASD and their previous experience with dogs. Finally, this study aims to elucidate and evaluate activities used in therapy to provide further clarity and guidance for future research and practice.

**METHODS**

**Study Design**

This study was initiated by Assistance Dogs Australia (ADA) to evaluate a new occupational therapy program, using initial data collected as part of a larger study. The study used a one-group pre-post design, with two repeated measures. This design was chosen to determine the outcomes of dog-assisted therapy. The study also collected information, through a questionnaire, on the interests, difficulties and previous experience with dogs of youth with ASD. Finally, the study seeks to determine and evaluate the activities used in dog-assisted therapy using the OT’s session documentation and a researcher-designed rating scale. Ethics approval was gained from University of Sydney Human Research Ethics Committee (2016/984).
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Participants

The study consisted of 34 children and adolescents who participated in occupational therapy intervention. Inclusion criteria required that participants were aged between 4 and 19 years and had a diagnosis of ASD. There were no exclusion criteria.

Minimum age was set at four years to ensure a reliable diagnosis of ASD had been made (mean age of diagnosis of ASD is 1.78 years), while still enabling early intervention, as recommended in practice guidelines for ASD (Maglione, et al. 2012). It was necessary to set the maximum age at 20 years to ensure participant maturity level was suitable for play-based intervention. The sample size was sufficient for a preliminary investigative purpose and, in fact, exceeds the majority of studies investigating animal assisted therapy (Davis 2015; O’Haire 2013).

Purposive sampling was used to directly and efficiently target the particular population for whom the therapy was designed. Subjects were recruited through Assistance Dogs Australia’s PAWS (Parent’s Autism Workshops and Support) network. Further subjects were recruited through advertisements on a community Facebook page and in Autism Community Network newsletter and finally through word of mouth. Parents gave their written, informed consent for their child to participate in the study.

Procedure

Sessions were held once per week over 5 weeks at Assistance Dog’s Australia (ADA) centre in Engadine, Sydney. Each session was 1 hour long, with the initial session being 1.5 hours long to allow orientation time. Caregivers were required to be present during all sessions to enable education of caregiver by the OT.

Caregiver Questionnaire was completed by the caregiver at home and sent to the OT to enable session planning. Standardised measures were completed by Caregivers within the first and final sessions. Documentation was completed immediately following sessions and later analysed by the researcher to collect activity frequencies and produce ratings.
Therapy session were run by an occupational therapist, with an assistance dog trainer present to ensure safety and the dog’s compliance. All sessions were planned and implemented by the OT. Session activities were created graded and chosen by the OT in accordance with interests and needs of the participant, established through the Caregiver Questionnaire. Session structure and content varied across the 5 sessions and between participants. See Supplementary file 1 for a list of the 12 most frequently used activities in this study and corresponding activity descriptions.

**Data collection and instruments**

*Standardised measures*

Two parent-report standardised measures were administered during the first and last sessions to be completed within session. These were the Autism Treatment Evaluation Checklist (ATEC; Rimland and Edelson 2000) and the Social Responsiveness Scale – 2 (SRS-2; Constantino 2002). These measures provided pre- and post-intervention scores to evaluate behaviour, social and communication skills. These outcomes correspond to those in previous research on AAT (Davis et al. 2015).

The Autism Treatment Evaluation Checklist (ATEC) measures behaviour of children with ASD, and is used to evaluate outcomes of treatment (Rimland and Edelson 2000). The measure consists of 77 items divided into four subscales: Speech/ Language Communication, Sociability, Sensory/Cognitive Awareness and Health/Physical/ Behaviour. Higher scores correspond to greater ASD severity. The ATEC has demonstrated high internal reliability (r=.94 for total score) and high construct validity based on comparison with Childhood Autism Rating Scale (CARS; Geier, Kern, and Geier 2013).

The Social Responsiveness Scale-2 (SRS-2) measures the severity of social impairment (Constantino 2002). It consists of 65 items, categorised into 5 subscales: social awareness, social cognition, social communication, social motivation, and autistic mannerisms. There is strong evidence supporting the validity of SRS-2, based on its use in over 40 studies (Wilkinson 2016). Studies of large samples also provide evidence of good interrater reliability and construct validity (Wilkinson 2016). High internal reliability has been found for total score and component scores (total score a=.97; Constantino 2002).
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Both ATEC and SRS-2 were held confidentially throughout the duration of the study. The ATEC was designed to be administered to participants aged 4-18, therefore two participants aged 19 were excluded from using this measure. The SRS-2 child and adult versions were administered to participants aged 4-18 and aged 19, respectively. SRS-2 was introduced after the program began and was completed by 21 participants.

Caregiver Questionnaire

This questionnaire was a non-standardised tool developed specifically for the study. The format and question design are based on pre-existing measures of ASD and the Occupational Performance Model – Australia (OPMA; Ranka and Chapparo 2011). The Caregiver Questionnaire was administered to the parent/caregiver during the initial session. It was used as a pre-intervention measure to gather information on the needs, difficulties and previous experience with dogs of youth with ASD. This seeks to answer the study’s secondary aim.

The questionnaire comprised 3 main sections: General issues (9 questions), dog-related issues (11 questions), and functional issues (7 questions + rating scale). Through a combination of open ended and dichotomous yes/no questions the questionnaire obtained information on participant demographics, previous experience with dogs, interests, and parents’ goals for therapy. It also provided data on participant difficulties in four functional areas: sensory-motor, socialisation, activities of daily living (ADLs), and play. This data was obtained through a 5-point frequency scale rating the child’s behaviour (43 questions) and through open-ended questions. See Supplementary file 2 for a copy of the Questionnaire.

Documentation

All therapy sessions were documented by the occupational therapist. Documentation recorded the activities used and the participant’s response to activities. See Supplementary file 3 for a copy of the documentation format. Using this documentation, data on activity frequency, participant response and dog involvement was collected to answer the study’s secondary aim – to determine and evaluate activities used in dog-assisted therapy. Scales were used to quantify the data on participant response to therapy. A four-point scale measured participant independence, and two five-point scales measured participant engagement and the degree of involvement of the dog in the session. Only the final sessions were rated. Final sessions were
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chosen to minimise the influence of novelty or initial anxiety on scores. Table 1 presents the scales used to rate activities.

[Insert Table 1 here]

Data analysis

Standardised measures

All statistical procedures on standardised measures were performed using SPSS (24.0). Descriptive statistics were calculated to produce means and confidence intervals for all total and sub-scale scores on both ATEC and SRS-2. Comparison of means and medians was undertaken to determine normality of the data. For all normally distributed data a paired sample t-test was used to compare means of pre- and post-intervention total and sub-scale scores. For all non-normal data, Wilcoxon’s signed rank test was used. This test is the non-parametric equivalent of a paired samples t-test and differs by using the median instead of the mean to conduct analyses. The P-value was set at 0.05 for both tests

Caregiver Questionnaire

All free text response answers regarding dog exposure, likes/dislikes, parent goals, and functional difficulties were categorised to produce a frequency table. All percentages in the frequency table were calculated using the total respondents for that particular question. This involved categorising the responses into common themes. The number of categories varied from three to 17 depending on the variety of responses. A category was established if two different responses were judged to fall under the one theme. For example, for free response answers to “most preferred activity”, categories included gross motor activities (to which 22 responses belonged) and technology-related activities (to which 16 responses belonged).

The Caregiver questionnaire rating scale used a 5-point scale ranging from never to always. SPSS (24.0) was used to produce scale-specific frequencies and percentages for each functional difficulty.

All remaining data from the Caregiver Questionnaire was analysed using SPSS (24.0) descriptive statistics to produce means, 95% CI, frequencies and percentages.

Documentation
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Activities were tallied using documentation notes. SPSS (24.0) descriptive statistics were calculated to produce frequencies and percentages for each activity. Ratings for activities used in final sessions for each participant were analysed using SPSS (24.0) to produce ratings specific to each activity. “Final sessions” were not always the fifth session. Five participants did not reach five sessions, in these cases their last session was rated instead.

RESULTS

Standardised measures

Twenty-five participant guardians completed the Autism Treatment Evaluation Checklist (ATEC) and 21 of the participant guardians completed the Social Responsiveness Scale (SRS-2) at pre-test and post-test.

Table 6 presents the means (M) and 95% confidence intervals (95%CI) for ATEC and SRS-2 pre-and post-intervention and the significance level. All data was found to be normally distributed except for ATEC speech and physical categories and SRS-2 total scores. Mean comparison tests on raw scores indicated no significant differences between pre- and post-tests in the ATEC or SRS-2 (both total and sub-scale scores).

[Insert Table 2 here]

Demographics

Thirty-four children and adolescents with ASD participated in this study. Eighty-two percent (n=28) of participants were receiving concurrent therapy. The most common intervention received was speech therapy (n=14, 42%). The demographic characteristics of the sample are presented in Table 2.

[Insert Table 3 here]

Dog exposure
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Table 3 presents the degree of participants’ exposure to dogs in the past and the nature of their interaction. The top 3 most frequent reports are included for each category and examples of parents’ statements, where applicable.

[Insert Table 4 here]

**Participant interests**

Parents reported their child’s likes and dislikes. The most common activities that participants liked were gross motor activities (n= 22, 67%), these included 23 different movement related activities such as swimming and running. The most common disliked activities were those involving noisy, crowded environments (n=9, 27%), such as attending shopping centres, festivals and markets.

The top 3 highest reported activities for each category and examples of parent’s statements are presented in Supplementary file 4 (Table 1).

**Parent goals for therapy**

Parents were asked about their goals for dog-assisted therapy. The most common goal that parents reported was to address their child’s anxiety (n= 17, 52%). Phrases included: “support when upset” and “become comfortable around dogs”. Forty-eight percent (n=16) reported wanting to improve social skills and communication, and 33% (n=11) hoped that the assistance dog would provide companionship and improve independence in life skills. Other less common goals for therapy included improvement in sensory regulation, emotional regulation, focus, play skills, motor skills and reducing undesirable behaviour.

**Functional difficulties – Frequency scale**

Functional difficulties and behaviours were rated based on the frequency to which they arise on a scale from “never” to “always” in the categories of sensory-motor, socialisation, activities of daily living (ADLs) and play. The two most frequently occurring sensory-motor difficulties were fine motor skills and noise regulation. Those in the socialisation category were inappropriate eye contact, and over-reacting when their child doesn’t get their way.
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Difficulties related to ADLs were rated relatively lower in frequency compared to other categories, these were difficulty brushing hair and cleaning teeth. Difficulties and behaviours associated with play were obsessions with particular interests, stubbornness about rituals and routines and resisting change.

Supplementary file 4 (Table 2) reports the frequencies and percentages of participants’ difficulties and behaviours, as rated by parents.

**Functional difficulties – Written comments**

The most common physical challenges reported were fine motor skills (n=9, 27%) and gross motor skills (n=9, 27%). The most common social challenges were being amongst crowds (n=12, 36%); and communication (n=10, 30%). Regarding play, parents most frequently reported their child had difficulty understanding how to play appropriately (n=9, 27%), for example, knowing what is acceptable, and following the rules. Difficulty dressing was most highly reported amongst ADLs (n=14, 42%). Finally, the most common sensory challenge reported was auditory (n=27, 82%).

Parents were also asked whether their child showed aggressive behaviour, to which 70% (n=23) responded in the affirmative. Participants were most often described to show aggression by attacking others (n=11, 33%), most often due to frustration (n=6, 18%).

The top 3 highest reported difficulties/behaviours for each category and examples of parent’s statements are presented in Supplementary file 4 (Table 3).

**Activities**

54 different types of activities were used across 164 sessions. The 12 most frequently used activities are presented in Table 4. See Supplementary file 1 for a description of all 12 frequently used activities.

[Insert Table 5 here]
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Mean final session ratings in dog involvement and participant engagement and independence, and corresponding 95% CI are reported for the 12 most frequent activities in Table 5.

[Insert Table 6 here]

**DISCUSSION**

This study evaluated the outcomes of five weekly dog-assisted therapy sessions with an occupational therapist for 34 children and adolescents diagnosed with ASD. Secondary aims of the study were to ascertain the interests, difficulties and previous dog exposure of youth with ASD and to determine and evaluate commonly used activities in dog-assisted therapy.

*Use of standardised measures and duration of the intervention*

The study findings indicated no significant difference in scores between initial and final sessions on the ATEC or SRS-2. These tools measured autism severity and social impairment, respectively.

The findings from this current study contradict similar studies on AAT. Redefer and Goodman (1989) conducted 18 dog-assisted therapy sessions and found a highly significant increase in prosocial behaviour and decrease in autistic behaviours. However, those findings on behaviours were specific to within therapy sessions only. This study, in contrast, used parent-rated measures of more generalised functional behaviour.

A study by Memishevikj and Hodzhikj (2010), using OT-conducted equine-assisted therapy (EAT), found reductions in autism severity as measured by ATEC. Other findings from studies on EAT include a significant reduction in social interaction, as measured by Gilliam Autism Rating Scale - 2 (GARS-2; Ward, Whalon, Rusnak, Wendell and Paschall 2013); reduced autism severity, measured by Childhood Autism Rating Scale (CARS; Kern, Fletcher, Garver, Mehta, Grannemann and Knox 2011); and significant reduction in social impairment, measured by SRS-2 (Bass, Duchowny and Llabre 2009). Comparability to this current study is however limited by the use of horses instead of dogs. Also, these studies all conducted a minimum of ten therapy sessions, and most rigorous studies on AAT for ASD have implemented 1-6 month-long intervention programs (Davis et al. 2015). One study
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reported significant improvement in ATEC scores from weekly EAT sessions at five weeks, and had a higher sample size of 60 compared to our study (Van den Hout and Bragonje 2010). Interestingly, improvements continued over the following five weeks of EAT in the Van den Hout and Bragonje (2010) study, suggesting the effect is dose-dependent.

Given the longer program length of successful AAT studies, it is possible that five weeks was an insufficient amount of time to produce significant change in our study. This may be for two reasons: (1) skills developed in therapy take time to generalise to everyday life, or (2) skills were simply not acquired over the five weeks. A study by Salgueiro, Nunes, Barros, Maroco, Salgueiro and Dos Santos (2012) on 12 weeks of AAT with dolphins supports reason number one. It found that significant developmental improvements using the psychoeducational profile-revised (PEP-R) only arose 11 months post intervention. A comparison of two studies on EAT using the SRS-2 revealed value in lengthening the duration of therapy. Holm et al. (2014) found no change over four months whereas, Bass et al. (2009) found a significant change over 12 weekly hour-long sessions. Although sample size may impact results, these studies support the view that social skills take time to generalise. It is also possible that social skills did generalise to the school environment in this current study, but were undetected due to the omission of teacher-report measures. The speed of skill transfer may have also been limited by a lack of parent training within sessions.

The possibility that skills were not acquired at all must be considered also. Time may be required for a child with ASD to become accustomed to a new environment and the dog, particularly for participants with high anxiety. For example, Stevenson et al. (2015) found that one anxious participant showed no change until the fifth and final session of dog-assisted therapy. Furthermore, anxiety may have limited skill development for some participants. According to Cappadocia and Weiss (2011), social skills require eight to 18 hours of social skill intervention, with the majority of interventions in rigorous studies lasting at least 12 weeks (Reichow and Volkmar 2010).

Interestingly, findings from the current study align with two previous studies with a similar intervention dosage. A study by Stevenson, Jarred, Hinchcliffe, and Roberts (2015) recruited three children with ASD for five fortnightly dog-assisted therapy sessions. ASD symptomology, as measured by the Autism Diagnostic Observation Schedule (ADOS-2), showed no improvement. However coded observations from sessions revealed an increase in social behaviours such as the levels of interaction and meaningful vocalisations.
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Similarly, a study by Holm et al. (2014) over four weeks found no meaningful change in SRS-2 scores. However, coding of target behaviour revealed that 70% of behaviours improved during intervention, compared to baseline. Taken together, this comparison highlights a potential difference in sensitivity between standardised and observational measures.

A systematic review on AAT for ASD by Davis et al. (2015) supports this trend in the literature. Amongst the seven studies that produced conclusive positive results, only two used standardised measures, with the majority using direct observation. Therefore, given that dog-assisted therapy targets specific skills, outcomes may have been better evaluated by using a combination of both observational and standardised measures (Berry, Borgi, Francia, Alleva and Cirulli 2013; Sachs-Ericsson, Hansen and Fitzgerald 2002).

The sensitivity of the measures, in particular the ATEC, may have also been impacted by the involvement of higher functioning participants. The ATEC is most sensitive to monitoring progress of individuals in the moderate to severe range (Magiati, Moss, Yates, Charman and Howlin 2011). Several participants in this current study fell into the higher functioning range, and four participants scored a zero. The inclusion of raw scores which do not account for age and developmental level may have also contributed to this floor effect (Hus, Bishop, Gotham, Huerta and Lord 2013; Magiati et al. 2011).

Finally, another possible explanation for absence of significant difference in scores is the inconsistency of respondents. Magiati et al. (2011) found reliability across different scorers of the ATEC to be low. It was noted that a switch from father to mother dramatically impacted the scores of one particular participant in their study, with an increase (i.e. a deterioration) of 37 units on the ATEC and 82 units on the SRS-2.

Activities

This study reported the twelve most frequently used activities and evaluated the degree of involvement of the assistance dog, and the participants’ engagement and independence for these activities during their final session.
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These activities correspond to those of previous studies on dog-assisted therapy. For example, Stevenson et al. (2015) and Redefer and Goodman (1989) also used activities that entailed fetch, tug of war, feeding, brushing, walking and direct dog interaction, such as patting and holding. Identification of these common activities is crucial to establishing a common dog-assisted therapy protocol.

This study found that the three most engaging activities also scored the highest in dog involvement. These were: ‘direct interaction with assistance dog’, ‘animal hospital’ and ‘tug of war’. This extends previous findings that animal presence increases participants’ engagement with the therapist (e.g. Ferrese, Forster, Kowalski and Wasilewski 1998; Silva et al. 2011). By comparing the degree of dog involvement in distinct activities, this study found that activities with higher dog involvement were more engaging than merely the presence of the dog. Greater engagement implies intrinsic motivation and enjoyment, which is theorised in the literature to improve social outcomes of therapy (Koegel, Koegel, and Brookman 2005; Silva et al. 2011). Therefore, future dog-assisted therapy should aim to optimise dog involvement and may use the above three activities as a guide.

Interestingly, ‘animal hospital’ was also the highest scoring activity in participant independence. Through considering the components of this activity, high independence indicates the practice of skills in imaginative play, fine motor skills, and decision-making. Perhaps ‘animal hospital’ also promoted engagement through sensory stimulus (touching, and listening through stethoscope) and providing a meaningful purpose.

Some factors limited the validity of activity ratings. One participant was physically aggressive towards the dog, prompting a distancing of the dog in subsequent sessions. This most likely affected the dog involvement ratings. Some participants also demonstrated excessive anxiety resulting in reluctance to interact with the dog. In these cases, activities with higher dog involvement are likely to have reduced scores on engagement (through lowered enjoyment and early cessation of activity). The study would have benefited from excluding participants with excessive dog-related anxiety, as previous similar studies have done (e.g. Stevenson et al. 2015).
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**Participant previous dog exposure**

Interactions of “playing” and “touching” were reported most often. This supports the idea that children and adolescents with ASD have a natural affinity towards animals (Wilson 1986) and that dog assisted therapy is intrinsically motivating (Sams, et al. 2006). The nature of the negative experiences with dogs (jumping, biting, unpredictability) emphasises the importance of therapies using trained assistance dogs that practice safe, predictable behaviour.

**Participant interests and difficulties**

Children and adolescents in this study were reported to prefer gross motor activities. This finding provides a possible explanation for the high engagement rating for ‘tug of war’, and suggests activities such as ‘fetch’, ‘walking’, and ‘making obstacle courses’ are intrinsically motivating.

The most disliked activities by participants were those involving noisy, crowded environments, and many parents reported this as a social and sensory difficulty. Many participants also disliked confinement. These findings promote the use of quiet, spacious rooms for therapy and the use of ‘walking’ and ‘fetch’ as activities that expose the participant to calm and open environments such as parks.

Parents reported that participants disliked fine-motor activities. This finding emphasises the utility of activities with a high dog involvement, such as animal hospital, in engaging participants to perform tasks that they otherwise would avoid. Dog-assisted therapy should aim to target this difficulty through activities such as: ‘making session schedule’, ‘painting’, ‘animal hospital’, and ‘brushing’, which all had fine motor components.

**Limitations**

The findings from this study should be interpreted with caution due to several limitations. Firstly, the small sample size of 34 may limit the generalizability of findings and the statistical power, even though a sample size exceeds all except three published studies on AAT for ASD (Bass et al. 2009; O’Haire, McKenzie, McCune and Slaughter 2014; Van den Hout and Bragonjie 2010).
Secondly, there are several confounders that may have interfered with the validity of results due to the lack of a control group and minimal enrolment criteria. Most participants were receiving concurrent therapy which may have contributed to outcomes and all participants reported some form of comorbidity, which may have impacted on the level of disability of participants (Mattila, Hurtig and Haapsamo 2010). These limitations, however, need to be tolerated to ensure findings are generalizable to the target population as it is estimated that over 70% of individuals with ASD have comorbidities (Lai, Lombardo and Baron-Cohen 2014; Mattila et al. 2010).

Thirdly, respondents and the research rater were not blinded to the intervention and the purpose of the study. This may result in overly favourable post-intervention scores due to confirmation bias.

Lastly, a large age range of participants was used for this study (ages 4 to 19 years). It is possible that children and adolescents would respond differently to dog-assisted therapy. The study fails to isolate outcomes for these age groups.

**Conclusion**

This study found no change in the outcome measures used to evaluate the dog-assisted therapy program. These findings differ from those of most previous AAT studies. However, the study methodology also differed as the therapy dosage was smaller in this study than most studies and no observational measures were used.

This study is original in that it provides insight into the difficulties and activity preferences of both children and adolescents with ASD and provides activity suggestions for future research and practice, particularly to use in combination with OT. To date there are few studies that have reported, in detail, on what dog-assisted therapy entails and no studies have sought to evaluate the impact of different components of therapy.

Future studies should use a larger dosage and incorporate measures throughout therapy to determine dosage required to achieve outcomes. Studies should also ensure a variety of pre, post and follow-up measures are used, including those which measure interaction with peers, and ensure the inclusion of a control group to evaluate therapy. Finally, future studies should
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

aim to determine the implications of ASD-associated difficulties and activity choices for therapy outcomes.

The findings from this study will enable refinement of dog-assisted therapy through targeting client difficulties and interests in therapy. Descriptions and evaluations of commonly used therapy procedures will enable replication in future, more rigorous studies, better comparability between studies and further refinement of activity selection. It is hoped that this study may act as a preliminary guide on how to implement dog-assisted therapy to achieve best outcomes for youth with ASD.
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

LIST OF TABLES

Table 1
Scales for dog involvement and participant independence and engagement in activities

<table>
<thead>
<tr>
<th>Independence</th>
<th>Engagement</th>
<th>Dog involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 = Independent</td>
<td>5 = Highly engaged (signs of enjoyment, verbalising about dog/activity)</td>
<td>5 = Touches dog</td>
</tr>
<tr>
<td>3 = Mostly independent</td>
<td>4 = Engaged</td>
<td>4 = Shares with dog/directly interacts</td>
</tr>
<tr>
<td>2 = Partly independent</td>
<td>3 = Intermittent engagement (distracted, or prematurely ended activity)</td>
<td>3 = Dog-therapist engagement (participant watching)</td>
</tr>
<tr>
<td>1 = Dependent</td>
<td>2 = Observed</td>
<td>2 = No dog involvement</td>
</tr>
<tr>
<td></td>
<td>1 = Not engaged (not looking, not enjoying)</td>
<td>1 = Dog removal</td>
</tr>
</tbody>
</table>

Table 2
Total and component raw scores for ATEC and SRS-2 and significance values

<table>
<thead>
<tr>
<th>Measure</th>
<th>Subscale</th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>95% CI</td>
<td>M</td>
</tr>
<tr>
<td>ATEC (N=25)</td>
<td>ATEC total</td>
<td>59.24</td>
<td>45.56 – 73.33</td>
<td>62.82</td>
</tr>
<tr>
<td></td>
<td>Speech</td>
<td>9.88</td>
<td>3.57 – 11.76</td>
<td>9.76</td>
</tr>
<tr>
<td></td>
<td>Sociability</td>
<td>15.40</td>
<td>10.33 – 17.78</td>
<td>15.60</td>
</tr>
<tr>
<td></td>
<td>Sensory/cognition</td>
<td>14.44</td>
<td>8.11 – 17.22</td>
<td>15.72</td>
</tr>
<tr>
<td></td>
<td>Health/physical</td>
<td>26.12</td>
<td>20.13 – 29.99</td>
<td>26.40</td>
</tr>
<tr>
<td>SRS-2 (N=21)</td>
<td>SRS-2 total</td>
<td>115.05</td>
<td>99.75-130.35</td>
<td>114.62</td>
</tr>
<tr>
<td></td>
<td>Social awareness</td>
<td>15.00</td>
<td>12.67 – 16.94</td>
<td>14.67</td>
</tr>
<tr>
<td></td>
<td>Social cognition</td>
<td>20.48</td>
<td>15.59 – 22.52</td>
<td>21.38</td>
</tr>
<tr>
<td></td>
<td>Social communication</td>
<td>36.76</td>
<td>28.94 – 41.51</td>
<td>37.33</td>
</tr>
<tr>
<td></td>
<td>Social motivation</td>
<td>17.90</td>
<td>13.68- 20.43</td>
<td>18.29</td>
</tr>
<tr>
<td></td>
<td>Restrictive and repetitive behaviours</td>
<td>21.52</td>
<td>17.17 – 24.38</td>
<td>21.57</td>
</tr>
</tbody>
</table>

ATEC: Autism Treatment Evaluation Scale
SRS-2: Social Responsiveness Scale – 2

* non-parametric Wilcoxon’s signed rank test was used
Table 3
Demographic characteristics of the sample (N=34)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) (n=33)</td>
<td>9.33</td>
<td>7.84 – 10.82</td>
</tr>
<tr>
<td>Age diagnosed (years) (n=32)</td>
<td>4.19</td>
<td>3.15 – 5.23</td>
</tr>
<tr>
<td>Distance travelled to therapy centre (km) (n=12)</td>
<td>66.00</td>
<td>18.84 – 111.50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (n=34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28</td>
<td>82</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Family structure (n=33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two parent household</td>
<td>27</td>
<td>82</td>
</tr>
<tr>
<td>Single mother</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>No siblings</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>One sibling</td>
<td>18</td>
<td>55</td>
</tr>
<tr>
<td>Two siblings</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>Three siblings</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Grandparent at home</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Other medical diagnoses (n=31)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioural disorder</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Global developmental delay</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Intellectual disability</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Sensory processing difficulties</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Mood disorder</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Other¹</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>Verbal ability (n=33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal</td>
<td>29</td>
<td>88</td>
</tr>
<tr>
<td>Nonverbal</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>School type (n=17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mainstream school</td>
<td>10</td>
<td>59</td>
</tr>
<tr>
<td>Special education school</td>
<td>7</td>
<td>41</td>
</tr>
<tr>
<td>Receiving other therapies (N=33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>Currently</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Previously²</td>
<td>9</td>
</tr>
<tr>
<td>Speech therapy</td>
<td>Currently</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Previously</td>
<td>11</td>
</tr>
<tr>
<td>Psychology</td>
<td>Currently</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Previously</td>
<td>7</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>Currently</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Previously</td>
<td>3</td>
</tr>
<tr>
<td>Equine therapy</td>
<td>Currently</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Previously</td>
<td>0</td>
</tr>
<tr>
<td>Music therapy</td>
<td>Currently</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Previously</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Currently</td>
<td>3</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Behavioural therapy</th>
<th>Previously</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Social intervention</td>
<td>Currently</td>
<td>4</td>
<td>12.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Previously</td>
<td>3</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Currently</td>
<td>3</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Previously</td>
<td>8</td>
<td>24.2</td>
<td></td>
</tr>
<tr>
<td>Never received another therapy</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Number of therapies received during participation (n=28)**

<table>
<thead>
<tr>
<th>Number of therapies received</th>
<th>1 type</th>
<th>2 types</th>
<th>3 types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 type</td>
<td>6</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>2 types</td>
<td>16</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>3 types</td>
<td>6</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

1 Other medical diagnoses include: Becker muscular dystrophy, allergies, asthma and visual spatial disorder

2 Previously: Not currently receiving therapy but have received in the past

3 Other interventions include: Fine motor skills groups, sensory processing therapy, augmentative and alternative communication (AAC), early intervention programs and paediatrician

**Table 4 (n=33)**
Participants’ previous exposure to dogs

<table>
<thead>
<tr>
<th>Frequency of previous dog interactions (n=25)</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Rarely</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Sometimes</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Frequently</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Everyday</td>
<td>13</td>
<td>52</td>
</tr>
</tbody>
</table>

**Dog at home (currently or previously) (n=18)**

<table>
<thead>
<tr>
<th>Dog at home (currently or previously) (n=18)</th>
<th>1 dog</th>
<th>13</th>
<th>72</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1 dog</td>
<td>5</td>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>

**Description of previous interactions with dogs (n=27)**

<table>
<thead>
<tr>
<th>Description of previous interactions with dogs (n=27)</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playing</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>Touching</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>Avoidant behaviours</td>
<td>6</td>
<td>22</td>
</tr>
</tbody>
</table>

**Example**

- Fetch or chasing
- Patting
- Ignoring, running away or being cautious
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**Negative experience with dog (n=9)**

<table>
<thead>
<tr>
<th>Experience</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitten</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Dog jumped up on subject</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>44</td>
</tr>
</tbody>
</table>

Arm was bitten

**Fear of certain characteristics of dogs (n=7)**

<table>
<thead>
<tr>
<th>Characteristics of Dogs</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loud barking</td>
<td>4</td>
<td>57</td>
</tr>
<tr>
<td>Excitable dog</td>
<td>2</td>
<td>29</td>
</tr>
<tr>
<td>Big dogs</td>
<td>1</td>
<td>14</td>
</tr>
</tbody>
</table>

Dogs that jump and run around unpredictably

**Duration dog has been at home (years) (n=18)**

<table>
<thead>
<tr>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.10</td>
<td>0.08 – 4.12</td>
</tr>
</tbody>
</table>

Table 5
Top 12 most frequently used activities (N=34)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
<th>Percentage of sessions that included the activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brushing</td>
<td>113</td>
<td>69</td>
</tr>
<tr>
<td>Walking assistance dog</td>
<td>93</td>
<td>57</td>
</tr>
<tr>
<td>Feeding assistance dog</td>
<td>89</td>
<td>54</td>
</tr>
<tr>
<td>Fetch</td>
<td>88</td>
<td>54</td>
</tr>
<tr>
<td>Direct interaction with assistance dog</td>
<td>60</td>
<td>37</td>
</tr>
<tr>
<td>Making session schedule</td>
<td>58</td>
<td>35</td>
</tr>
<tr>
<td>Tug of war</td>
<td>48</td>
<td>29</td>
</tr>
<tr>
<td>Peeling and cutting vegetables</td>
<td>48</td>
<td>29</td>
</tr>
<tr>
<td>Painting</td>
<td>40</td>
<td>24</td>
</tr>
<tr>
<td>Dog trick</td>
<td>36</td>
<td>22</td>
</tr>
<tr>
<td>Animal hospital</td>
<td>34</td>
<td>21</td>
</tr>
<tr>
<td>Making obstacle course</td>
<td>32</td>
<td>20</td>
</tr>
</tbody>
</table>
Table 6
Mean ratings for final session of 12 most frequently used activities (N=34)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Mean independence(^1) (95% CI)</th>
<th>Mean engagement(^2) (95% CI)</th>
<th>Mean dog involvement(^3) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brushing</td>
<td>2.29 (1.41 – 3.17)</td>
<td>4.07 (3.89 – 4.25)</td>
<td>3.92 (3.49 – 4.34)</td>
</tr>
<tr>
<td>Walking assistance dog</td>
<td>2.86 (2.03 – 3.69)</td>
<td>3.90 (3.66 – 4.14)</td>
<td>4.08* (3.90 – 4.27)</td>
</tr>
<tr>
<td>Feeding assistance dog</td>
<td>2.71 (1.44 – 3.99)</td>
<td>3.98 (3.74 – 4.21)</td>
<td>4.17 (3.64 – 4.70)</td>
</tr>
<tr>
<td>Fetch</td>
<td>2.25 (0.73 – 3.77)</td>
<td>3.88 (3.61 – 4.14)</td>
<td>3.38 (3.47 – 4.20)</td>
</tr>
<tr>
<td>Direct interaction with assistance dog</td>
<td>3.07 (2.46 – 3.68)</td>
<td>4.37* (4.15 – 4.59)</td>
<td>5 (constant)</td>
</tr>
<tr>
<td>Making session schedule</td>
<td>3.12* (2.68 – 3.56)</td>
<td>3.92 (3.63 – 4.21)</td>
<td>2 (constant)</td>
</tr>
<tr>
<td>Tug of war</td>
<td>3.00 (0.52 – 5.48)</td>
<td>4.13* (3.93 – 4.33)</td>
<td>4.26* (4.07 – 4.46)</td>
</tr>
<tr>
<td>Peeling and cutting vegetables</td>
<td>2.53 (2.04 – 3.01)</td>
<td>3.96 (3.80 – 4.13)</td>
<td>2.25 (4.09 – 4.74)</td>
</tr>
<tr>
<td>Painting</td>
<td>2.75 (1.23 – 4.27)</td>
<td>3.94 (3.48 – 4.39)</td>
<td>3.64 (2.87 – 4.41)</td>
</tr>
<tr>
<td>Dog trick</td>
<td>2.90 (2.49 – 3.31)</td>
<td>3.92 (3.62 – 4.22)</td>
<td>4.0 (3.39 – 4.61)</td>
</tr>
<tr>
<td>Animal hospital</td>
<td>3.40* (2.72 – 4.08)</td>
<td>4.13* (3.94 – 4.33)</td>
<td>4.45* (4.10 – 4.81)</td>
</tr>
<tr>
<td>Making obstacle course</td>
<td>3.33* (1.90 – 4.77)</td>
<td>3.82 (3.37 – 4.26)</td>
<td>4.06 (3.72 – 4.40)</td>
</tr>
</tbody>
</table>

* Top 3 scores for that category are highlighted
\(^1\) Independence was rated on a 4-point scale: 1 = Dependent, 4 = Independent
\(^2\) Engagement was rated on a 5-point scale: 1 = Not engaged, 5 = highly engaged
\(^3\) Dog involvement was rated on a 5-point scale: 1 = Removal of dog from therapy, 5 = touching dog
ACKNOWLEDGEMENTS

I would like to sincerely thank A/Prof. Dr Lynette Mackenzie and Dr Meryl Lovarini for their continual support and dedication throughout this project. I would also like to thank Dr Kim Bulkeley for her helpful input to this project.

I would also like to thank Assistance Dogs Australia (ADA) for initiating this project and their assistance and support throughout the project. In particular, I would like to thank Alberto Alvarez-Campos, Assistance Dogs Programs Manager and Claire Dickson, Occupational Therapist at Assistance Dogs Australia. The initiative of ADA is truly inspiring.

Finally, I would like to thank Scentre Group, the corporation that provided the funding grant for ADS through their Westfield Community Program. Without their funding, this project would not have been possible.
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COMPLIANCE WITH ETHICAL STANDARDS

Funding: Assistance dogs Australia was funded by Scentre Group

Conflict of interest: The authors declare that they have no conflict of interest.

Ethical approval:

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

Informed consent: Informed consent was obtained from all individual participants included in the study.

AUTHOR’S CONTRIBUTIONS

BC conceived of the study, participated in its design and coordination, statistical analysis, interpretation of the data and drafted the manuscript. LM and ML participated in the design and interpretation of the data and helped to draft the manuscript. All authors read and approved the final manuscript.
REFERENCES


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SUPPLEMENTARY FILES

Supplementary file 1: List of 12 most frequently used activities in this study and corresponding activity descriptions

Outcomes of Dog-Assisted Therapy for Children and Adolescents with Autism Spectrum Disorder

Journal of Autism and Developmental Disorders

Brianna Clark (BSc), Lynette Mackenzie (PhD), Meryl Lovarini (PhD)

Affiliation: Faculty of Health Sciences, University of Sydney, Australia

Corresponding Author: bcla8297@uni.sydney.edu.au

Table 1: List of 12 most frequently used activities in this study and corresponding activity descriptions

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetch</td>
<td>Involves throwing a ball (inside or outdoors) for the assistance dog (AD) to catch and return. AD either places ball in participant’s hand or drops it in a bucket near participant. Components include: Use of language ‘fetch’, ‘back’, ‘give’ Use of command to “drop” ball into a box instead of put in hand OT, participant and AD (on leash) all running together to get the ball. Variation or additions: Throwing ball into crate Give kibble reward after verbal promt to “give” Can use stuffed toy AD to throw instead of ball.</td>
</tr>
<tr>
<td>Walking</td>
<td>Involves participant holding long or short leash and walking AD along the streets, into shops or in the park</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Components include:</td>
</tr>
<tr>
<td></td>
<td>• Commands “stop” and “go”</td>
</tr>
<tr>
<td></td>
<td>• Participant deciding where to go</td>
</tr>
<tr>
<td></td>
<td>Variation or additions:</td>
</tr>
<tr>
<td></td>
<td>• Place targets/obstacles en route eg foot pads and hula hoops</td>
</tr>
<tr>
<td></td>
<td>• AD therapist or OT may hold long lead to guide</td>
</tr>
<tr>
<td>Feeding</td>
<td>Involves putting kibble or vegetables into bowl or feeding AD from hand</td>
</tr>
<tr>
<td></td>
<td>Components include:</td>
</tr>
<tr>
<td></td>
<td>• Judgement on how much food to give</td>
</tr>
<tr>
<td></td>
<td>• Commands “wait”, “sit”, and “eat”</td>
</tr>
<tr>
<td>Peeling and cutting vegetables</td>
<td>Involves participant peeling vegetables and using a knife to cut vegetables on chopping board. Vegetables include carrot, zucchini, apple</td>
</tr>
<tr>
<td></td>
<td>Variation or additions:</td>
</tr>
<tr>
<td></td>
<td>• Participant writes a 3 course meal (planning to what feed)</td>
</tr>
<tr>
<td>Brushing</td>
<td>Involves participant using a glove brush or handled brush to groom AD</td>
</tr>
<tr>
<td></td>
<td>Variation or additions:</td>
</tr>
<tr>
<td></td>
<td>• OT runs brush up clients arm or leg to see how feels</td>
</tr>
<tr>
<td></td>
<td>• OT and participant talk about specific body parts</td>
</tr>
<tr>
<td>Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Obstacle course</td>
<td>Involves the participant helping to construct a course. The course may use a balance beam, steps, ramp, stepping stones, and/or crash mat. The participant uses a long or short leash to guide AD through course.</td>
</tr>
<tr>
<td>Components include:</td>
<td></td>
</tr>
<tr>
<td>• Taking AD through tunnel</td>
<td></td>
</tr>
<tr>
<td>• Teaching AD how to jump through hoop</td>
<td></td>
</tr>
<tr>
<td>• Communicating “wait and “let’s go”</td>
<td></td>
</tr>
<tr>
<td>• Decision making on spacing of stepping stones</td>
<td></td>
</tr>
<tr>
<td>• Connecting balance beams</td>
<td></td>
</tr>
<tr>
<td>• Finding ways to motivate AD</td>
<td></td>
</tr>
<tr>
<td>Variations or additions:</td>
<td></td>
</tr>
<tr>
<td>• Reward with kibble at end</td>
<td></td>
</tr>
<tr>
<td>Painting</td>
<td>Involves participant donning an apron and engaging in painting AD’s paw and making paw prints on paper. Participant also paints own hands and OTs hands and makes hand prints on paper. Participant may also use a paint brush to paint on paper.</td>
</tr>
<tr>
<td>Variations or additions:</td>
<td></td>
</tr>
<tr>
<td>• Paint names of AD and self on paper</td>
<td></td>
</tr>
<tr>
<td>Animal hospital</td>
<td>Involves participant choosing toy medical equipment to use on AD. Participant may checks vital signs, inject OT.</td>
</tr>
<tr>
<td>Variations or additions:</td>
<td></td>
</tr>
<tr>
<td>• fill in a medical chart</td>
<td></td>
</tr>
<tr>
<td>Session schedule</td>
<td>This involves the participant writing name of the assistance dog on activity cards that state the activity in which the dog will participate. The participant then orders the cards based on the schedule he/she would like. The participant sticks the cards to a board on the wall.</td>
</tr>
<tr>
<td>Direct interaction with</td>
<td>This involves the participant interacting directly with the assistance dog. This may or may not occur spontaneously. This can include patting the dog, shaking the dog’s hand or lying with or beside to the dog.</td>
</tr>
<tr>
<td>assistance dog</td>
<td>This involves the client pulling a rope that the dog holds in its mouth.</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Tug of war</strong></td>
<td>Components include:</td>
</tr>
<tr>
<td></td>
<td>• saying “shake” when shaking dog’s paw before the “match”</td>
</tr>
<tr>
<td></td>
<td>• Saying “tug” to being tugging</td>
</tr>
<tr>
<td></td>
<td>• Client, dog and OT tug rope 3 ways</td>
</tr>
<tr>
<td></td>
<td>• Client walks with rope, dog tries to catch</td>
</tr>
<tr>
<td></td>
<td>• Involves deciding who competes</td>
</tr>
<tr>
<td></td>
<td>• Writing name under “winner”</td>
</tr>
<tr>
<td><strong>Dog tricks</strong></td>
<td>Participant uses a range of hand gestures and verbal commands to prompt AD to do tricks</td>
</tr>
<tr>
<td></td>
<td>Components include:</td>
</tr>
<tr>
<td></td>
<td>• Participant holds block or balloon out for AD to tip (touch with nose)</td>
</tr>
<tr>
<td></td>
<td>• Uses gestures to practice ‘roll over’</td>
</tr>
</tbody>
</table>
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

Supplementary file 2: Caregiver Questionnaire

Outcomes of Dog-Assisted Therapy for Children and Adolescents with Autism Spectrum Disorder

Journal of Autism and Developmental Disorders

Brianna Clark (BSc), Lynette Mackenzie (PhD), Meryl Lovarini (PhD)

Affiliation: Faculty of Health Sciences, University of Sydney, Australia

Corresponding Author: bcla8297@uni.sydney.edu.au

Caregiver Questionnaire

Baseline assessment (to be completed in conjunction with the parent/caregiver)

Participant ID:

GENERAL ISSUES
- Age:
- Gender:
- Family situation (who lives at home?):
- At what age was the diagnosis of ASD confirmed?:
- What other interventions have been used in the past to address ASD?:
- Is the participant involved in any CURRENT intervention programs? (detail below):
- Other associated difficulties, injuries, disabilities, illnesses or allergies that the participant has?:

ISSUES RELATED TO DOGS
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

- Identified anticipated benefits of therapy with Assistance Dogs by parents/caregivers:

- The desired foci for the therapy sessions with Assistance Dogs identified by parents/caregivers:

- Does the household own a dog? Yes No
  If yes:
  Type of breed:
  Length of time the dog has been present:

- Has the participant ever had an interaction with a dog? Yes No
  If yes:
  How often?
  How does the participant interact with the dog/s?

- Has the participant ever had a bad experience with a dog? Yes No
  If yes give details:

- Has the participant ever reacted badly with a dog? (e.g. related to size, colour, excitable nature etc) Yes No
  If yes give details:

**ISSUES RELATED TO FUNCTIONING – SENSORY-MOTOR**

- What sensory information (e.g. sound, light, smell, touch, taste) are the most challenging for the participant to process (if any)?

- What physical activities (if any) are the most challenging for the participant?

- Ratings by the parent/caregiver:

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>Always</th>
<th>Frequently</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>My child has difficulty with gross motor skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child has difficulty with fine motor skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child has difficulty with balance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child has difficulty with co-ordination</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child likes to be touched and held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child is excessively attached to me, teachers or other people</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child lacks curiosity about their environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child’s facial expressions fit the situation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

- **My child speaks much louder than needed**
- **My child is attracted to loud noise (e.g. music, TV, loud people)**
- **My child covers their ears**
- **My child has an excessive fear of noises**
- **My child has clumsy posture**
- **My child engages in toe walking**

**Any additional comments:**

#### ISSUES RELATED TO FUNCTIONING – SOCIALISATION

- **What types of social situations/interactions are most challenging for the participant (if any)?**

**Ratings by the parent/caregiver:**

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>Difficulty</th>
<th>Difficulty</th>
<th>Difficulty</th>
<th>Difficulty</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>My child will listen to and obey instructions I give them</td>
<td>My child is non verbal</td>
<td>My child engages in appropriate eye contact</td>
<td>My child responds when I call their name</td>
<td>My child appears to be in their own world</td>
<td>My child is engages in inappropriate crying or laughing</td>
</tr>
<tr>
<td>My child has temper tantrums and over reacts when they do not get their way</td>
<td>My child ignores pain – e.g. bumps head with no response</td>
<td>My child hates crowds (e.g. has difficulty in restaurants and supermarkets)</td>
<td>My child is anxious or scared</td>
<td>My child expresses joy when reunited with me after time apart</td>
<td>My child lacks ability to imitate actions</td>
</tr>
<tr>
<td>My child expresses appropriate emotional response</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Any additional comments:**

#### ISSUES RELATED TO FUNCTIONING – ACTIVITIES OF DAILY LIVING

- **What types of self-care tasks (if any) are the most challenging for the participant? (e.g. eating, dressing, bathing, toileting, teeth cleaning, hair brushing etc)**

**Ratings by the parent/caregiver:**

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>Difficulty</th>
<th>Difficulty</th>
<th>Difficulty</th>
<th>Difficulty</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
<td>Frequently</td>
<td>Sometimes</td>
<td>Rarely</td>
<td>Never</td>
<td></td>
</tr>
<tr>
<td>My child will listen to and obey instructions I give them</td>
<td>My child is non verbal</td>
<td>My child engages in appropriate eye contact</td>
<td>My child responds when I call their name</td>
<td>My child appears to be in their own world</td>
<td>My child is engages in inappropriate crying or laughing</td>
</tr>
<tr>
<td>My child has temper tantrums and over reacts when they do not get their way</td>
<td>My child ignores pain – e.g. bumps head with no response</td>
<td>My child hates crowds (e.g. has difficulty in restaurants and supermarkets)</td>
<td>My child is anxious or scared</td>
<td>My child expresses joy when reunited with me after time apart</td>
<td>My child lacks ability to imitate actions</td>
</tr>
<tr>
<td>My child expresses appropriate emotional response</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

- Any additional comments:

### ISSUES RELATED TO FUNCTIONING – PLAY/IMAGINATIVE PLAY
- What aspects of play are most challenging for the participant?:

#### Ratings by the parent/caregiver:

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>Always</th>
<th>Frequently</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>My child plays with toys appropriately</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child is interested in toy parts (such as car wheels)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child engages in appropriate turn taking during games</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child engages in self stimulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child engages in head banging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child engages in self stimulation inflicting pain or injury</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child arranges toys in rows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child plays with a particular toy/-listens to particular music/watches a particular video</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child is stubborn about rituals and routine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child resists change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Any additional comments:
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

Supplementary file 3: OT session documentation format

Outcomes of Dog-Assisted Therapy for Children and Adolescents with Autism Spectrum Disorder

Journal of Autism and Developmental Disorders

Brianna Clark (BSc), Lynette Mackenzie (PhD), Meryl Lovarini (PhD)

Affiliation: Faculty of Health Sciences, University of Sydney, Australia

Corresponding Author: bcla8297@uni.sydney.edu.au

Assistance Dogs Australia for Autism Spectrum Disorder Project
Documentation

Date: _______________ Session: _______________
Participant’s ID(name): _____________________________ Age: _____________
Goals of therapy (as per Caregiver Questionnaire/previous session):

<table>
<thead>
<tr>
<th>Interests:</th>
<th>Participate characteristics</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SENSORY-MOTOR</td>
<td></td>
</tr>
<tr>
<td>Parent identified goals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focus:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOCIAL</td>
<td></td>
</tr>
<tr>
<td>Parent identified goals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focus:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADL</td>
<td></td>
</tr>
<tr>
<td>Parent identified goals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focus:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

<table>
<thead>
<tr>
<th>PLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent identified goals:</td>
</tr>
<tr>
<td>Focus:</td>
</tr>
</tbody>
</table>

Session Outline (including parent position in room/ sibling involvement):

Parents:
AD:
ADT:

Engagement key:
1. Highly engaged = signs of enjoyment - laughing, smiling, eye contact
2. Engaged = engaged the whole activity
3. Observed = watched someone else do activity but didn’t participate
4. Not engaged = not looking, not enjoying

<table>
<thead>
<tr>
<th>Activity</th>
<th>Behaviour (number of instances)</th>
<th>Assistance/Prompting (faded)</th>
<th>Use of language</th>
<th>Equipment used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Including engagement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Highly engaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Engaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Intermittent engagement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Observed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Not engaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Including attending to AD, awareness of AD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Extensions/goals/activities for next session:

Participant’s behaviour:

<table>
<thead>
<tr>
<th>Communication with Assistance Dog</th>
<th>Eye contact/looking</th>
<th>Speaking</th>
<th>Touching</th>
</tr>
</thead>
<tbody>
<tr>
<td>[consistently (c), inconsistently(i), not at all(n)]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

<table>
<thead>
<tr>
<th>[prompting most to least]</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication with OT (including greeting, engaging in activities)</td>
<td>Eye contact</td>
<td>Requesting/responding</td>
<td>Following instructions</td>
</tr>
<tr>
<td>[consistently(c), inconsistently(i), not at all(n)] [prompting most to least]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preceding activity/event</th>
<th>Description</th>
<th>Intervention/redirection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-stimulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inappropriate behaviour towards OT/Assistance Dog</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overall impression of therapy session:

<table>
<thead>
<tr>
<th>Participant’s:</th>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enjoyment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comfort with AD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Name: ___________________ Date completed: __________________

Signature: ______________________________________
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

Supplementary file 4: Tables to supplement results

Outcomes of Dog-Assisted Therapy for Children and Adolescents with Autism Spectrum Disorder

Journal of Autism and Developmental Disorders

Brianna Clark (BSc), Lynette Mackenzie (PhD), Meryl Lovarini (PhD)

Affiliation: Faculty of Health Sciences, University of Sydney, Australia

Corresponding Author: bcla8297@uni.sydney.edu.au

Table 1
Activities that participants’ like/dislike (N=33)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preferred activities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=33)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross motor activities</td>
<td>22</td>
<td>67</td>
<td>Swimming, running and swinging</td>
</tr>
<tr>
<td>Technology</td>
<td>16</td>
<td>48</td>
<td>iPads and computer games</td>
</tr>
<tr>
<td>Board games and toys</td>
<td>11</td>
<td>33</td>
<td>Puzzles and Lego</td>
</tr>
<tr>
<td><strong>Least preferred activities</strong></td>
<td>(n=23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities involving noisy, crowded environments</td>
<td>9</td>
<td>39</td>
<td>Attending shopping centres, festivals and markets</td>
</tr>
<tr>
<td>Tasks that involve sitting or confinement</td>
<td>8</td>
<td>35</td>
<td>Desktop tasks, waiting, and sedentary activities</td>
</tr>
<tr>
<td>Fine motor activities</td>
<td>6</td>
<td>26</td>
<td>Painting, drawing, colouring, writing and play-doh</td>
</tr>
</tbody>
</table>
# Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

## Table 2

Frequency of functional difficulties and autistic behaviours (N=33). Shadings represent the highest frequency for each question.

<table>
<thead>
<tr>
<th>Question</th>
<th>Never n (%)</th>
<th>Rarely n (%)</th>
<th>Sometimes n (%)</th>
<th>Frequently n (%)</th>
<th>Always n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensory-motor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child has difficulty with gross motor skills</td>
<td>5 (15.6%)</td>
<td>8 (25%)</td>
<td>12 (38%)</td>
<td>7 (22%)</td>
<td>0</td>
</tr>
<tr>
<td>My child has difficulty with fine motor skills</td>
<td></td>
<td>0</td>
<td>5 (16%)</td>
<td>3 (9%)</td>
<td>19 (59%), 5 (16%)</td>
</tr>
<tr>
<td>My child has difficulty with balance</td>
<td>6 (19%)</td>
<td>10 (31%)</td>
<td>13 (41%)</td>
<td>3 (9%)</td>
<td>0</td>
</tr>
<tr>
<td>My child has difficulty with co-ordination</td>
<td>1 (3%)</td>
<td>8 (25%)</td>
<td>10 (31%)</td>
<td>11 (34%), 2 (6%)</td>
<td></td>
</tr>
<tr>
<td>My child doesn't like to be touched and held</td>
<td>5 (17%)</td>
<td>13 (43%)</td>
<td>10 (33%)</td>
<td></td>
<td>2 (7%)</td>
</tr>
<tr>
<td>My child is excessively attached to me, teachers or other people</td>
<td>9 (30%)</td>
<td>11 (37%)</td>
<td>0</td>
<td>8 (27%), 2 (7%)</td>
<td></td>
</tr>
<tr>
<td>My child lacks curiosity about their environment</td>
<td>11 (37%)</td>
<td>6 (20%)</td>
<td>7 (23%)</td>
<td>4 (13%), 2 (6%)</td>
<td></td>
</tr>
<tr>
<td>My child’s facial expressions don't fit the situation</td>
<td>3 (10%)</td>
<td>12 (40%)</td>
<td>9 (30%)</td>
<td>5 (17%), 1 (3%)</td>
<td></td>
</tr>
<tr>
<td>My child speaks much louder than needed</td>
<td>1 (3%)</td>
<td>5 (14%)</td>
<td>5 (14%)</td>
<td>14 (39%), 5 (17%)</td>
<td></td>
</tr>
<tr>
<td>My child is attracted to loud noise (e.g. music, TV, loud people)</td>
<td>5 (16%), 10 (28%), 10 (28%), 6 (17%), 1 (3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child covers their ears</td>
<td>4 (13%), 6 (20%), 14 (47%), 5 (17%), 1 (3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>6 (20%)</th>
<th>20 (67%)</th>
<th>4 (13%)</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>My child won't listen to and follow instructions I give them</td>
<td>0</td>
<td>6 (20%)</td>
<td>20 (67%)</td>
<td>4 (13%)</td>
<td>0</td>
</tr>
<tr>
<td>My child is non verbal</td>
<td>12 (40%)</td>
<td>4 (13%)</td>
<td>5 (17%)</td>
<td>5 (17%)</td>
<td>4 (13%)</td>
</tr>
<tr>
<td>My child engages in inappropriate eye contact</td>
<td>2 (7%)</td>
<td>11 (37%)</td>
<td>14 (47%)</td>
<td>3 (10%)</td>
<td>0</td>
</tr>
<tr>
<td>My child won't respond when I call their name</td>
<td>4 (13%)</td>
<td>15 (50%)</td>
<td>10 (33%)</td>
<td>1 (3%)</td>
<td>0</td>
</tr>
<tr>
<td>My child appears to be in their own world</td>
<td>7 (23%)</td>
<td>11 (30%)</td>
<td>9 (25%)</td>
<td>3 (8%)</td>
<td></td>
</tr>
<tr>
<td>My child engages in inappropriate crying or laughing</td>
<td>4 (13%)</td>
<td>7 (23%)</td>
<td>12 (40%)</td>
<td>7 (23%)</td>
<td>0</td>
</tr>
<tr>
<td>My child has temper tantrums and over reacts when they do not get their way</td>
<td>3 (10%)</td>
<td>7 (23%)</td>
<td>15 (50%)</td>
<td>5 (17%)</td>
<td></td>
</tr>
<tr>
<td>My child ignores pain – e.g. bumps head with no response</td>
<td>4 (13%)</td>
<td>5 (16%)</td>
<td>15 (47%)</td>
<td>6 (19%)</td>
<td>2 (6%)</td>
</tr>
<tr>
<td>My child hates crowds (e.g. has difficulty in restaurants and supermarkets)</td>
<td>4 (13%)</td>
<td>3 (9%)</td>
<td>9 (28%)</td>
<td>10 (31%)</td>
<td>6 (19%)</td>
</tr>
</tbody>
</table>
## Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Moderate</th>
<th>Strong</th>
<th>Very Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>My child is anxious or scared</strong></td>
<td>1 (3%)</td>
<td>5 (16%)</td>
<td>10 (32%)</td>
<td>12 (39%)</td>
<td>3 (10%)</td>
</tr>
<tr>
<td><strong>My child doesn't express joy when reunited with me after time apart</strong></td>
<td>12 (40%)</td>
<td>9 (30%)</td>
<td>8 (27%)</td>
<td>1 (3%)</td>
<td>0</td>
</tr>
<tr>
<td><strong>My child lacks ability to imitate actions</strong></td>
<td>4 (13%)</td>
<td>7 (23%)</td>
<td>10 (33%)</td>
<td>8 (27%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td><strong>My child expresses inappropriate emotional responses</strong></td>
<td>0</td>
<td>8 (27%)</td>
<td>14 (47%)</td>
<td>7 (23%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td><strong>ADLs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>My child shows discomfort or difficulty with showering</strong></td>
<td>8 (27%)</td>
<td>8 (27%)</td>
<td>7 (23%)</td>
<td>6 (20%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td><strong>My child shows discomfort or difficulty with dressing</strong></td>
<td>3 (10%)</td>
<td>8 (27%)</td>
<td>14 (47%)</td>
<td>4 (13%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td><strong>My child shows discomfort or difficulty with brushing their teeth</strong></td>
<td>2 (7%)</td>
<td>9 (30%)</td>
<td>6 (20%)</td>
<td>10 (33%)</td>
<td>3 (10%)</td>
</tr>
<tr>
<td><strong>My child shows discomfort or difficulty with brushing their hair</strong></td>
<td>2 (8%)</td>
<td>7 (27%)</td>
<td>1 (4%)</td>
<td>12 (46%)</td>
<td>4 (15%)</td>
</tr>
<tr>
<td><strong>My child shows discomfort or difficulty when going to bed</strong></td>
<td>4 (13%)</td>
<td>10 (33%)</td>
<td>4 (13%)</td>
<td>11 (37%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td><strong>My child shows discomfort or difficulty with eating three meals a day</strong></td>
<td>6 (21%)</td>
<td>4 (14%)</td>
<td>14 (48%)</td>
<td>4 (14%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td><strong>Play</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>My child plays with toys inappropriately</strong></td>
<td>0</td>
<td>8 (28%)</td>
<td>13 (45%)</td>
<td>4 (14%)</td>
<td>4 (14%)</td>
</tr>
</tbody>
</table>
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>My child is not interested in toy parts (such as car wheels)</td>
<td>1 (3%)</td>
<td>4 (13%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 (40%)</td>
<td>4 (13%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 (30%)</td>
<td>9 (30%)</td>
<td></td>
</tr>
<tr>
<td>My child does not engage in appropriate turn taking during games</td>
<td>0</td>
<td>5 (17%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 (50%)</td>
<td>8 (22%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 (7%)</td>
<td>2 (7%)</td>
<td></td>
</tr>
<tr>
<td>My child engages in self stimulation</td>
<td>3 (11%)</td>
<td>5 (18%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 (29%)</td>
<td>9 (32%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 (11%)</td>
<td>3 (11%)</td>
<td></td>
</tr>
<tr>
<td>My child engages in head banging</td>
<td>20 (67%)</td>
<td>7 (23%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 (7%)</td>
<td>1 (3%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>My child engages in self stimulation inflicting pain or injury</td>
<td>18 (60%)</td>
<td>5 (17%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 (20%)</td>
<td>1 (3%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>My child arranges toys in rows</td>
<td>7 (24%)</td>
<td>6 (21%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 (17%)</td>
<td>11 (38%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>My child plays with a particular toy/listens to particular music/watches a particular video very frequently</td>
<td>1 (3%)</td>
<td>1 (3%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 (9%)</td>
<td>15 (47%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 (38%)</td>
<td>12 (38%)</td>
<td></td>
</tr>
<tr>
<td>My child is stubborn about rituals and routine</td>
<td>0</td>
<td>0</td>
<td>13 (41%)</td>
</tr>
<tr>
<td></td>
<td>11 (34%)</td>
<td>8 (25%)</td>
<td></td>
</tr>
<tr>
<td>My child resists change</td>
<td>0</td>
<td>0</td>
<td>14 (44%)</td>
</tr>
<tr>
<td></td>
<td>9 (28%)</td>
<td>9 (28%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3
Descriptions of participants’ difficulties (N=33)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor (n=23)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine motor skills</td>
<td>9</td>
<td>39</td>
<td>Pointing</td>
</tr>
<tr>
<td>Gross motor</td>
<td>9</td>
<td>39</td>
<td>Ball skills</td>
</tr>
</tbody>
</table>
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>(n)</th>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance</td>
<td>6</td>
<td>26</td>
<td>Walking, climbing stairs, riding a bike</td>
</tr>
<tr>
<td><strong>Sensory (n=31)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound</td>
<td>27</td>
<td>87</td>
<td>Loud noise, crowded places, and thunder storms</td>
</tr>
<tr>
<td>Oral</td>
<td>12</td>
<td>44</td>
<td>Fussy with food/textures</td>
</tr>
<tr>
<td>Light</td>
<td>10</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td><strong>Socialisation (n=31)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being amongst crowds</td>
<td>12</td>
<td>39</td>
<td>Shopping centres</td>
</tr>
<tr>
<td>Communication</td>
<td>10</td>
<td>32</td>
<td>Reading social cues, and communicating needs</td>
</tr>
<tr>
<td>Novelty</td>
<td>5</td>
<td>16</td>
<td>New situations, new people, places, and change in routine</td>
</tr>
<tr>
<td><strong>ADLs (n=26)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dressing</td>
<td>14</td>
<td>54</td>
<td>Zippers, taking jumpers/tight shirts on/off, tying shoe laces, buttons and hats</td>
</tr>
<tr>
<td>Eating</td>
<td>13</td>
<td>50</td>
<td>Fussy eating, not eating enough, and difficulty using utensils</td>
</tr>
<tr>
<td>Brushing teeth</td>
<td>12</td>
<td>46</td>
<td>Chewing tooth brush, and too rushed</td>
</tr>
<tr>
<td><strong>Play (n=23)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty playing</td>
<td>9</td>
<td>39</td>
<td>Knowing what is acceptable and following the rules</td>
</tr>
<tr>
<td>appropriately</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repetitive play and</td>
<td>8</td>
<td>35</td>
<td>Obsessions with things and collecting objects as play</td>
</tr>
<tr>
<td>restricted interests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social aspects of play</td>
<td>6</td>
<td>26</td>
<td>Difficulty engaging peers, playing with people, and reading social cues</td>
</tr>
<tr>
<td><strong>Aggressive behaviour (n=23)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attacking others</td>
<td>11</td>
<td>33</td>
<td>Hitting, biting and kicking</td>
</tr>
</tbody>
</table>

80
<table>
<thead>
<tr>
<th></th>
<th>Count</th>
<th>Total</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-harm</td>
<td>7</td>
<td>21</td>
<td>Hitting self, scratching and biting</td>
</tr>
<tr>
<td>Outbursts</td>
<td>4</td>
<td>17</td>
<td>Yells, clenches fists, screams, tantrum, and swears</td>
</tr>
<tr>
<td><strong>Cause of behaviour</strong></td>
<td></td>
<td></td>
<td>(n=19)</td>
</tr>
<tr>
<td>Frustration</td>
<td>6</td>
<td>32</td>
<td>Frustration towards self</td>
</tr>
<tr>
<td>Showing objection to something</td>
<td>6</td>
<td>32</td>
<td>During unfair play, when doesn’t want to do something, when toys are taken away</td>
</tr>
<tr>
<td>People</td>
<td>5</td>
<td>26</td>
<td>People getting too close</td>
</tr>
</tbody>
</table>
APPENDICES

Appendix A: Journal Submission Guidelines

Editorial procedure

Double-Blind Peer Review

MANUSCRIPT FORMAT

All JADD manuscripts should be submitted to Editorial Manager in 12-point Times New Roman with standard 1-inch borders around the margins.

APA Style

Text must be double-spaced; APA Publication Manual standards must be followed.

As of January 20, 2011, the Journal has moved to a double-blind review process. Therefore, when submitting a new manuscript, DO NOT include any of your personal information (e.g., name, affiliation) anywhere within the manuscript.

When you are ready to submit a manuscript to JADD, please be sure to upload these 3 separate files to the Editorial Manager site to ensure timely processing and review of your paper:

- A title page with the running head, manuscript title, and complete author information. Followed by (page break) the Abstract page with keywords and the corresponding author e-mail information.
- The blinded manuscript containing no author information (no name, no affiliation, and so forth).
- The Author Note

Types of papers

The preferred article length is 20-23 double-spaced manuscript pages long (not including title page, abstract, tables, figures, addendums, etc.) Manuscripts of 40 double-spaced pages (references, tables and figures counted as pages) have been published. The reviewers or the editor for your review will advise you if a longer submission must be shortened.

Review your manuscript for these elements

Order of manuscript pages:

- Title Page with all Author Contact Information & Abstract with keywords and the corresponding author e-mail information.
- Blinded Manuscript without contact information and blinded Abstract, and References
- Appendix
- Figure Caption Sheet
- Figures
- Tables
- Author Note

Title page
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

The title page should include:

- The name(s) of the author(s)
- A concise and informative title
- The affiliation(s) and address(es) of the author(s)
- The e-mail address, telephone and fax numbers of the corresponding author

Abstract
Please provide an abstract of 120 words or less. The abstract should not contain any undefined abbreviations or unspecified references.

Keywords
Please provide 4 to 6 keywords which can be used for indexing purposes.

Text

Text Formatting
Manuscripts should be submitted in Word.

- Use a normal, plain font (e.g., 10-point Times Roman) for text.
- Use italics for emphasis.
- Use the automatic page numbering function to number the pages.
- Do not use field functions.
- Use tab stops or other commands for indents, not the space bar.
- Use the table function, not spreadsheets, to make tables.
- Use the equation editor or MathType for equations.
- Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).

Headings
Please use no more than three levels of displayed headings.

Abbreviations
Abbreviations should be defined at first mention and used consistently thereafter.

Footnotes
Footnotes can be used to give additional information, which may include the citation of a reference included in the reference list. They should not consist solely of a reference citation, and they should never include the bibliographic details of a reference. They should also not contain any figures or tables.

Footnotes to the text are numbered consecutively; those to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data). Footnotes to the title or the authors of the article are not given reference symbols.

Always use footnotes instead of endnotes.

Acknowledgments
Acknowledgments of people, grants, funds, etc. should be placed in a separate section on the title page. The names of funding organizations should be written in full.
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

Body

- The body of the manuscript should begin on a separate page. The manuscript page header (if used) and page number should appear in the upper right corner. Type the title of the paper centered at the top of the page, add a hard return, and then begin the text using the format noted above. The body should contain:
  - Introduction (The introduction has no label.)
  - Methods (Center the heading. Use un-centered subheadings such as: Participants, Materials, Procedure.)
  - Results (Center the heading.)
  - Discussion (Center the heading.)

Headings

Please use no more than three levels of displayed headings.
Level 1: Centered
Level 2: Centered Italicized
Level 3: Flush left, Italicized

Footnotes

Center the label “Footnotes” at the top of a separate page. Footnotes can be used to give additional information, which may include the citation of a reference included in the reference list. They should not consist solely of a reference citation, and they should never include the bibliographic details of a reference. They should also not contain any figures or tables. Footnotes to the text are numbered consecutively; those to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data). Footnotes to the title or the authors of the article are not given reference symbols.

Always use footnotes instead of endnotes. Type all content footnotes and copyright permission footnotes together, double-spaced, and numbered consecutively in the order they appear in the article. Indent the first line of each footnote 5-7 spaces. The number of the footnote should correspond to the number in the text. Superscript arabic numerals are used to indicate the text material being footnoted.

Author Note

The first paragraph contains a separate phrase for each author’s name and the affiliations of the authors at the time of the study (include region and country).

The second paragraph identifies any changes in the author affiliation subsequent to the time of the study and includes region and country (wording: “authors name is now at affiliation”).

The third paragraph is Acknowledgments. It identifies grants or other financial support and the source, if appropriate. It is also the place to acknowledge colleagues who assisted in the study and to mention any special circumstances such as the presentation of a version of the paper at a meeting, or its preparation from a doctoral dissertation, or the fact that it is based on an earlier study.

The fourth paragraph states, “Correspondence concerning this article should be addressed to...” and includes the full address, telephone number and email address of the corresponding author.
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

Terminology
- Please always use internationally accepted signs and symbols for units (SI units).

Scientific style
- Generic names of drugs and pesticides are preferred; if trade names are used, the generic name should be given at first mention.
- Please use the standard mathematical notation for formulae, symbols etc.:
  - Italic for single letters that denote mathematical constants, variables, and unknown quantities
  - Roman/upright for numerals, operators, and punctuation, and commonly defined functions or abbreviations, e.g., \( \cos \), \( \det \), \( e \) or \( \exp \), \( \log \), \( \max \), \( \min \), \( \sin \), \( \tan \), \( d \) (for derivative)
  - Bold for vectors, tensors, and matrices.

References

Citation
Cite references in the text by name and year in parentheses. Some examples:
- Negotiation research spans many disciplines (Thompson 1990).
- This result was later contradicted by Becker and Seligman (1996).
- This effect has been widely studied (Abbott 1991; Barakat et al. 1995; Kelso and Smith 1998; Medvec et al. 1999).

Reference list
The list of references should only include works that are cited in the text and that have been published or accepted for publication. Personal communications and unpublished works should only be mentioned in the text. Do not use footnotes or endnotes as a substitute for a reference list.
Reference list entries should be alphabetized by the last names of the first author of each work.
- Journal article
- Article by DOI
- Book
- Book chapter
- Online document
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

Journal names and book titles should be italicized.

Tables

- All tables are to be numbered using Arabic numerals.
- Tables should always be cited in text in consecutive numerical order.
- For each table, please supply a table caption (title) explaining the components of the table.
- Identify any previously published material by giving the original source in the form of a reference at the end of the table caption.
- Footnotes to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data) and included beneath the table body.

Each table should be inserted on a separate page at the back of the manuscript in the order noted above. A call-out for the correct placement of each table should be included in brackets within the text immediately after the phrase in which it is first mentioned. Copyright permission footnotes for tables are typed as a table note.

Electronic supplementary material

Springer accepts electronic multimedia files (animations, movies, audio, etc.) and other supplementary files to be published online along with an article or a book chapter. This feature can add dimension to the author's article, as certain information cannot be printed or is more convenient in electronic form.

Before submitting research datasets as electronic supplementary material, authors should read the journal’s Research data policy. We encourage research data to be archived in data repositories wherever possible.

 Submission

- Supply all supplementary material in standard file formats.
- Please include in each file the following information: article title, journal name, author names; affiliation and e-mail address of the corresponding author.
- To accommodate user downloads, please keep in mind that larger-sized files may require very long download times and that some users may experience other problems during downloading.

Audio, Video, and Animations

- Aspect ratio: 16:9 or 4:3
- Maximum file size: 25 GB
- Minimum video duration: 1 sec
- Supported file formats: avi, wmv, mp4, mov, m2p, mp2, mpg, mpeg, flv, mxf, mts, m4v, 3gp

Text and Presentations

- Submit your material in PDF format; .doc or .ppt files are not suitable for long-term viability.
- A collection of figures may also be combined in a PDF file.

Spreadsheets

- Spreadsheets should be submitted as .csv or .xlsx files (MS Excel).

Specialized Formats

- Specialized format such as .pdb (chemical), .wrl (VRML), .nb (Mathematica notebook), and .tex can also be supplied.

Collecting Multiple Files
Outcomes Dog-Assisted Therapy Youth with Autism Spectrum Disorder

- It is possible to collect multiple files in a .zip or .gz file.

Numbering
- If supplying any supplementary material, the text must make specific mention of the material as a citation, similar to that of figures and tables.
- Refer to the supplementary files as “Online Resource”, e.g., "... as shown in the animation (Online Resource 3)", “... additional data are given in Online Resource 4”.
- Name the files consecutively, e.g. "ESM_3.mpg", “ESM_4.pdf”.

Captions
- For each supplementary material, please supply a concise caption describing the content of the file.
- Processing of supplementary files
  - Electronic supplementary material will be published as received from the author without any conversion, editing, or reformatting.
- Accessibility
  - In order to give people of all abilities and disabilities access to the content of your supplementary files, please make sure that
  - The manuscript contains a descriptive caption for each supplementary material
  - Video files do not contain anything that flashes more than three times per second (so that users prone to seizures caused by such effects are not put at risk)

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This journal is committed to upholding the integrity of the scientific record. As a member of the Committee on Publication Ethics (COPE) the journal will follow the COPE guidelines on how to deal with potential acts of misconduct. Authors should refrain from misrepresenting research results which could damage the trust in the journal, the professionalism of scientific authorship, and ultimately the entire scientific endeavour. Maintaining integrity of the research and its presentation can be achieved by following the rules of good scientific practice, which include:
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To ensure objectivity and transparency in research and to ensure that accepted principles of ethical and professional conduct have been followed, authors should include information regarding sources of funding, potential conflicts of interest (financial or non-financial), informed consent if the research involved human participants, and a statement on welfare of animals if the research involved animals.

Authors should include the following statements (if applicable) in a separate section entitled “Compliance with Ethical Standards” when submitting a paper:

- Disclosure of potential conflicts of interest
- Research involving Human Participants and/or Animals
- Informed consent

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Authors must disclose all relationships or interests that could influence or bias the work. Although an author may not feel there are conflicts, disclosure of relationships and interests affords a more transparent process, leading to an accurate and objective assessment of the work. Awareness of real or perceived conflicts of interests is a perspective to which the readers are entitled and is not meant to imply that a financial relationship with an organization that sponsored the research or compensation for consultancy work is inappropriate. Examples of potential conflicts of interests that are directly or indirectly related to the research may include but are not limited to the following:

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The corresponding author will include a summary statement on the title page that is separate from their manuscript, that reflects what is recorded in the potential conflict of interest disclosure form(s).

See below examples of disclosures:

**Funding:** This study was funded by X (grant number X).

**Conflict of Interest:** Author A has received research grants from Company A. Author B has received a speaker honorarium from Company X and owns stock in Company Y. Author C is a member of committee Z.

If no conflict exists, the authors should state:

Conflict of Interest: The authors declare that they have no conflict of interest.

Research involving human participants and/or animals

1) Statement of human rights

When reporting studies that involve human participants, authors should include a statement that the studies have been approved by the appropriate institutional and/or national research ethics committee and have been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

If doubt exists whether the research was conducted in accordance with the 1964 Helsinki Declaration or comparable standards, the authors must explain the reasons for their approach, and demonstrate that the independent ethics committee or institutional review board explicitly approved the doubtful aspects of the study.
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The following statements should be included in the text before the References section:

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“For this type of study formal consent is not required.”

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The welfare of animals used for research must be respected. When reporting experiments on animals, authors should indicate whether the international, national, and/or institutional guidelines for the care and use of animals have been followed, and that the studies have been approved by a research ethics committee at the institution or practice at which the studies were conducted (where such a committee exists).

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**Ethical approval:** “All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.”

If applicable (where such a committee exists): “All procedures performed in studies involving animals were in accordance with the ethical standards of the institution or practice at which the studies were conducted.”

If articles do not contain studies with human participants or animals by any of the authors, please select one of the following statements:

“This article does not contain any studies with human participants performed by any of the authors.”

“This article does not contain any studies with animals performed by any of the authors.”

“This article does not contain any studies with human participants or animals performed by any of the authors.”

**Informed consent**

All individuals have individual rights that are not to be infringed. Individual participants in studies have, for example, the right to decide what happens to the (identifiable) personal data gathered, to what they have said during a study or an interview, as well as to any photograph that was taken. Hence it is important that all participants gave their informed consent in writing prior to inclusion in the study. Identifying details (names, dates of birth, identity numbers and other information) of the participants that were studied should not be published in written descriptions, photographs, and genetic profiles unless the information is essential for scientific purposes and the participant (or parent or guardian if the participant is incapable) gave written informed consent for publication. Complete anonymity is difficult to achieve in some cases, and informed consent should be obtained if there is any doubt. For example, masking the eye region in photographs of participants is inadequate protection of anonymity. If identifying characteristics are altered to protect anonymity, such as in genetic profiles, authors should provide assurance that alterations do not distort scientific meaning.

The following statement should be included:

**Informed consent:** “Informed consent was obtained from all individual participants included in the study.”

If identifying information about participants is available in the article, the following statement should be included:

“Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.”
Authors' contributions

To give appropriate credit to each author of a paper, the individual contributions of authors to the manuscript should be specified in this section. An "author" is generally considered to be someone who has made substantive intellectual contributions to a published study. To qualify as an author one should 1) have made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; 2) have been involved in drafting the manuscript or revising it critically for important intellectual content; and 3) have given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content. Acquisition of funding, collection of data, or general supervision of the research group, alone, does not justify authorship.

We suggest the following kind of format (please use initials to refer to each author's contribution): AB conceived of the study, participated in its design and coordination and drafted the manuscript; JY participated in the design and interpretation of the data; MT participated in the design and coordination of the study and performed the measurement; ES participated in the design of the study and performed the statistical analysis; FG conceived of the study, and participated in its design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

All contributors who do not meet the criteria for authorship should be listed in an acknowledgements section. Examples of those who might be acknowledged include a person who provided purely technical help, writing assistance, or a department chair who provided only general support.

NOTE: Because the Journal of Autism and Developmental Disorders operates double-blind peer review, the Authors' contributions section should be uploaded as part of the acknowledgment file, and not included in the main manuscript file.
Appendix B: Ethics application approval

Research Integrity & Ethics Administration

Human Research Ethics Committee Tuesday, 10 January 2017

Assoc Prof Lynette Mackenzie Ageing Work and Health Unit; Faculty of Health Sciences Email: lynette.mackenzie@sydney.edu.au

Dear Lynette

The University of Sydney Human Research Ethics Committee (HREC) has considered your application.

After consideration of your response to the comments raised your project has been approved. Approval is granted for a period of four years from 10 January 2017 to 10 January 2021

Project title: Outcomes of a therapeutic program with children and adolescents with Autism using trained assistance dogs

Project no.: 2016/984

First Annual Report due: 10 January 2018

Authorised Personnel: Mackenzie Lynette; Dickson Claire; Lovarini Meryl Patricia;

Documents Approved:

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### Condition/s of Approval

- Research must be conducted according to the approved proposal.

- An annual progress report must be submitted to the Ethics Office on or before the anniversary of approval and on completion of the project.

- You must report as soon as practicable anything that might warrant review of ethical approval of the project including:
  - Serious or unexpected adverse events (which should be reported within 72 hours).
  - Unforeseen events that might affect continued ethical acceptability of the project.

- Any changes to the proposal must be approved prior to their implementation (except where an amendment is undertaken to eliminate immediate risk to participants).

- Personnel working on this project must be sufficiently qualified by education, training and experience for their role, or adequately
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supervised. Changes to personnel must be reported and approved.

- Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, as relevant to this project.

- Data and primary materials must be retained and stored in accordance with the relevant legislation and University guidelines.

- Ethics approval is dependent upon ongoing compliance of the research with the National Statement on Ethical Conduct in Human Research, the Australian Code for the Responsible Conduct of Research, applicable legal requirements, and with University policies, procedures and governance requirements.

- The Ethics Office may conduct audits on approved projects.

- The Chief Investigator has ultimate responsibility for the conduct of the research and is responsible for ensuring all others involved will conduct the research in accordance with the above. This letter constitutes ethical approval only. Please contact the Ethics Office should you require further information or clarification. Sincerely

Associate Professor Stephen Assinder Chair Human Research Ethics Committee (HREC 1)

The University of Sydney HRECs are constituted and operate in accordance with the National Health and Medical Research Council’s (NHMRC) National Statement on Ethical Conduct in Human Research (2007) and the NHMRC’s Australian Code for the Responsible Conduct of Research (2007).