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Animal Assisted Therapy (AAT) and Animal Assisted Intervention (AAI) for individuals with Autism Spectrum Disorder (ASD): A Systematic Review and Meta-Analysis of Randomised Control Trials (RCT's) and Control Trial Studies

and;

Man's best friend: What is the difference in outcomes (family functioning, quality of life, parental stress and child social communication) in families that have a dog present with children with Autism Spectrum Disorder (ASD): A control comparison study.

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Doctorate in Clinical Psychology

University of Edinburgh

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Declaration of Own Work

Name: Lianne White

Title of Work: Animal Assisted Therapy (AAT) and Animal Assisted Intervention (AAI) for individuals with Autism Spectrum Disorder (ASD): A Systematic Review and Meta-Analysis of Randomised Control Trials (RCT's) and Control Trial Studies and

Man's best friend: What is the difference in outcomes (family functioning, quality of life, parental stress and child social communication) in families that have a dog present with children with Autism Spectrum Disorder (ASD): A control comparison study.

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Contents

Thesis Portfolio Abstract

This thesis aimed to investigate the growing interest in research and clinical practice related to the inclusion of animals in a broad range of intervention services, particularly for individuals with Autism Spectrum Disorder (ASD). The first chapter is a systematic review and meta-analysis reviewing Animal Assisted Therapies (AAT's) and Animal Assisted Interventions (AAI's) to identify any potential benefits for individuals with ASD (O'Haire, 2013) and review the quality of the evidence because some have commented that the evidence base lacks scientific merit (Lentini & Knox, 2015). Eleven scientifically robust studies (3 RCT's, 1 follow up to RCT and 7 Control Condition studies) were included for narrative synthesis. Three RCT's were subject to an exploratory meta-analysis. Results indicate benefits social function and well-being outcomes for individuals with ASD; however, there is a high level of variability across length of intervention and degree of follow up post intervention. Further effort in this area should focus on standardising interventions and creating a consensus on AAT/Is (Lentini & Knox, 2015) with particular consideration of species involved.

The second chapter is an empirical study exploring the role of pet dogs in families with children with ASD. A cross-sectional survey was completed by 46 families living with a companion dog and 30 families without a companion dog. Data was gathered on child and parent reports of family functioning, child quality of life, child social communication, parental stress, parents reports on impact of the dog on their child with autism, and relationships of children and parents with their dog. Data was analysed using Tests of Difference, exploratory Linear Regression and Correlations to explore the groups differences and the role of the dog within the dog families. Improved family functioning and child quality of life were found in the dog group compared to the no dog group. Parent-dog relationship also impacted on child-dog relationship. These findings need to be replicated with larger groups and with the addition of qualitative data to provide richer understanding into the role of dogs in families with children of ASD; however, these findings are a positive contribution to a growing evidence base.

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Lay Summary

There is little research on the impact pet dogs have on families with children who have a diagnosis of Autism Spectrum Disorder (ASD). ASD is a developmental disorder which leads to difficulties in social communication, social and emotional interaction and flexibility of thought. Research from studies of children without ASD and their parents have shown that pet dogs influence children's social, emotional, and cognitive (thinking) development. The current study aims to increase understanding in the area of the impact of pet dogs on families with children who have ASD. There are two parts to this study. The first part reviews published evidence on the effects of therapies involving animals for people with ASD and found benefits in social function and well-being outcomes for individuals with ASD. The second part used a survey of UK families with a child with ASD, half of which had a dog and half had no dog at home. The study involved both children with ASD and one of their parents completing short questionnaires. Results indicate families with dogs report better family functioning and improved child quality of life than families without a dog. . It provides an in-depth analysis of the impact pet dogs have on families who have a diagnosis of ASD.

Chapter 1: Systematic Review

Animal Assisted Therapy (AAT) and Animal Assisted Intervention (AAI) individuals with Autism Spectrum Disorder (ASD). A Systematic Review and Meta-Analysis of Randomised Control Trials (RCT's) and Control Trial Studies

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Abstract

This review investigates the growing interest in research and clinical practice related to the inclusion of animals in a broad range of intervention services, particularly individuals with Autism Spectrum Disorder (ASD). Animal Assisted Therapies (AAT's) and Animal Assisted Interventions (AAI's) are potentially beneficial to individuals with ASD (O'Haire, 2013). However, the evidence base is lacking scientific merit. The current review serves to address this limitation. The review was carried out within PRISMA guidelines. Eleven scientifically robust studies (3 RCT's, 1 follow up to RCT and 7 Control Condition studies) were included for narrative synthesis. Three RCT's were subject to an exploratory meta-analysis. Results indicate a high level of variability across length of intervention and degree of follow up post intervention. Benefits were found for individuals in AAT and AAI groups compared to control groups in social function (social awareness, social motivation and verbal social behaviour) and well-being outcomes (hyperactivity and posture). While some commonalities exist across studies in the types of social and well-being outcomes being measured (e.g. social communication, social motivation, quality of life and hyperactivity); direct comparison is perhaps less relevant as the interventions administered are not standardised to the degree that this is useful. Further effort in this area should focus on standardising interventions and creating a consensus on AAT/Is (Lentini & Knox, 2015) with particular consideration of species involved. Application of this research in clinical practice may require a Stepped Care Model (Richards, 2012) to ensure those experiencing particular difficulties benefit appropriately.

Key Words: ASD, RCT's, Control Trials, Animal-Assisted Interventions (AAIs), Animal Assisted Therapy (AATs)

Introduction

The current review investigates the growing interest in research and clinical practice related to the inclusion of animals in a broad range of intervention services, particularly those for Autism Spectrum Disorder (ASD) (O'Haire, 2013). The current review aims to improve understanding of scientifically robust studies in Animal-Assisted Interventions (AAIs) and Animal-Assisted Therapies (AATs); as integration of assistance and 'therapy'animals into clinical and domestic settings for ASD increases there is a critical need for scientific evaluation and, if theoretically efficacious, the development of evidence-based best practices to inform clinical practice (O'Haire, 2017; Grandin, Fine, O'Haire, Carlisle, & Bowers, 2015). AAI's and AAT's are utilised across many populations globally, including physical and mental health services and across the lifespan (Nordgren, 2014; Morrison, 2007; Linder, 2018). Animals have been used in diverse and dynamic contexts to improve outcomes for individuals experiencing dementia, anxiety, cancer, loneliness and literacy issues. Animals within therapeutic settings and incorporated in treatment as usual in mental health services across the age range are also increasingly proven to be effective (O'Callaghan, 2011). While the scope for AAI's and AAT's is far reaching the focus of the current review is on ASD across the lifespan. Review of the most scientifically rigorous available research carried out to date will serve to accelerate best practice in this area, inform replication of high-quality research thereby strengthening the rigour of the evidence base, and aid the development of practice guidelines.

Animal Interaction and Animal-Assisted Interventions

Research investigating the benefits of human animal interaction (HAI) is growing rapidly (O'Haire, 2013). There is, however, a wide variance in terminology and definitions, and a lack of consistency in practice relating to animal assisted interventions. The most widely

cited definitions of AAIs within the literature identify differentiated structured therapies, referred to as AAT, from informal interventions called animal-assisted activities (AAA) or use of assistance animals such as assistance dogs (Delta-Society, 1996; IAHAIO, 2018). AAI is defined by the International Association of Human Animal Interaction Organisations (IAHAIO) as "goal oriented and structured intervention that intentionally includes or incorporates animals in health, education and human services (e.g., social work) for the purpose of therapeutic gains in humans". AAI's include AAT which is defined as "a goal oriented, planned and structured therapeutic intervention directed and/or delivered by health, education or human service professionals, including e.g. psychologists and social workers". AAT focuses on enhancing physical, cognitive, behavioural and/or socio-emotional functioning of the individual or group recipient(s). However, there are few guidelines on good practice (IAHAIO, 2018). The need for a consensus in terminology and standardisation in approaches is highlighted by Lentini and Knox (2015) as it would serve to strengthen the reliability, validity and replicability of interventions; thereby, improving the efficacy and scientific underpinnings of animal interaction as a modality of treatment in improving outcomes for many.

Despite shortcomings in definitions and a lack of professional guidelines, practice of AAT/AAI has dramatically increased over the last 10 years along with an increase in studies aiming to evaluate efficacy. Interaction with animals across human populations, including individuals with mental and physical health difficulties and intellectual disabilities, has been demonstrated be beneficial in improving a range of outcomes, including anxiety, depression, cystic fibrosis, dementia (Chen et al, 2014; Tseng et al, 2013; Kårefjärd, 2019). However, reviews in the field have highlighted issues with methodological rigor of evaluations of AAT/I and difficulty in drawing conclusions across heterogenous study designs (O'Haire, 2013). The focus of this review is to examine evidence on the influence of AAT/I on

individuals with Autism Spectrum Disorder (ASD) where there is growing research evidence (Gabriels et al, 2015; Gabriels et al, 2018; Pan et al., 2019; Wijker et al 2019). Benefits of human-animal interaction is woven through evolution however it was in the early 1960's, that these benefits were first utilised in a therapeutic setting. Levinson noted the improved outcomes of his patients in a child psychology service when his dog was present (Chandler, 2005; Levinson, 1969, 1997; Pavlides, 2008). Building on these observations Levinson developed what he called "pet therapy," this is acknowledged as the birth of AAT (Chandler; Levinson, 1969; Pavlides, 2008).

Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is characterised by difficulties with social communication and interaction. It is a heterogeneous neurodevelopmental condition defined by the DSM-5 (APA, 2013) as a person experiencing persistent difficulties in social interaction in a range of contexts and as showing restricted, repetitive behaviors. These problems must be evident in early childhood, cause significant impairment in functioning, and not be explained by intellectual disorders or developmental delays (APA, 2013). Severity of symptoms, impairments in social communication, and functional impact will vary across individual cases resulting in a spectrum (Weitlauf et al, 2014).

As ASD is neurodevelopmental and pervasive in nature individuals with ASD and the people who support them will experience varying degrees of difficulties throughout the lifespan. ASD is also associated with an increased incidence of anxiety, depression and subsequent stress (Wijker et al, 2019). The multifaceted nature of ASD necessitates a variety of therapeutic interventions including educational, behavioural, systemic and pharmacological. Individuals with a diagnosis of ASD and their families may also increasingly seek complimentary therapies including AAT/I as an alternative and/or addition to other forms of

intervention in a bid to address the multifactorial nature of ASD (Trzmiel, 2019). While the practice of AAT/I and use of autism assistance dogs in increasing (Lentini & Knox, 2015), and evidence base for such therapies is increasing, systematic reviews of research (O'Haire, 2013; O'Haire, 2017) have highlighted a range of challenges and methodological limitations, and there remains a lack of clarity around the mechanisms involved in AAT/I. Particular features of ASD which AAT/I may address include social communication and pro-social behaviours as animals may act as a "social catalyst" for initiating and facilitating social interaction (Harris & Williams, 2017; O'Haire, 2013). Socio-emotional insight and Theory of Mind (TOM) can also be impaired in individuals with ASD (Wijker et al, 2019). Animals' expression of emotion may be more noticeable and less complex than humans which may make interactions with animals less cognitively demanding for people with ASD (Grandin et al, 2015).

Furthermore, an individual with ASD who fails to interpret subtle human communication cues or to comply with social norms will not face judgement or rejection from an animal; thereby offering more opportunities for a positive experience of social interaction and reducing the likelihood of withdrawal due to unsuccessful interactions(Grandin et al, 2015).

Animal Interaction and ASD

The benefits of interaction with pet animals have been observed with around 70% of UK families owning pets (Marsa-Sambola et al , 2016). However, with emphasis on empirical studies and evidence-based practice, further research is required to formally quantify these potential benefits. Studies to date have identified an improvement in physical, social, emotional and cognitive functioning to those who interact with animals for children. AAT/Is are an emerging area of research and the psychological mechanisms underpinning their effects are currently debated (Harris & Williams, 2017). Some of the key psychological

aspects of AAIs are particularly pertinent to ASD. For example, animals may facilitate social interactions between humans, a key challenge for those with ASD (O'Haire, 2017). Animals may provide a neutral focal point for individuals around which spontaneous social interaction and communication may take place (Marsa Sambola et al.,2017). McNicholas and Collis (2010) found that the presence of a dog facilitated more social interactions than when a dog was not present. AAIs may also increase empathy and understanding of other's minds, which are both required for social interaction. A case study of a child with ASD showed that their empathy levels increased after a service animal was incorporated into their daily life at home (Grandgeorge et al, 2012). This may serve to improve family life as increased empathy may encourage more prosocial behaviours and reducing conflict and improving quality of life within the family home.

It is suggested that animals may be more behaviourally salient with regards to signalling some emotions than humans (Harris & Williams, 2017). This may provide a strong basis for more successful social interactions for individuals with ASD. Furthermore, the human-animal relationship is not hampered by judgment instead pets offer unconditional positive regard (Grandgeorge et al, 2012). Therefore, a failure to respond in a socially appropriate way will not result in a rupture of the relationship or judgement from the animal. Finally, animals may serve as a transitional object (Winnicott, 1971) to modulate arousal and stress. For example, children with ASD may find social interaction stressful. The presence of an animal has been found to reduce arousal and improve social interaction in children with ASD both in therapeutic and non-therapeutic scenarios (Wright et al., 2015).

Given the growth in practice of AAI for ASD and increases in published studies, researchers have begun to systematically review the evidence. One of the first systematic reviews demonstrated a range of positive outcomes following AAT/I for individuals with ASD

including reducing stress, improving social communication and mood (O'Haire, 2013). This review included fourteen studies and found that children with ASD engaged with an adult and typically developing peers more pro-socially in the presence of guinea pigs, rather than toys. O'Haire's (2013) systematic review of for AAIs in ASD reported a tentative "proof of concept" however, she argued that more rigorous empirical studies are required in order to further establish a convincing evidence base for AAIs in relation to ASD as although many studies indicated positive outcomes they were also limited by methodological weaknesses.

Lentini & Knox (2015) also completed a systematic review of forty-seven studies to update on terminology within the field however, there remains a gap in this area with regards to reviewing the randomised control trial and control condition studies. Lentini & Knox (2015) served to clarify terminology within this area. It does differ however from the current study as the scientific prowess of the included studies was not considered i.e. studies without control groups were included. While this and other reviews (O'Haire, 2013; O'Haire, 2017) have built on the progressive body of evidence in this area there is a distinct lack of particular focus on the scientific quality of studies of AAT/I for ASD. O'Haire (2013) identified the need for improved rigor and high-quality research in this area in order to evidence further the "proof of concept" (O'Haire, 2013) that was identified in her review. The current review aims to improve understanding of high-quality research in this area in order to strengthen the conceptual ideology evident throughout literature and inform real-world application of these interventions by ensuring they are based on best practice (Lentini & Knox, 2015).

Rationale for the current systematic review and meta-analysis

While there is a growing body of evidence relating to AAT/I for ASD the field would benefit in particular from reviewing research that provides the strongest scientific evidence on the

efficacy of AAT/I for ASD. The established gold standard of research is Randomised Control Trials (RCTs). Best practice indicates that RCT's produce credible scientific research by providing the most robust evidence while reducing bias in a particular area (Bondemark & Ruf, 2015). To date a review of the RCT and control condition literature for animal interaction and ASD has not been completed. Therefore, this study provides a systematic review of the RCT and control trial literature and a meta-analysis using a sub-set of published trials with sufficient homogeneity of outcome measures. Homogeneity of outcomes would be considered present if the study is measuring similar concepts e.g. social communication and/or making use of the same outcome measure.

With consideration of the recent COVID-19 restrictions the necessity for the current review is more pertinent. Typical services for families for ASD may not be available as previously offered due to COVID-19 restrictions. As a result, complimentary therapies and or interventions which families can access out with traditional clinic-based settings are essential. The impact of the global pandemic on individuals with ASD is far reaching and significant; focus on the quality and accessibility of interventions for this population is vital (Pellicano & Stears, 2020). Hence completion of this review of evidence is timely.

Aims

The aim was to systematically review and meta-analyse (as appropriate) RCTs and control condition studies of AAT/I for ASD patients. The review specifically addressed the research question: Does AAT/I positively impact outcomes in individuals diagnosed with ASD compared to no interaction with animals? It was hypothesised that AAI would have a positive impact on social, emotional and well-being outcomes for individuals with ASD compared to outcomes for those in control groups (no animal interaction) with ASD.

Methods

Electronic search of PsycINFO, ProQuest, MEDLINE (using OVID), Web of Science and ProQuest Dissertations were searched for relevant published, unpublished and grey literature within the time frame of 2009-2021. The rationale for this timeframe was to include all recent reviews and capture the most up to date developments in the area to inform further progression of the evidence base. Search terms included Autism/Autism Spectrum Disorder AND Animal / Animal Assisted Interaction/ Human Animal Interaction/ Pet/ Companion animal AND Randomised control trial (RCT)/Control conditions/ Waitlist control. The search was carried out within PRISMA guidelines and registered with PROSPERO registration number CRD42020165374.

Inclusion and Exclusion Criteria

Inclusion criteria were that: 1) Studies included were animal-based interventions (characterised by therapeutic intervention or as an activity to identify therapeutic benefit and/or improve health, well-being or ASD symptomatology e.g. AAT/I) for participants with ASD involving direct animal contact during the intervention;

2) Studies must identify as RCT's or have used control conditions with the control condition excluding other animal-based intervention (e.g. wait list control);

3) Participants must be diagnosed with Autism Spectrum Disorder (ASD). The age range was set for under eighteen however as ASD is a developmental disorder and participants will experience difficulties in areas such as social communication across their lifespan any studies which met the above criteria and included participants above eighteen were noted and information highlighted separately. As this area is under researched it was identified to be appropriate to highlight all studies that met inclusion criteria removing age as a limiting factor.

4) Studies published in English.

Exclusion criteria included: 1) Studies conducted or assessed in a language other than English in order to reduce the possibility of changes occurring due to translations or the cultural context; or studies which included participants with no formal diagnosis of ASD

2) Non-RCT/control trail studies were not included.

3). Unpublished studies and grey literature.

Results

Quality Assessment

Papers were assessed by two raters independently for quality and risk of bias using the Quality Assessment Tool for Quantitative Studies (QATQS) (Armijo-Olivio et al, 2012). This tool was selected as it allowed a focus on methodological limitations, in greater detail than tools used when reviewing other animal-related studies (Hooijmans et al, 2014). Aside

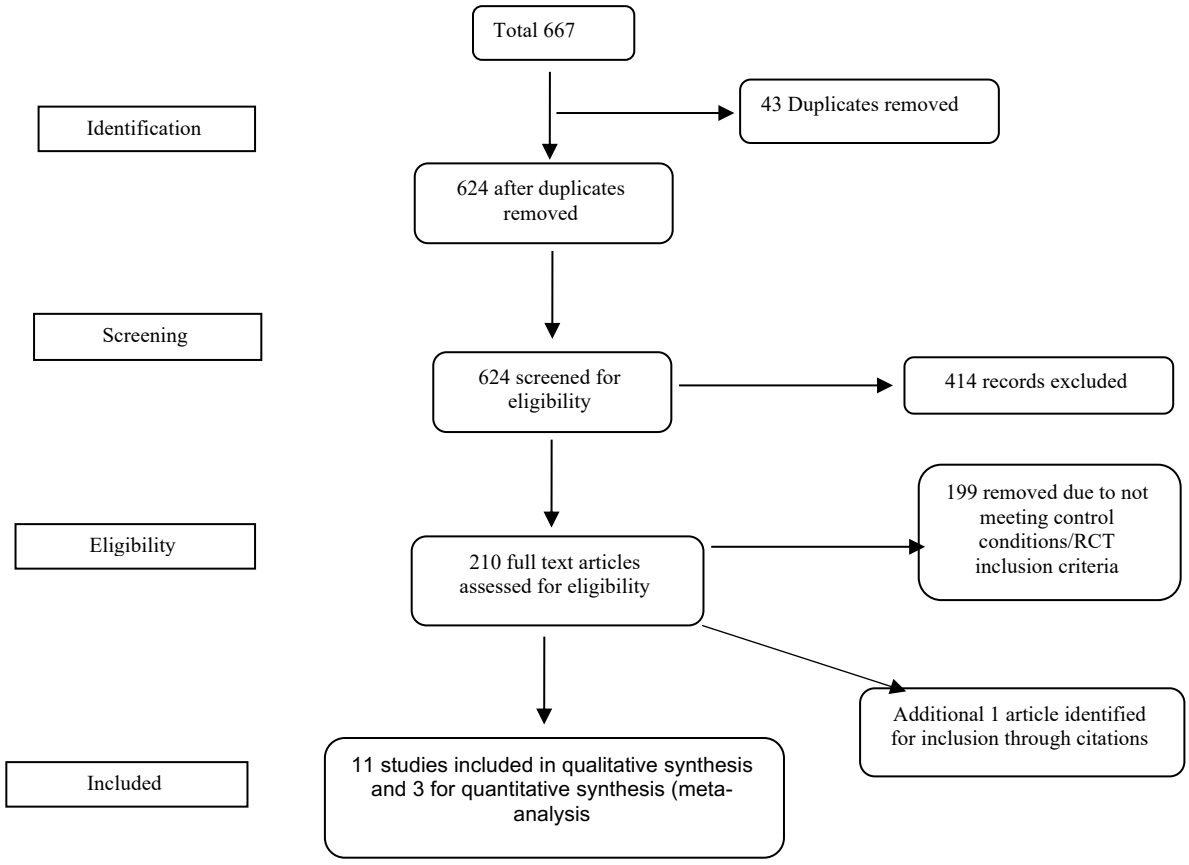
Table 1. Quality Assessment Tool for Quantitative Studies (QATQS)

	Selection Bias	*Design	Confounders	Blinding	Data Collection	Withdrawal and Drop out	Intervention	Appropriateness of analysis
Gabriels et al (2015)	2	1	2	2	2	1	1	1
Gabriels et al (2018)	2	1	2	2	2	1	1	1
Pan et al (2019)	2	1	2	2	1	1	1	1
Steiner (2015)	3	1	3	2	1	1	2	2
Borgi et al (2015)	2	3	2	2	1	1	2	1
Fung & Leung (2014)	2	3	1	2	1	1	1	2
Jenkins (2013)	2	3	3	2	1	1	1	2
Petty (2017)	2	3	2	2	2	1	1	1
Bass et al (2009)	2	3	2	3	1	1	2	1
Lanning (2014)	3	3	3	2	2	1	2	1
Harris & Williams (2017)	3	3	3	2	1	1	1	1

from design (where numbers assigned to particular formats e.g. 1=RCT, 3=Control Conditions) ratings were indicated 1-3 on a descending scale from Strong to Weak. Disagreements between raters were resolved through discussion. The inter-rater reliability was calculated using Cohen's K as 0.9 which indicates excellent inter-rater reliability. Table 1 below illustrates the details of the quality assessment.

First author and study characteristics, including: year of publication, study design, number of participants, age range of participants, intervention design, length and frequency of intervention, outcome measures, domains measured, and results. Four of the included studies were described as RCT's (one as a follow up to an RCT), the remaining studies were control

Figure 1 Study Flow Diagram



condition studies either citing waitlist as the control group or a randomly assigned non-animal intervention control group (see Table 2 below).

In total 535 participants took part in the studies reviewed, with sample sizes ranging 7 to 127 (Mean= 46.27) participants. Participants ranged in age from 6 years to 18 years old,. All participants were met criteria for ASD based on diagnosis from healthcare professionals, recruitment from specialist ASD clinics or schools and/or completion of a screener measure confirming ASD diagnosis. A trend of a steady rate of publication of high-quality research is noted with one study published in 2013 compared to three in 2015 and two in 2019. In terms of AAI, the length and frequency of AAT/I also varied greatly from 5 to 25 weekly sessions varying in length from 30-70 minutes. Ten out of the 11 included studies involved horses in their intervention (Therapeutic Horseback Riding (THR): Gabriels et al, 2015; Gabriels et al, 2018; Pan et al, 2019; Jenkins, 2013; Petty, 2013,), Equine Assisted Therapy (EAT): (Borgi et al, 2015) and Horse Therapy (Steiner, 2015; Bass et al, 2009; Harris & Williams, 2019; Lanning, 2014), the remaining one study utilised dogs in their intervention (animal assisted therapy (AAT) () and animal assisted play therapy (AAPT) (Fung & Lueng, 2014). There was variability amongst the design of the dog and horse interventions e.g. within horses some involved riding and others did not, instead incorporating care activities for example. In relation to outcome measures used ten out of 11 studies used standardised measures (for example the Social Responsiveness Scale (SRS) (Bruni, 2012), Tower of London (ToL) (Shallice, 1982) and the Aberrant Behaviour Checklist (ABAC) (Aman et al, 1985)) (Gabriels et al, 2015; Gabriels et al, 2015; Pan et al, 2019; Harris & Williams, 2019; Borgi et al, 2015; Steiner, 2009; Petty, 2013; Wiker, 2019; Bass et al, 2009; Lanning, 2014) for their measurement of effectiveness of intervention, the remaining two studies utilised rated

observations and original rating measurements (Fung & Leung, 2014; Jenkins, 2013). Domains measured are listed below and are wide ranging but can be categorised by Social Function and Well-Being outcomes. Social function include social interaction, social communication, social initiation and social cognition; in addition, one study took into account animal engagement/relationship with animal. Well-Being outcomes include: measures of Behaviour (Irritability, Hyperactivity, Repetitive Autistic Behaviours), Language (expressive, vocabulary), Emotion (stress, anxiety, depression, self-esteem) and Physical outcomes (Sensory, cortisol levels, motor skills, gait).

The use of standardised outcome measures varied across both the horse and dog-intervention studies. This makes accurate comparison of findings and standardisation of interventions challenging. Several studies did utilise standardised measures which improves their scientific power and validity of results. However, some studies, for example Fung and Lueng (2014), relied on unique rating systems which makes accurate standardisation and replicability of the intervention less likely.

All of the 11 studies noted a statistically significant difference in outcomes in at least one outcome measure for active intervention groups. Studies included in the current review which used non-standardised outcome measures (Fung & Lueng, 2014; Jenkins, 2013) report less significant positive outcomes for both experimental and control groups for both dog-based and horse-based studies. Outcome measures in the included studies can be grouped into two categories: Social function and well-being outcomes.

Comparing outcomes of the outcomes in dog-based studies using AAT and AAPT to horse-based studies including THR and EAT indicates that significant improvements in measured outcomes in active groups. Considering canine interventions first, Wijker et al (2019)

reported a significant intervention effect on impairments in social responsiveness rated by the informant e.g. carer or family member. (SRS-A(I), − 11.9; 95% CI − 20.3 to − 3.5; p = 0.010; d = 0.46). A decrease in impairments in social responsiveness in both groups at T1 with an increase initially and further improvement in active AAT group compared to the control group at 10 week follow up. No significant findings were noted on psychological and physical symptom scores in the SRS-R or intervention effects on self-esteem (RSES, 0.8, 95% CI − 1.3 to 2.9; p = 0.440; d = 0.16) and reduction in deficits in social responsiveness as rated by the participant (SRS-A, −1.3, 95% CI −7.9 to 5.3; p=0.690; d=0.05) were not significant. However, the AAT group recorded reduced impairments in social responsiveness as rated by participants' spouses, close family members, or friends. This gives insight into the value of gaining a systemic perspective on the benefits of AAT's as individuals with ASD may not always objectively identify changes or benefits. Compared to the waiting list control group, animal assisted therapy (AAT) with a dog reduced perceived stress and agoraphobia symptoms. There was also an indication that depressive symptoms reduced due to the therapy. The analyses implied that these effects, small to medium in size, remained at the 10-week follow-up (Wijker et al, 2019).

Fung & Leung (2014) utilised non-standardised unique rating systems to assess the impact of their canine intervention, measuring outcomes around verbal and non-verbal behaviours in participants with ASD. They reported a significant increase in verbal social behaviours, however, direct comparison to other dog-based studies (Wijker et al, 2019) is difficult due to the unique rating system used. Interestingly studies which used non-standardised measuring systems were rated as lower quality in the above quality assessment (see table 1 above) and fewer significant results were reported compared to studies which used standardised outcome measures. Fung and Leung (2014) used pre- and post-intervention measurement and found no significant difference in outcomes aside from Verbal Social Behaviour (VSB). Authors found

a significant increase in VSB from the baseline stage to the posttreatment stage in the intervention group ($z = –2.02$, $p = .043$, $d = .32$). There was no significant difference in VSB between the baseline and the posttreatment stages ($z = –1.48$, $p = .138$) in the control group. The sample size in this study is small (N=10) so the weight of the results are also less indicative of a population effect than the more well powered dog-based study (Wijker et al, 2019).

The ten horse-based studies utilised a variety of outcome measures both standardised and non-standardised within the social functions category. These studies also included wellbeing and physical outcome assessments. Commonalities were noted in outcomes measured in standardised ways across studies for example, ASD specific outcomes relating to social impairments (e.g., social communication, social awareness, social motivation and pro-social behaviours) are reported in seven of the ten horse intervention studies (Pan et al, 2019; Gabriels et al, 2015; Gabriels et al, 2018; Steiner, 2015; Borgi et al, 2015; Bass et al, 2009, Steiner, 2015). A statistically significant group x time interaction was presented by Pan et al (2019) in the SRS overall score, $F(1, 20) = 4.92$, $p = .038$, $g^2 = .20$.

As follow-up to the significant interaction, simple effects paired sample t tests uncovered that the AAI group means significantly increased, $t(10) = 2.87$, $p = .017$, $d = .66$, while the means for the control group remained unchanged, $t(10) = .108$, $p=.916$,$d=.02$. The interaction effect of the social motivation subscale was also significant, $F(1, 25) = 4.80$, $p = .038$, $g^2 = 161$ with significant improvements at the 0.1 significance level in social awareness and social communication behaviours. THR was also illustrated to produce significant initial improvements in number of words and different words spoken during a standard language sample in Gabriels et al, (2018).

As with the dog-based study Fung and Leung (2014), Jenkins et al.'s (2013) use of non-standardised outcome measures resulted in poorer quality assessment in the above QATAS table. Authors reported that THR produced no significant changes in affect or in participants' responses or rate of spontaneous initiations. THR did not produce clinically significant changes in off-task behaviour or compliance. THR did not have an effect on the occurrence of problem behaviour. However, participants' posture improved during THR. There was little change in the rate of gestural commands and THR did not produce systematic or meaningful improvement in the areas measured by the THR parent reports post intervention little perceived benefit follow up intervention on the child's motivation, language acquisition and problem behaviours.

In addition to social functions outcomes, outcomes relating to well-being and emotional welfare included hyperactivity, sensory seeking, irritability and quality of life were measured across a four of the 10 horse studies (Harris & Williams, 2017; Bass et al, 2009; Pan et al, 2019; Lanning, 2014). Bass et al (2009) utilised standardised measurement and reported Sensory Profile overall score as statistically significant group x time interaction, $F(1, 31) = 10.98$, $p = .002$, $g^2 = .26$ on sensory profile for the experimental group this was also seen on follow with the experimental group significantly increased between pre- and post-testing, $t(18) = -7.29$, p \ .01, $d = -.059$, while the means of the control group only marginally increased, $t(13) = -1.77$, $p = .101$. Statistically significant results for experimental group in sensory seeking, attention and distractibility, sensory sensitivity, and sedentary but not for motor/perception were also noted. Harris & Williams (2017) also used standardised measures and found significant reduction in the severity of ASD symptoms and hyperactivity from pre- to post-test for the intervention group only. A significant difference was found

between pre- and post-test scores for the intervention group only ($t(9) = 2.4$, $p = 0.040$, $r = 0.625$), which denotes a large effect size. The mixed ANOVA for the Irritability subscale of the ABC-C revealed no significant main or interaction effects. Wilcoxon signed rank and Mann Whitney U tests showed no significant within-group, between-groups or interaction effects for the Lethargy, Inappropriate Speech and Stereotypy subscales of the ABC-C. Gabriels et al' (2018) made use of similar standardised measures and reported that the THR group-maintained reductions in irritability behaviour at a 0.1 level (effect size = 0.32, $p = 0.07$). (Effect size = 0.32, $p = 0.07$), which was 73% of efficacy preserved from the primary post-intervention endpoint (within 1-month post-intervention). Hyperactivity behaviours did not sustain this same trend. Similar findings were identified in other studies, with Pan et al (2019) finding THR participants had significant improvements in hyperactivity.

There were no significant improvements in number of words or new words spoken during the standard language sample. Linear mixed effects model analysis indicated that greater weekly pre-lesson irritability levels were associated with smaller post-lesson reduction in salivary cortisol levels, and greater weekly pre- lesson hyperactivity levels were associated with smaller cortisol reduction in the THR group, but not in the BA control group. Well-being outcomes in dog-based studies e.g. Fung & Leung (2014) showed that THR did not have an effect on the occurrence of problem behaviour. However, participants' physical well-being in their posture improved during THR. There was little change in the rate of gestural commands and THR did not produce systematic or meaningful improvement in the areas measured by the THR parent reports post intervention little perceived benefit of intervention on the child's motivation, language acquisition and problem behaviours.

Mixed results are noted regarding post-intervention changes on outcomes such as hyperactivity. This is consistent with research in the area outlining a lack of consensus in the field (O'Haire, 2013; Leintini & Knox, 2015). For example, some studies (Harris & Williams, 2017; Pan et al, 2019) identify an initial positive effect, however, other studies indicate no significant change in the same outcome (Gabriels et al, 2018). This may indicate differences in the design of the interventions being offered and timing of the outcome measures.

While these are all horse studies which utilised standardised measures the length and intensity and activities within interventions varied across these studies. Gabriels et al, (2018) is a follow up paper which serves to identify long term influence of THR intervention. Unfortunately, sustained change is not noted for hyperactivity but is noted for other well-being outcomes (Irritability and Number of Words spoken). This suggests that it may have particular benefits such as reduction in hyperactivity may require on-going intervention in order for participants to continue to experience its benefits. This observation is unsurprising given the pervasive nature of ASD.

Use of similar standardised outcome measures means consistent evaluation of particular parameters could be made across both dog and horse-based intervention studies. A significant intervention effect was shown on impairments in social responsiveness in two studies Bass et al , 2009; Borgi et al et al, 2015). These studies were all rated highly in the quality assessment. There was an indication that depressive symptoms reduced due to the therapy. The analyses implied that these effects, small to medium in size, remained at the 10-week follow-up. A decrease in impairments in social responsiveness in both groups at T1 with an increase in impairments at T2 compared to T0 in the control group, and a slight decrease in

impairments at T2 in the intervention group. No significant findings were noted on psychological and physical symptom scores in the SRS-R Intervention effects on self-esteem (RSES, 0.8, 95% CI − 1.3 to 2.9; $p = 0.440$; $d = 0.16$) and deficits in social responsiveness rated by the participant (SRS-A, −1.3, 95% CI −7.9 to 5.3; p=0.690; d=0.05) were not significant. Bass et al, (2009) reported a statistically significant group x time interaction in the SRS overall score, $F(1, 20) = 4.92$, $p = .038$, $g^2 = .20$. As follow-up to the significant interaction, simple effects paired sample t tests uncovered that the experimental group means significantly increased, $t(10) = 2.87$, $p = .017$, $d = .66$, while the means for the control group remained unchanged, $t(10) = .108$, p=.916,d=.02. The interaction effect of the social motivation subscale was significant, $F(1, 25) = 4.80$, $p = .038$, $g^2 = 161$. Improved socialization was also found in Borgi et al, (2015) with greater change in the TR group compared to the control group (change between baseline and final scores, mean ± SD, EAT: 0.72 ± 0.22, controls: 0.23 ± 0.21, ANOVA Time x Group interaction $F(1,18) = 5.30$, $p = 0.034$, Tukey test $p < 0.01$).

Based on the included studies in the current review the difference in effectiveness of dog-based studies and horse-based studies is not explicitly comparable as the proportion of horse-based studies far exceeds dog-based intervention studies. This information in itself highlights that research efforts of RCT's and control design studies are more weighted in horse-based AAI studies. Both horse and dog-based AAI studies focus on social function well-being outcomes and while there is a degree of variability in results (perhaps due to the variability of intervention administered) the above results highlight improvements in both categories of outcomes. In particular, improvements in specific social impairments for individuals with a diagnosis of ASD were noted in several studies (Harris & Williams, 2017; Bass et al, 2009; Fung & Leung, 2014; Borgi et al, 2015, Gabriels et al, 2015; Gabriels et al, 2018; Steiner,

2015). The studies are presented below with RCT studies ordered first followed by Control condition studies.

Table 2. Data Extraction Table: Characteristics of Study, Outcome Measures and Results

Study (Author and Year)	**Design**	**Participants N**	**Intervention including Length and Frequency**	**Outcome Measures****	**Domains Measured**	**Results** *Domains in bold indicate improvement for intervention group which reach statistical significance. No significant improvement for control group unless indicated.
Garbriels (2015)	RCT	Participants with ASD N= 127 (down to 116) 58 experimental 58 control 6-16 years	THR intervention or a barn activity (BA) control group without horses that used similar methods 10 weekly sessions	SRS, ABAC, BOT-2, PPVT-2, SALT, Sensory Integration Praxis Test, Vineland VABS-II,	Irritability, Social withdrawal, stereotypy, hyperactivity and inappropriate speech, Social communication, Receptive vocabulary, Expressive language, Praxis on Verbal command and Postural Praxis	**Irritability** and hyperactivity, **Social cognition** and social communication, **Total number of words** and **new words**
Gabriels et al (2018)	RCT (Follow up)	Follow-up data of 44% (*N* = 64/116) 6-16 years	Follow up investigation for prolonged results from previously administered 10 week manualised (THR) 6-month follow-up of participants who took part in a previously-published RCT comparing THR group to a no-horse contact active control group.	ABAC subscales and SRS subscales	Irritability, Social withdrawal, stereotypy, hyperactivity and inappropriate speech, Social communication, Word fluency	Maintained reductions in **irritability** and sustained significant initial improvements made in **social and communication behaviours**, along with **number of words** and **new words**.

Pan et al (2019)	RCT (Replication of Gabriels et al (2015) RCT)	ASD (*N* = 16) Intervention group: N=8 Control Group: N=8 6-16 years	THR intervention group or no horse interaction barn activity (BA) control group 10 weekly sessions	SRS, ABC, SALT, Cortisol measure	Social Awareness, Social Cognition, Social Motivation, Social Communication and Autistic Mannerisms, Irritability, Lethargy/Social Withdrawal, Stereotypy, Hyperactivity, and Inappropriate Speech, Cortisol levels	**Hyperactivity, and social awareness,** and **irritability** and **social communication** behaviours.
Study (Author and Year)	**Design**	**Participants** **N**	**Intervention including Length and Frequency**	**Outcome Measures****	**Domains Measured**	**Results** *Domains in bold indicate improvement for intervention group which reach statistical significance. No significant improvement for control group unless indicated.
Steiner (2015)	RCT	N=26 (12 boys and 14 girls) Randomly assigned to groups. Horse therapy group of 13 children (6 boys, 7 girls) Control group of 13 children (6 boys, 7 girls) 10-13 years	Horse therapy for 30 minutes a week, and also received pedagogical sessions of education. Weekly sessions 30 minutes (length of intervention not indicated in paper)	Physical gait parameters, PAC-test	Gait analysis: Front, rear and sides, PAC: Communication (language, numbers, subtraction, paper-using), Self-care (dressing, washing, moving for transport, feeding), Motor skills (growth motor function skills, manual function), Socialization (housework, games)	**Length of the gait cycle** became more stable in the sagittal plane. **Self- Service, Socialisation, Motor skills and Communication skills**
Borgi et al (2015)	Control Conditions (Waitlist Control)	N=28 EAT group=15 Control group N= 13 6-12 years	Equine Assisted Therapy (EAT) 25 weekly sessions over 6 months (60-70 minute sessions)	Vineland, ToL	Adaptive functioning: Communication, Daily Living Skills, Socialization, and Executive Functioning: Motor Skills, executive functioning, deficits in planning and problem-solving	**Socialization** scores on the Vineland and **shorter reaction time** in **problem-solving** situations on the ToL.
Study (Author and Year)	**Design**	**Participants** **N**	**Intervention including Length and Frequency**	**Outcome Measures****	**Domains Measured**	**Results** *Domains in bold indicate improvement for intervention group

						which reach statistical significance. No significant improvement for control group unless indicated.
Fung and Leung (2014)	Control Conditions (Group-Comparison)	N=10 (8 boys 2 girls) 7-10 years	Animal Assisted Play Therapy (AAPT) incorporating a dog in the active group. A baby doll was used as the dog's surrogate in the comparison group. 14 sessions	Own coding measurement: Social (including verbal and non-verbal social behaviour) and Non-social behaviours.	Verbal and non-verbal behaviour. Social and Non-social behaviours.	**Significant increase in Verbal Social Behaviour.**
Jenkins (2013)	Control Conditions (Single case experimental design with waitlist control)	N=7 (six boys, one girl) Two of the participants were identical twin boys Experimental group= 4Control group= 3 6-14 years (M=9.5 years)	Therapeutic Horse Riding (THR) program. 9 weekly 60 minutes sessions	Child behaviour checklist (parent and teacher), Test of Motor Proficiency, second edition, Observational measurement	Adaptive behaviour Maladaptive behaviour Internalising behaviour Externalising behaviour Observations: Affect ("happiness/unhappiness") Responses to initiations & spontaneous initiations Compliance Off-task behaviour Problem behaviours Verbal commands	Participants' **posture** improved during THR. Little changes in the rate of gestural commands during THR.
Petty (2017)	Control Conditions (Nested pilot study)	N=67 (THR *n* = 31; BA *n* = 36) 6-16 years .	Therapeutic horseback riding (THR) intervention group No-horse barn activity (BA) control group. 10 weekly sessions	Pet attachment measure: Child's attitude and behaviour towards animals, PACRA	Animal care, Animal abuse Relationship with pet, Manner of behaviour towards the pet-following a THR intervention	**Animal Attachment** for the THR intervention group (AATS) particularly with **child having a good relationship with the pet and the child acting in a caring manner toward their pet.**
Bass et al (2009)	Control Conditions (Waitlist Control)	N=34 Experimental group: 2 girls and 17 boys, Age 5-10 years (M=6.95 SD 1.67) Control group: 3 girls and 12 boys Age 4-10 years (M= 7.73, SD=1.65)	Horseback riding intervention 12 weekly sessions	SRS and Sensory Profile	Social awareness, social cognition, social communication, social motivation, and autistic mannerisms, Sensory seeking, emotionally reactive, low endurance/tone, oral sensory sensitivity, inattention/ distractibility, poor registration,	**Sensory Profile overall score**. **sensory seeking, attention and distractibility, sensory sensitivity, and sedentary** but not for motor/perception**.** A group x time interaction present in the **SRS overall score**, the interaction effect of the **social motivation s**ubscale was also significant

					sensory sensitivity, sedentary, and fine motor/perception	
Study (Author and Year)	**Design**	**Participants** **N**	**Intervention including Length and Frequency**	**Outcome Measures****	**Domains Measured**	**Results** *Domains in bold indicate improvement for intervention group which reach statistical significance. No significant improvement for control group unless indicated.
Lanning (2014)	Control Conditions (Control group: Non animal intervention)	N= 25 (Intervention group= 13 Control Group=12) Age 4-15 years	Intervention group: riding activities, control group: safety lessons 12 weekly 60-minute sessions	PedsQL, CHQ	Physical Functioning, Role/Social Emotional/Behavioural, Role/Social Limitations-Physical, Bodily Pain/Dis- comfort, Behaviour, Mental Health, Self Esteem, General Health Perception, Parental Impact, Emotional, Parental Impact Time, Physical and Psycho- social	**Quality of life, self-esteem** and **general behaviour** respectively. While higher physical and psychosocial summary scores recorded in the EAA group than control group.
Harris & Williams (2017)	Control Conditions	N= 26 (Intervention Group= 12 Control Group=14) Age 6-9 years Control Group (M= 7.5, SD=10.57) Intervention Group (M= 8.5 SD=10.56)	Intervention group: Horse riding lessons 5-7 weekly sessions lasting 45 minutes.	CARS2, the ABC-C, MOPI Observational measure of compliance and behaviour	Severity of Autism Irritability, Social withdrawal, stereotype, hyperactivity and inappropriate speech Compliance and behaviour within intervention	**Severity of ASD symptoms** and **hyperactivity reduced.**

**Full descriptive names for measures used: Social Responsiveness Scale (SRS), Aberrant Behaviour Checklist (ABAC)Systematic Analysis of Language Transcripts (SALT), Sensory Integration Praxis Test, Vineland VABS-II (Adaptive Functioning), Pedagogical Analysis and Curriculum (PAC-Test), Tower of London (ToL) (Executive Functioning), Parent's Account of Children's Relationships with Animals (PACRA), Paediatric Quality of life 4.0 Generic Core Scales (PedsQL), Child Health Questionnaire (CHQ) Childhood Autism Rating Scale, Second Edition (CARS2) and Measurement of Pet Intervention Checklist (MOPI)

As identified in the inclusion criteria studies which met all inclusion criteria but included individuals with a diagnosis of ASD aged over eighteen years old were identified. One study, Wijker et al (2019) met this criteria. While it was decided not to include this study in the main body of the review it is important to highlight it as a study of scientific merit in a growing area of research. Wijker et al (2019) carried out a RCT including 53 adults (27 waiting list control and 27 intervention group) with a diagnosis of ASD. They utilised Animal Assisted Therapy (AAT) for 10 weekly 60 minutes one-on-one sessions involving a therapy dog and compared the results to the waiting list control group. Researchers measured perceived stress, anxiety, agoraphobia, depression, somatization, cognitive-performance deficits, interpersonal sensitivity and mistrust, hostility, sleep difficulties and self-esteem of participants and also utilised carer reports (Using the Perceived stress scale, Adult SRS, SCL-90-R, Rosenberg Self-Esteem Scale). Results indicate a decrease for AAT group overall. Depressive symptoms also reduced. Improvements preserved in 10-week follow.

Meta-Analysis

The meta-analysis of three (two RCT's and 1 control design) out of 12 studies where the same evaluation tool- the Social Responsiveness Scale (SRS) was performed to measure the effect of horse-assisted therapy (EAT and THR); the results of which are illustrated below (See Figures 2-5). Additional data was requested from authors of Gabriels et al (2018) to facilitate inclusion in the meta-analysis but this information was not received. Due to the limited data available interpretation of the meta-analysis should be considered as a preliminary exploration of this area and when available further studies and data sets can be added to expand the current analysis. Both Bass et al (2009) and Gabriels et al (2015) show an intervention effect in favour of the experimental group on all parameters tested Social Communication, Social Awareness, Social Motivation and Social Cognition. By comparison

Pan et al (2019) show an intervention effect in favour of control groups in all but one parameter, Social Awareness. This study has only eight participants per group therefore the least impact within the meta-analysis. Intervention for each study was similar with 10-12 weekly sessions. Gabriel's (2015) boasts the largest sample size, an RCT of this calibre is rated highly on the QATQS and occupies the most weight within the meta-analysis (50-71%). Encouragingly, Gabriels et al' outcomes indicate a favourable intervention effect on experimental group social parameters. While this is based on a small number of horse-based studies the quality of the included studies and one larger RCT give merit to the results and contribute to the evidence of AAT/I in targeting ASD specific social deficits.

Figure 2. Social Communication

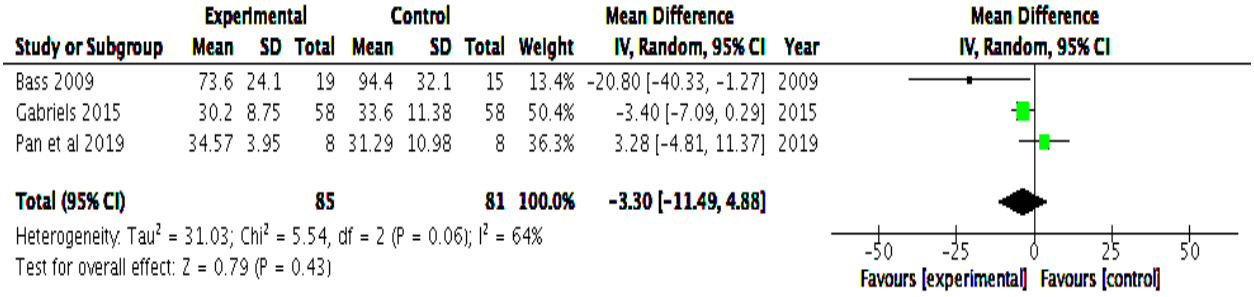


Figure 3. Social Awareness

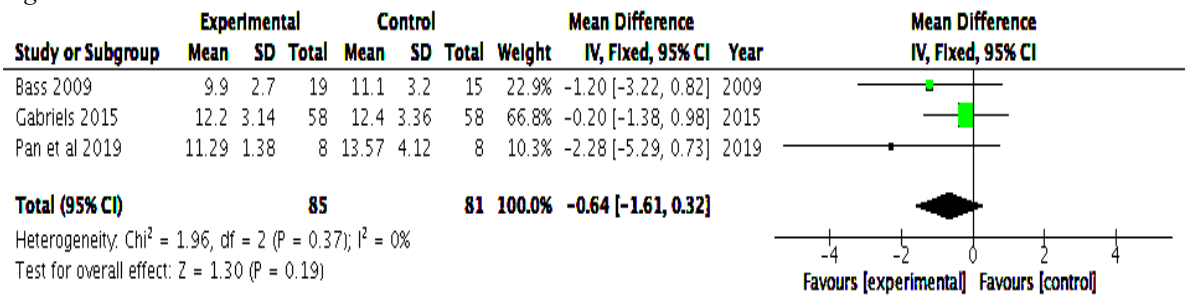


Figure 4. Social Motivation

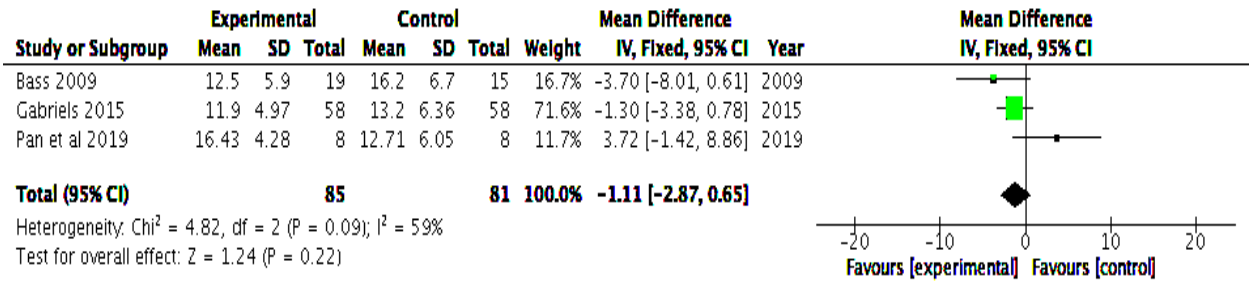
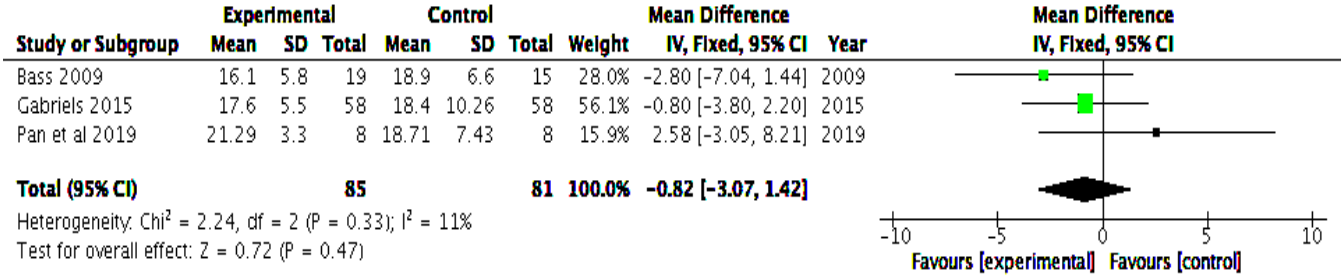


Figure 5. Social Cognition



*Heterogeneity percentage more than 50% means high heterogeneity. P value indicates significance for both heterogeneity and overall effect.

Discussion

Beneficial effects of AAI for people with ASD have been reported in all studies in the review including both improvement in social and well-being outcomes. The hypothesis that there will be improved outcomes for AAT/I groups compared to outcomes of control groups is tentatively accepted. However, the degree of improved social functioning, reduced hyperactivity, improved behaviour, and improved quality of life across studies is variable and the reliability and sustainability of results is also in question. Data presentation and narrative synthesis in this review presented a considerable challenge due to lack of a standardized approach in the area in terms of methods of measurement and intervention protocols adopted. Consensus on the effectiveness of the interventions is not easily measurable and comparable due to a great variety of the tools and scales used by the researchers. The variety of outcomes measures, which span social function and wellbeing outcomes, highlights the depth and breadth of potential benefit animal interventions may have for individuals with ASD. Experimental groups across all studies recorded significant improvements in areas measured

in at least one outcome. In particular improvements in social impairments were noted for individuals with a diagnosis of ASD in several studies (Harris & Williams, 2017; Bass et al, 2009; Fung & Leung, 2014; Borgi et al, 2015, Gabriels et al, 2015; Gabriels et al, 2018; Steiner, 2015). The current review highlights improvements following AAI in specific areas for individuals with ASD. In particular meta-analysis of social functions (social motivation, social communication, social awareness and social cognition) outline positive effects for AAI groups in comparison to control groups in all three high quality studies included.

Well-being outcomes such as hyperactivity, irritability and quality of life were also observed to be positively influence by AAT/Is compared to control groups (Harris & Williams, 2017; Gabriels et al, 2018; Pan et al, 2019). This serves to strengthen the evidence base for a variety of AAT/I and further confirms the wider benefits in terms of wellbeing experienced by individuals with ASD as a result of AAI's.

The difficulty, however, is the variability in interventions offered across various studies. As highlighted above, the length and content of intervention offered varied greatly (5-25 weekly sessions). There is a considerable variability in the interventions amongst studies e.g. horse-based studies, some involve riding sessions while others incorporate care activities such as grooming the animal. In addition, some studies were well powered (Gabriels et al, 2015, Petty, 2017) compared to other underpowered studies (Jenkins, 2013; Fung & Leung, 2014). Comparison of standardised and non-standardised measures offers the opportunity to consider the assortment of outcomes that animals may affect. The rationale for selecting measures appropriate to the intervention offered ought to be considered when commenting on use of standardised versus non-standardised measures. The emerging and distinctive nature of AAI means that perhaps standardised measures may not always be the most appropriate evaluation of intervention effectiveness however may have implications for research.

Further consideration ought to be given to the particular population of focus in the current review. ASD itself is diverse and dynamic in its presentation. Individuals with a diagnosis of ASD may be non-verbal with intensive care needs, in contrast, another individual may be extremely high functioning. With this in mind standardisation of an AAT/I for individuals on such a continuum may be ineffective. Hence, standardised evaluation of said interventions may also not do justice to the experience of the recipients of the intervention neither to the effectiveness of the intervention. Weak central coherence and social communication deficits are key features ASD (DSM-V) therefore insight into the impact of AAT/Is may be limited. For this reason, bolstering reports from systemic observations e.g. observations by parents/carers/spouses of children/adults which may offer more beneficial feedback into the impact of the intervention (Wijker et al, 2019). Results of the current review highlight some improvement in social and well-being outcomes for AAT/I groups.

Therapeutic mechanisms of animal interventions remain unclear however benefits of animal interventions have been theorized to be successful due to the attributes of the animal which contribute to therapeutic change (O'Haire, 2013; O'Haire, 2017). There is also a suggestion that forming a relationship with an animal can lead to cognitive and behavioural benefits through development of skills and improvement of personal agency (O'Haire, 2013). Animals have been found to influence cognitive (perspective taking), emotional (reduction in stress and anxiety) and social (improved social interaction and reduced loneliness) development in typically developing children (TDC) (Purewal et al., 2017) which may provide rationale for the observed outcomes of AAT/Is. The challenge is identifying a sustained improvement in these outcomes. Inconsistencies amongst studies relate also to the presence or absence of follow up data. Gabriels et al, (2018) is the only long-term (beyond 10 weeks). Longer term studies may serve to proof or in fact disprove proposed mechanisms of AAT/I appropriate to ASD.

Limitations of this review and Future Directions

The need for further evaluation and high-quality research to improve the evidence base for AAT/I for ASD is valid despite the individualised nature of both ASD and animal-assisted interventions. This would serve to strengthen the reliability, validity and replicability of interventions; thereby, improving the efficacy and scientific underpinnings of animal interaction as a modality of treatment in improving outcomes for many (Lentini & Knox, 2015). In order to improve the validity and scientific prowess of the area opportunities to evaluate and replicate research carried out is imperative. While the included studies were control design or RCT's the quality of particular studies were lower than would be expected from such designs. In particular those studies which utilized a unique rating scale were rated lowest quality in the QATQS. Kazdin, (2017) recommended measures to improve the evidence base of AAI's including well-designed studies using an array of methodologies and developing theoretically informed strategic plans to further research in this area. Therefore, making use of both standardised and non-standardised measures is useful as a means of gathering evidence in the area of AAI's to inform theoretical development in this area. However, ways of monitoring progress is imperative to ensure implementation is effective and has an impact on AAI research thereby establishing a stronger evidence base. Consideration of the views of others within the individual's system (e.g., caregivers/family members) may be helpful in giving an external and alternative perspective on the impact of AAT/Is. This should provide richer insight into the impact animals have which individuals with ASD may not identify themselves as readily (Wijker et al, 2019). For this reason, mixed methods design and consideration of feedback and data gathering from systemic sources may be most useful as a focus for future research. Given the state of the current evidence base mixed methods and qualitative feedback may have a useful role to play.

Evidence-based interventions are recommended as best practice in many fields (Bondemark & Ruf, 2015)**.** In addition, service provision and allocation of funding is usually based on evidence and evaluation of interventions involved. Finally, participants and their families engaging in interventions offered may seek evidence relating to their effectiveness. Use of standardised outcome measures may serve to contribute to confidence and participation. Investigation further into this area may be helpful for further research.

The current review identifies that RCT and control design dog-based and horse-based studies indicate a significant benefit to children with ASD and for some these benefits was sustained in follow up (Gabriels et al, 2018). In this study standardised measures are understood to mean outcome measures which have undergone scrutiny with regards to psychometric properties and effectiveness. These are measures which have been subject to assessment of validity and reliability and are regarded as meeting a particular standard based on these assessments. Non-standardised measures have not been subject to the same exploration. Benefits of standardised outcomes measures include the opportunity for follow-up and accurate measurement of post-intervention effects. As with all measures, non-standardised measures follow-up may also be possible; however, their reliability and the influence of many other factors may also need to be taken into consideration (e.g. inter-rater reliability, environmental factors etc).

Of particular note throughout this review the stark disproportion of horse-based studies in comparison to canine interventions, yet many families live with pet dogs and canine assistance animals are being trained to support people with ASD. Direct comparison of the depth and breadth of literature comparing different species has not been explicitly addressed (Harris & Williams, 2017) but this may be a direction for future research. Consideration of particular therapeutic mechanisms offered by different species may be helpful. The lack of

particular consideration of the same is a noticeable absence throughout the studies reviewed. Harris & Williams (2017) did identify the qualities of horses used in THR such as calm, gentle movements which may be beneficial to individuals' with ASD. Aside from this study there is a distinct lack of consideration of the characteristics and influential mechanisms presented by the selected species. This seems an area which warrants further attention.

Implications for Clinical Practice

The author notes a disproportionate inclusion of horse-based studies compared to dog-based studies. This is an observation rather than a criticism. However, it may be helpful for future research to focus on dog versus horse-based studies in an effort to evaluate and compare the effectiveness of both. A criticism of the available literature may be that there are less high-quality dog-based studies available for inclusion in the current review as they did not meet inclusion criteria (i.e. RCT or Control design studies). This requires further investigation as it is more likely that a higher percentage of the population are more likely to have access to dogs rather than horses (Paley, 2017). Further consideration of application AAT/I in clinical practice should consider patterns within the current research around length and intensity of effective interventions. As outlined above a standardisation in AAT/I has yet to be established. Limited high quality follow-up research indicates that most AAT/I benefits observed by individuals with ASD decline over time. This suggests that regular and prolonged input is required in order to preserve such improvements. Alternatively, timing of intervention may be appropriate to consider. Particular measured outcomes were more affected (e.g. social motivation and awareness) than others (e.g. sensory seeking behaviour). In this way it may be helpful to target particularly socially pertinent times in children's lives (e.g. transition to high school) where AAI might be particularly influential and supporting the functioning of young people with ASD. In the same vein, offering AAT/Is to those with ASD

who are particularly struggling with social interaction, hyperactivity and emotional well-being outcomes may be most appropriate. Tailoring the frequency of intervention to match an individuals' level of need in line with the NHS Stepped Care Model (Richards, 2012) is also recommended. In this way appropriate intensity of and type of intervention can be offered to individuals who require it.

Conclusions

The current review explores an area of research with an evolving evidence base where it is still slightly unclear what works for whom. The current evidence base has focused more on the outcome and the not measuring what the potential mediators of therapeutic change are. Results suggest that AATs and AAIs are beneficial to individuals with ASD for improving social function and well-being outcomes. However there is a high level of variability across length of intervention, type of intervention, and degree of follow-up post-intervention. Further effort in this area should focus on standardising interventions and creating a consensus on AAT/I practice (Lentini & Knox, 2015) with particular consideration of species involved. Application of this research in clinical practice may require a Stepped Care Model (NICE, 2011) to ensure those experiencing particular difficulties have access to AAT/I tailored to their needs so that they benefit appropriately. There is also further need for work with canine intervention given the number of families with pet dogs and growth of assistance dogs for ASD. Chapter two will serve to address this area in more depth.

References

Aman, M. G., Singh, N. N., Stewart, A. W., & Field, C. J. (1985). The **aberrant behavior checklist**: A **behavior** rating scale for the assessment of treatment effects. American Journal of Mental Deficiency, 89(5), 485–491.

American Psychiatric Association (APA), (2013). Autism Spectrum Disorder. In *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596.dsm05

Armijo-Olivo, S., Stiles, C.R., Hagen, N.A., Biondo, P.D., Cummings, G.G. (2012). Assessment of study quality for systematic reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Project Quality Assessment tool: methodological research. *Journal Evaluation Clinical Practice*. 18(1), 12-8. PMID: 20698919

Bass et al, M., Duchowny, C, & Llabre, M, (2009). The Effect of Therapeutic Horseback Riding on Social Functioning in Children with Autism. *Journal of Autism & Developmental Disorder*, 39:1261–1267 DOI 10.1007/s10803-009-0734-3

Borgi et al, M, Lovliva, D, Cerino, S, Chiarotti, F, Venerosi, A., Bramini, M., Nonnis, E., Marcelli, M., Vintin, C., De Santis, C., Bisacco, F., Fagerlie, M, Frascarelli, M, Cirulli, F.(2015). *Journal of Autism Developmental Disorders* 45 (8), 1-11. DOI 10.1007/s10803-015-2530-6

Bruni, T. P. (2014). Test Review: Social Responsiveness Scale–Second Edition (SRS-2). *Journal of Psychoeducational Assessment*, *32*(4), 365–369. https://doi.org/10.1177/0734282913517525

Chandler, C.K. (2005). *Animal assisted Therapy in counseling.* Routledge, NY: Taylor and Francis Group.

Chen, C. C. J., Crews, D., Mundt, S., & Ringenbach, S. D. (2014). Effects of equine interaction on EEG asymmetry in children with autism spectrum disorder: A pilot study. *International Journal of Developmental Disabilities*, *61*(1), 56–59. doi:10.1179/2047387714Y.0000000044

Delta-Society (1996). Standards of Practice for Animal-Assisted Activities and Animal-Assisted Therapy. United States of America.

Daly, B. & Suggs, S. (2010). Teachers' experiences with humane education and animals in the elementary classroom: Implications for empathy development. *Journal of Moral Education*, *39*, 101–112.

Fung, S. & Leung, A. (2014). Pilot Study Investigating the Role of Therapy Dogs in Facilitating Social Interaction among Children with Autism. *Journal of Contemporary Psychotherapy* (44), 253–262. DOI 10.1007/s10879-014-9274-z

Gabriels et al, R., Pan, Z., Dechant, B, Agnew, J., Brim, N. & Mesibov, G. (2015). Randomized Controlled Trial of Therapeutic Horseback Riding in Children and Adolescents with Autism Spectrum Disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, 54 (7) 541-549.

Gabriels et al, R., Pan, Z, Guerin, N., Dechant, B. & Mesibov, G. (2018). Long-Term Effect of Therapeutic Horseback Riding in Youth with Autism Spectrum Disorder: A Randomized Trial. 5 (156), doi: 10.3389/fvets.2018.00156

García-Gómez, A., Risco, M. L., Rubio, J. C., Guerrero, E., & García-Peña, I. M. (2014). Effects of a program of adapted therapeutic horse riding in a group of autism spectrum disorder children. *Electronic Journal of Research in Educational Psychology*, *12*, 107–128. doi:10.14204/ejrep

Grandgeorge, M.; Tordjman, S.; Lazartigues, A.; Lemonnier, E.; Deleau, M.; Hausberger, M. (2012). Does pet arrival trigger prosocial behaviours in individuals with autism? *PLoS ONE*, *7*.

Grandin, T., Fine, A. H., O'Haire, M. E., Carlisle, G. K., & Bowers, C. M. (2015). The role of animals for individuals with autism spectrum disorder. In A. H. Fine (Ed.), *Handbook on animal-assisted therapy: Foundations and guidelines for animal-assisted interventions (*4), 225–236. San Diego, CA: Academic Press.

Harris, A & Williams, J. (2017). The Impact of a Horse Riding Intervention on the Social Functioning of Children with Autism Spectrum Disorder. *International Journal of Environmental Research and Public Health. 14*, 776; doi:10.3390/ijerph14070776

Hooijmans, C. R., Rovers, M. M., de Vries, R. B., Leenaars, M., Ritskes-Hoitinga, M., & Langendam, M. W. (2014). SYRCLE's risk of bias tool for animal studies. *BMC medical research methodology*, *14*, 43. https://doi.org/10.1186/1471-2288-14-43

International Association of Human-Animal Interaction Organizations (IAHAIO), (2018). The IAHAIO definitions for Animal Assisted Intervention and Guidelines for Wellness of Animals (2014-2018).https://iahaio.org/wp/wp-content/uploads/2020/07/iahaio_wp_updated-2020-aai-adjust-1.pdf

Jenkins, S. & Reed DiGennaro, F. (2013). An experimental analysis of the effects of therapeutic horseback riding on the behavior of children with autism. *Research in Autism Spectrum Disorders* 7, 721–740.

Karefjard, A., Nordgren, L (2019) Effects of dog-assisted intervention on quality of life in nursing home residents with dementia. *Scandinavian Journal of Occupational Therapy* 26(6) 433-440 DOI: 10.1080/11038128.2018.1467486

Kazdin A. E., (2017) Strategies to improve the evidence base of animal-assisted interventions, *Applied Developmental Science*, 21:2, 150-164, DOI: 10.1080/10888691.2016.1191952

Kern, J. K., Fletcher, C. L., Garver, C. R., Mehta, J. A., Grannemann, B. D., Knox, K. R., & Trivedi, M. H. (2011). Prospective trial of equine-assisted activities in autism spectrum disorder. *Alternative Therapies in Health and Medicine*, *17*(3), 14.

Lanning, B., Maytyasik Baier, M., Ivey-Hatz, J., Krenek, N. & Tubbs, J. (2014). Effects of Equine Assisted Activities on Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders,* 44,1897–1907. DOI 10.1007/s10803-014-2062-5

Lentini, J.A., Knox, M.S., (2015). Equine-Facilitated Psychotherapy with Children and Adolescents: An Update and Literature Review. *Journal of Creativity in Mental Health*, 10:278–305, Taylor & Francis Group, LLCISSN: 1540-1383 print/1540-1391 online. DOI: 10.1080/15401383.2015.1023916.

Levinson, B.M. (1970). Pets, child development and mental illness. *Journal of the American Veterinary Medical Association*. 157, 1759-1766.

Levinson, B.M. (1972). *Pets and Human Development.* Springfield, IL: Thomas. Levinson, B.M. (Ed.). (1997). *Pet-oriented child psychotherapy* (2nd ed). Revised and updated by G.P. Mallon. Springfield, IL: Charles C. Thomas.

Linder, D.E., Mueller, M.K., Gibbs, D.M. *et al. (2018).* Effects of an Animal-Assisted Intervention on Reading Skills and Attitudes in Second Grade Students. *Early Childhood Educ J* **46,** 323–329. https://doi.org/10.1007/s10643-017-0862-x

McNicholas, J.; Collis, G.M. (2000). Dogs as catalysts for social interactions. *British Journal of Psychology*, *91*, 61–70.

Marsa-Sambola, F., Williams, J., Muldoon, J., Lawrence, A., Connor, M., & Currie, C. (2017). Quality of life and adolescents' communication with their significant others (mother, father, and best friend): the mediating effect of attachment to pets. *Attachment & Human Development*, *19*(3), 278-297. https://doi.org/10.1080/14616734.2017.1293702

Memishevikj, H., & Hodzic, S. (2010). The effects of equine-assisted therapy in improving the psycho-social functioning of children with autism. *Journal of Special Education and Rehabilitation*, *11*(3–4), 57–67.

Morrison, M. L. (2007). Health Benefits of Animal-Assisted Interventions. *Complementary Health Practice Review*, *12*(1), 51–62. https://doi.org/10.1177/1533210107302397

National Institute for Health and Care Execllence (NICE), 2011). **Common mental health problem identification and pathways to care**. https://www.nice.org.uk/guidance/cg123/chapter/1-guidance

Nordgren, L., & Engström, G. (2014). Animal-Assisted Intervention in Dementia: Effects on Quality of Life. *Clinical Nursing Research*, *23*(1), 7–19. https://doi.org/10.1177/1054773813492546

O'Callaghan D. M. & Chandler, C. K. (2011) An Exploratory Study of Animal-Assisted Interventions Utilized by Mental Health Professionals, Journal of Creativity in Mental Health, 6:2, 90-104, DOI: 10.1080/15401383.2011.579862

O'Haire, M. E. (2013). Animal-assisted intervention for autism spectrum disorder: A systematic literature review. *Journal of Autism and Developmental Disorders*, *43*(7), 1606–1622. doi: 10.1007/s10803-012-1707-5

O'Haire, M. E., (2017). Research on animal-assisted intervention and autism spectrum disorder, 2012–2015, *Applied Developmental Science*, 21(3), 200-216, DOI: 10.1080/10888691.2016.1243988

Paley,L. (2017) Pet Data Report, Pet Food Manufacturing Association, https://www.pfma.org.uk/_assets/docs/Data%20report/PFMA-Pet-Population-Report%202017_WEB.pdf

Pan, Z., Granger, D., Geurin, N., Shoffner, A. & Gabriels et al, R., (2019). Replication Pilot Trial of Therapeutic Horseback Riding and Cortisol Collection with Children on the Autism Spectrum. Frontiers in Veterinary Science, *5* (312) https://www.frontiersin.org/articles/10.3389/fvets.2018.00312/full.

Pavlides, M. (2008). *Animal-assisted interventions for individuals with autism.* London, England: Jessica Kingsley Publishers.

Pelletier-Milet, C.& Pomfret, N. (2012). Riding on the autism spectrum: How horses open new doors from children with ASD.VT Trafalger Square Books.

Purewal, R., Christley, R., Kordas, K., Joinson, C., Meints, K., Gee, N., & Westgarth, C. (2017). Companion Animals and Child/Adolescent Development: A Systematic Review of the Evidence. *International Journal of Environmental Research and Public Health*, 14(3), 234. https://doi.org/10.3390/ijerph14030234

Petty, J., Pan, X., Dechant, B., Gabriels et al, L., (2017). Therapeutic Horseback Riding Crossover Effects of Attachment Behaviors with Family Pets in a Sample of Children with Autism Spectrum Disorder. *International Journal of Environmental Research and Public Health.* 14, 256; doi:10.3390/ijerph14030256.

Richards, D. (2012). Stepped Care: A Method to Deliver Increased Access to Psychological Therapies

Canadian Journal of Psychiatry, 57 (4), 210-215. https://doi.org/10.1177%2F070674371205700403

Shallice, T. (1982). Specific impairments of planning. *Philosophical Transactions of the Royal Society of London. B, Biological Sciences*, *298*(1089), 199–209.

Steiner, H. & Kertesz, Z. (2014). Effects of therapeutic horse riding on gait cycle parameters and some aspects of behavior of children with autism. *Acta Physiologica Hungarica,* 102 (3), 324–335, DOI: 10.1556/036.102.2015.3.10.

TsengS-H,ChenH-C,TamK-W.(2013). Systematic review and meta-analysis of the effect of equine assisted activities and therapies on gross motor outcome in children with cerebral palsy. *Disability Rehabilitation,* 35(2), 89–99.

Weitlauf, A. S., Gotham, K. O., Vehorn, A. C., & Warren, Z. E. (2014). Brief report: DSM-5 "levels of support:" a comment on discrepant conceptualizations of severity in ASD. *Journal of autism and developmental disorders*, *44*(2), 471–476. https://doi.org/10.1007/s10803-013-1882-z

Winnicott, D. W. (1971). Playing and reality. New York: Routledge Press.

Wijker et al, C., Leontjeavas, R., Spek, A., Enders-Slegers, M. (2019). Effects of Dog Assisted Therapy for Adults with Autism Spectrum Disorder: An Exploratory Randomized Controlled Trial. *Journal of Autism and Developmental Disorders* https://doi.org/10.1007/s10803-019-03971-9

Chapter 2: Empirical Chapter

Man's best friend: What is the difference in outcomes (family functioning, quality of life, parental stress and child social communication) in families that have a dog present with children with Autism Spectrum Disorder (ASD): A control comparison study.

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Abstract

This study takes a novel family perspective on Human Animal Interaction (HAI); it takes both child and parent perspectives focusing on the impact of companion dogs on children with Autism Spectrum Disorder (ASD) (46) while also utilising a no-dog comparison group (30) within this population. This cross-sectional within group and between group design aimed to contribute to knowledge regarding the outcomes and potential mechanisms through which companion dogs may contribute to ASD families' experiences. Child and parent questionnaires were used to gather data on family functioning, child quality of life, child social communication, parental stress, impact of the dog on Autism, and child and parent relationship with the pet dog. Higher family functioning and child quality of life were also found in the dog group. Parent-dog relationship (pet attachment) also impacted on child-parent relationship and on the parent reported impact of the dog on the child's Autism (Social Skills, Adaptability and Conflict Management Skills). These findings are a positive contribution to a growing evidence base on the impact of dogs on children with ASD and their families. However, they need to be replicated with larger groups and with the addition of qualitative data to provide richer understanding into the role of dogs in families with children of ASD.

Key Words: Autism Spectrum Disorder (ASD), Pet Dogs, Control Comparison, Family Perspective

The area of human-animal interaction (HAI) has attracted increasing attention in recent years (Mills & Hall, 2014). Emerging research has investigated the benefits of Animal-Assisted Intervention (AAI), Animal-Assisted Activities (AAA), Animal-Assisted Therapy (AAT) and the benefits of service and companion animals for individuals in a range of populations and settings (Nimer & Lundahl, 2007; O'Haire, 2013; Wright et al, 2015). These constructs are defined in chapter one as outlined by the International Association of Human animal Interaction Organisation (IAHAIO, 2018). In addition to the growth of AAT/I for children with ASD, around 70% of UK families own pets (Marsa-Sambola et al., 2016). Systematic reviews on 'pet effects', the impact of living with pets at home, show conflicting findings across studies investigating the benefits to health and well-being for pet owners and make the point that the evidence on pets is unclear (Islam & Towell, 2013). However, with emphasis on empirical studies and evidence-based practice, further research is required to formally quantify these potential 'pet effects' on specific groups of children and their families. Research to date has identified an improvement in physical, social, emotional and cognitive functioning to those who interact with animals for both adults and children (Gabirels et al, 2015; O'Haire, 2017; Harris & Williams, 2017). O'Haire's (2013) systematic review of AAIs for Autism Spectrum Disorder (ASD) reported a tentative 'proof of concept', however, she argued that more rigorous empirical studies are required in order to further establish a convincing evidence base for AAIs in relation to ASD.

Animal interventions have been investigated in a range of clinical and non-clinical populations including older people, children with disabilities, hospital in-patients and families with children with ASD (Garrity, 1989; Allen 2008; Gabriels et al, 2015). Furthermore, O'Haire (2013) carried out a systematic review of 14 studies of AAI with young ASD participants. Findings indicated a notably small range of samples sizes with studies using 1-42 participants. The target population of the studies reviewed was children

and adolescents (age range: 3–17 years). There was also a homogeneity identified with regards to diversity of participants with males more likely to receive a diagnosis. The average percentage of dominant cohort were males, making up 80.9% of all study participants (O'Haire, 2013). The paucity of control groups in the area of human-animal interaction has been well acknowledged (Kazdin, 2015; O'Haire, 2013; Nimer, 2007). However, there has been an increase in controlled studies and use of follow up studies in recent years. Chapter one serves to improve evidence in this area by reviewing twelve scientifically robust studies (see Chapter 1). In addition, Halle et al (2016) carried out a two and a half year follow up on the benefits of animals in families with children with ASD. This review (Halle et al, 2016) takes into account AAIs; however, little attention has been given to non-assistance trained pet dogs in the home. This is a gap in the literature which the current study aims to investigate further.

Autism Spectrum Disorder

ASD is a heterogeneous neurodevelopmental condition defined by the DSM-5 as a person experiencing persistent difficulties in social interaction in a range of contexts and as showing restricted, repetitive behaviors. These problems must have been evident in early childhood, cause significant impairment in functioning and not be explainable by intellectual disorders or developmental delays (DSM-5, APA, 2013). Severity of symptoms, impairments in social communication and functional impact will vary across individual cases. Historically males were more likely to receive a diagnosis, there is an increasingly recognized gender difference with regards to female and male presentations with females appearing more socially driven than males (Sedgewick, Hill, Yates, Pickering, & Pellicano, 2016). As ASD is neurodevelopmental and pervasive in nature individuals with ASD and the people who support them will experience varying degrees of difficulties throughout their lifespan.

Research indicates that the average cost of support and treatment of ASD for an individual in the United Kingdom (UK) is on average between £1.5 million (ASD without an intellectual disability) and £2.4 million (ASD and an intellectual disability) (Beuschar et al, 2014). Given the limited resource of services and capacity of families and carers, consideration should be given to developing accessible low-cost interventions which are beneficial for individuals with ASD. Alternative solutions to reduce distress and improve functioning of individuals with ASD is not only ethically valuable but also economically beneficial ensuring limited-service resources can be optimally utilized.

Theoretical Keystones of Human-Animal Interaction (HAI) in ASD

AAIs are an emerging area of research and the psychological mechanisms underpinning their effects are currently debated (Harris & Williams, 2017). Some of the key psychological aspects of AAIs are pertinent to ASD. For example, animals may facilitate social interactions between humans (O'Haire, 2017). This is illustrated in animals providing a neutral focal point for individuals around which spontaneous social interaction may take place (Marsa-Sambola, et al, 2017). McNicholas and Collis (2010) found that the presence of a dog facilitated more social interactions than when a dog was not present. AAIs may also increase empathy and understanding of other's minds, which are both required for social interaction (Grandgeorge et al, 2012; O'Haire, 2017; Marsa-Sambola, et al, 2017). Grandgeorge et al, (2012) described increased empathy in a child after interaction with a service animal was incorporated into daily life. While this is a single case example it does illustrate improvements in aspects of social interaction which individuals with ASD often struggle to display. This may serve to improve family life as increased empathy may encourage more prosocial behaviours and reducing conflict and improving quality of life within the family home (Grandgeorge et al, 2012). It is suggested that animals may be more behaviourally salient with regards to signalling some emotions than humans (Harris & Williams, 2017).

This may provide a strong basis for more successful social interactions for individuals with ASD. Furthermore, the human-animal relationship is not hampered by judgment instead pets offer unconditional positive regard (Harris & Williams, 2017). Therefore, a failure to respond in a socially appropriate way will not result in a rupture of the relationship or judgement from the animal. Finally, animals may serve a transitional object (Winnicott, 1971) to modulate arousal and stress. For example, children with ASD may find social interaction stressful. The presence of an animal has been found to reduce arousal and improve social interaction in children with ASD both in therapeutic and non-therapeutic scenarios (Wright et al., 2015). Therapeutic benefits of animal interventions have been theorized to be successful due to the attributes of human-animal interactions, which contribute to therapeutic change (O'Haire, 2017). There is also a formation of a relationship with an animal that can lead to cognitive and behavioural benefits through development of skills and improvement of personal agency (O'Haire, 2013). Pets are part of a child's family and therefore their social context, which will influence the child's development (Bronfenbrenner, 1979). A child's interactions with animals are also part of a larger social network (Gee, 2017); these interactions may encourage further social development and interaction within their wider systems including family, school, community and wider society (sometimes termed social facilitation or social lubrication effects). The presence of an animal within a child's family will influence these systems and affect developmental outcomes (Gee, 2017).

Pets and ASD

The distinction between formalised animal intervention and pet effects within the home is important to highlight. However, the companion animal and structured animal-assisted therapies and interaction literature do emphasize similarities in benefits which can serve to inform clinical practice and guidance for ASD families when considering pet acquisition.

Most studies on pets and children and families have usually involved typically developing children (Kurdek, 2008). The benefits of companion animals have been documented for children with ASD in therapeutic contexts, however, little research has been carried out investigating the benefits of pets at home for children with ASD (O'Haire, 2013; O'Haire,2017; Harris & Williams, 2017). In addition, fewer studies have considered the family perspective where children have ASD. Indications that pet owners feel a sense of safety with their pets, which provides support, comfort and relief allowing engagement in activities and measured risk taking has been well-established (Allen, Blascovich & Mendes, 2002; Kurdek, 2008). Pet dogs seem to have a particularly beneficial influence on children and families. Recent research (Muldoon, Williams & Lawrence, 2018; Muldoon Williams, Lawrence & Currie, 2019) has highlighted that attachment to pet dogs improves older children's mental health and wellbeing. Focusing on one animal type also allows exploration of the features of the animal and how it interacts with humans. For example, dogs can recognize human emotions and seek out human company in a way that other pets do not (Albuquerque et al., 2016) they are also the most common pet in the UK, and thus there is a focus on dogs in this research.

The benefits of pet dog acquisition to parents/carers of children with autism have been documented through measuring parent reported parent stress and family functioning (Wright et al, 2015). These studies indicate significant improvements for the family unit who do acquire a dog compared to a control group of those that do not (Wright et al, 2015). While a useful contribution to evidence in this area the documented benefit does not particularly consider the child's experience.

Pet ownership and emotional attachment to pets can have an impact on mental health and physiological arousal of family members. Neuroimaging studies where adult participants

looked at pictures of their pets indicate a neural response associated with reward regions, particularly in relation to emotion and affiliation (Stoeckel et al, 2014). The same study identified the role of oxytocin and vasopressin in human-pet bonding. This evidence serves to operationalise the theoretical concepts of emotional attachment to pets and stress regulation, mental improvement in identified above. There is also potential to harness this evidence in relation to difficulties such as anxiety, depression and ASD. Dogs in particular offer unconditional positive regard and affection to family members (Harris & Williams, 2017). Canines can teach children responsibility altruism and compassion as they may be responsible for care duties and walking (Robinson, 2020). Improved physical activity and contact with green space are also a secondary gain which dog ownership offers (Wright et al, 2015). Rhodes (2020) also identified that having a dog increased physical activity by 82%.

Pets and Child Social, Cognitive & Emotional Development

Literature on children with ASD and their relationship with their pets is sparse. Companion animals have been found to influence cognitive (perspective taking), emotional (reduction in stress and anxiety) and social (improved social interaction and reduced loneliness) development in typically developing children (TDC) (Purewal et al., 2017), however studies to date have not focused specifically on the impact of pets on children with ASD. There are several reasons why children with ASD may benefit from pets, especially dogs. Animals may act as "social catalyst" for social interaction as where an animal facilitates social interaction between humans (Harris & Williams, 2018). Building a relationship with a pet is akin to forming an attachment to any other living entity (Melson, 1990; Bowlby, 1960). The role and strength of this relationship has been found to impact children's development. For example, TDC who reported a strong bond with their pets were seen to display greater empathy to others (Daly & Morton, 2006). Children with ASD have deficits socially (O'Haire, 2013) and can also experience developmental delay in relation to emotional domains. Animals may

facilitate socio-emotional development in children with ASD (O'Haire, 2013; Harris & Williams, 2017). ASD inevitably leads to a deficit in the ability to form social relationships. Improvements in social connectivity and interaction have been noted from research in HAI, therefore there is potential for children with ASD to benefit in similar ways (O'Haire, 2013).

Animals have also been found to support self-regulation and stress reduction (Gabriels et al, 2018). For example, children with ASD may find social interaction stressful. The presence of an animal has been found to reduce arousal and improve social interaction in children with ASD both in therapeutic and non-therapeutic scenarios (Wright et al., 2015). As outlined in chapter one a review of scientifically robust studies, Randomised Control Trials (RCTs) and Control Condition studies illustrate improvements in social and well-being outcomes for individuals with ASD (Gabriels et al, 2015, Gabriels et al, 2018, Pan et al, 2019; Fung & Leung, 2014).

Pets and parenting children with ASD

Parenting children with ASD is associated with higher levels of stress, anxiety and social isolation in comparison to parents of typically developing children, or children with other non-developmental disabilities (Dunn, Burbine, Bowers, & Tantleff-Dunn, 2001; Weiss et al., 2013). High stress levels have a negative impact on the well-being of the individual; elevated stress levels of both parents and/or children can also limit the effectiveness of the outcomes of ASD interventions and have a negative impact on family functioning (Robbins et al., 1991; Burgoyne, 2014; Osborne et al., 2008). Wright et al (2015) carried out a cross-sectional study gathering data from parents of children with ASD who were acquiring a dog and a control group of parents who were not. Wright's (Wright et al, 2015) study found that physical contact and companionship with a dog, increased physical activity and exposure to

natural environments, reduced stress and anxiety, improving parental mental health. Parents have also reported having 'time away' while walking the dog has improved their stress levels and increased perceived levels of coping (Hall et al., 2016). However, in contrast to other studies (e.g. Hall et al., 2015) parental stress levels were not impacted significantly.

Having a dog was found to lead to improved child safety and acceptability within the community and improved perceived parental competence. This study also utilised the Lincoln Autism Pet Dog Impact Scale (LAPDIS) assessing the impact the dog has on the child's ASD. The current study has opted to make use of this scale.

The population of children as with other studies is relatively homogenous with 87-91% of the participants being male. Burgoyne et al. (2014) assessed parent's perspectives of assistance dogs (specially trained canines that have been specifically trained to support people) for children with ASD. Gaining a parental perspective on the perceived benefits is helpful. Unlike others in this area, the study is well powered (using 77 participants with a trained assistance dog and 70 waiting list control participants) and gathered both qualitative and quantitative data. This study, however, uses control participants for children with ASD who wish to seek a dog, arguably the characteristics of both family groups may be similar as both groups have identified the potential benefits of acquiring a dog. The current proposed study will use a comparison family group which has not sought to acquire a dog. This may highlight characteristics which are novel to each group and serve to inform the evidence base further. Comparably the current study intended to utilise a mixed method design to provide richer data in an under researched area.

Rationale for Current Study with Consideration of Clinical Relevance

HAI is a developing area of research and has been hampered by methodological and measurement limitations (Kazdin, 2015). The proposed study aims to contribute to the research on HAI by taking a novel family perspective, including both child and parent reports focusing on 'pet effects' on children with ASD. The study will include a mixed method cross-sectional design in order to initially explore dog owning families with children with ASD with non-dog owning families with children with ASD. This study draws on two streams of research: firstly, there is AAT/I research indicating that dog interventions are beneficial for children with ASD (O'Haire, 2013; Chapter 1 above); secondly, there is evidence that parents of children with ASD report positive effects of the dog on parental stress and family functioning (Hall et al., 2016). The aims are of offer a unique family perspective on the impact of pet dogs on children with ASD and their parents by comparing dog owning families with families without dogs.

The measures for the current study have been selected based on evidence which suggests that interaction with a pet dog in typically developing children is associated with benefits in social communication and attachment relationships (Marsa-Sambola, 2017). Parental research identifies reduced stress levels and improved perceived relationships and family functioning in families with children with ASD (Hall et al, 2016).

Research Questions

Primary Research Question

Does family functioning and quality of life of families with children with ASD who have a dog differ compared to families of children with ASD who do not have a dog?

Secondary Research Questions

1. Does the severity of social communication vary in a child with ASD who has a dog present in the home compared to a child with ASD who does not?
2. Do parental stress levels differ between families with children with ASD who own a dog compared to families with children with ASD and no dog present?
3. How does the nature of the relationship with the dog (pet attachment) influence parent stress levels, child quality of life, family functioning and child social communication?

It is hypothesised that the presence of a dog will have a positive influence on the family functioning of dog families. It is predicted that both parent and child report family functioning will be influenced in a positive way in comparison to families that do not have a dog. In addition, it is hypothesised that the presence of the dog will have a positive impact on child social communication, parental stress levels, child quality of life (parent and child report) and child self-esteem. With regards to the nature of the relationship with the dog, it is hypothesised that the stronger the (parent and child) relationship with the dog, the more likely the dog is to influence the family functioning, parent stress levels, child quality of life (parent and child report) and child social communication.

Methods

Design

The study is a cross-sectional within group and between group design. Families with children with ASD and a pet dog and a comparison group of families with children with ASD without a pet dog are included in the study. Consent was sought from all parents for both themselves and their children's participation. Child consent was also be sought in line with BPS guidelines and the Charter for Ethical Research Involving Children. All study information

and consent forms were age and ASD appropriate. For example, use of pictures to demonstrate the research process in consent forms.

Participants and Sampling

Participants were recruited via online advertising on social media and through local National Health System (NHS) ASD and Child and Adolescent Mental Health Services (CAMHS) and local autism support services including the National Autism Society (NAS) branches. Inclusion criteria included children (age 8-16 years old) who have received a diagnosis ASD based on the DSM-IV or DSM V criteria and parents of these children. Inclusion criteria for comparison group included a child diagnosis of ASD and no pet dog in the household. Inclusion criteria for "active group": Diagnosis of ASD and pet dog present within the immediate family environment. Inclusion criteria for Parents/Carer group: Primary parent/carer for child/children with diagnosis of ASD. They must live with the child/children. Exclusion criteria for parent/carer group: If the child does not live with the parent/carer they would not be eligible to take part in the study. Children with diagnosed comorbid intellectual disability were also excluded due to the research requirements to read to a reading age of eight for all questionnaires and complete the online survey.

Sample Size

In order to conduct a comprehensive, a priori estimation of the minimum sample size required to achieve sufficient power, multiple methods were utilised. Sample sizes for quantitative data was calculated based in comparison to similar studies and taking into consideration a G power calculation (Faul, Erdfelder & Buchner, 2009 identified a medium

effect size (d=0.5). Wright et al. (2015) completed a cross sectional study gathering data from parents of children with ASD who those who were acquiring a dog (38) and a control group of parents who were not acquiring a dog (24). Based on the information available, the categorical data gathered from measures and the anticipated method of statistical analysis, a target sample size of 85 has been identified with 43 in the control group and 42 in the pet group. This sample size was not reached and there was a significant degree of dropout or non-completion of outcome measures the reasons of which are discussed below. For this reason, N of participants for outcome measures vary depending on completion levels. A recalculation of G Power was completed based on actual sample size gathered. The G-Power Plot (Plot 1 see Appendix E) illustrates the power of the study based on potential samples. Future studies may provide increased sample sizes and therefore improve the power of the research.

Measures

Parents completed the consent form and demographic information detailed below before completing parent report questionnaires. Finally, dog owning parents completed the Dog ownership measures. The child consent form was then completed, and child questionnaires were made available, detailed below. Dog owning children completed pet attachment questionnaires in addition to all child measures detailed below.

Parent Questionnaire (see Appendix F):

***Demographics*:** Demographic information was gathered for each participant (including age and gender), when their child received their ASD diagnosis, how many children living in the family have diagnosis of ASD, the family's socioeconomic status was recorded using the parental level of education and occupation. Dog ownership etc. Information on support

services which the family currently utilise were also recorded in an effort to control for group differences. Demographic information gathered is highlighted above in Table 1.

***Parental Stress*:** The Parental Stress Scale (Berry & Jones, 1995) an 18-item measure of parent stress. Likert-type scale measured parental stress levels. Responses include "Strongly agree", "Somewhat agree", "Neither Agree or Disagree", "Somewhat Disagree" and "Strongly Disagree" (Cronbach's Alpha .66-.74, internal consistency, $\alpha = .84$. There is evidence of convergent validity with family functioning, $r = –.51$, parental anxiety, $r = .44$, and depression, $r = .35$ (Zelman & Ferro, 2018).This scale was selected due to its psychometric properties and proven ability to capture parental stress levels (Berry & Jones, 1995; Hall et al, 2016).

Parent Report Family Functioning: The Brief Assessment of Family Functioning Scale (BAFFS) (Mansfield et al, 2018) a three-item version of the General Functioning Scale of the Family Assessment to assess family functioning. Parents completed a Likert scale with responses including "strongly agree", "somewhat agree", "somewhat disagree" and "strongly disagree". Construct Validity −.40 to −.60, internal consistency, $\alpha = .71$ Coefficient alpha 0.71 (95% CI 0.68, 0.73) (Mansfield et al, 2018).This scale was selected due to its brevity and ability to reflect family functioning (Mansfield et al, 2018).

Parent Report Child Social Communication: The Social Communication Questionnaire (SCQ) a 40 item screening questionnaire for ASD symptomology. (Rutter et al, 2003). Alpha reliability coefficient for the total scale was 0.90 All the individual item to total score correlations were positive and mainly substantial, in the range 0.26-0.73 (23 of the 39 exceeding 0.50) substantial correlations for internal consistency with the total score (0.64,

0.53, 0.45 and 0.57) (Bolte et al, 2008). Responses include “yes” and “no”. This was selected due to its well-established evidence base (Chesnut et al, 2016).

Parent Report Child Quality of Life: The Kidscreen- 10 Index Parent version (Cronbach’s Alpha is .82) (Young, 2004) with test-retest reliability at $r = 0.43$ to $r = 0.63$ and Associations with self-reported psychosomatic complaints were $r = -0.52$ (-0.36) (Ravens-Sieberer et al, 2010). A Likert type rating scale measuring child’s quality of life and parents reports on the same. Responses include “Not at all”, “Slightly”, “Moderately” “Very” and “Extremely”. This was selected due to its brief but well evidenced ability to capture the parent’s perceptions of the child’s quality of life (Young, 2004) and the ability to compare the child’s reports of the same.

Parent Pet Attachment (only for pet owning parents):

Parent Questionnaires included Lexington Attachment to Pets Scale (LAPS) (Internal consistency Cronbach’s alpha:.92, Internal reliability 0.94 for general attachment (11 items), 0.83 for people substitution (7 items), and 0.85 for animal rights (5 items)) (Johnson et al., 2015) Likert-type rating scale measuring attachment/bond to pets (Garrity et al., 1989). Responses include “agree strongly,” “agree somewhat,” “disagree somewhat,” and “disagree strongly,” Selected to reflect the parents pet attachment as well evidenced elsewhere (Johnson et al, 2015).

Parent report Perceived Impact of Dog (only for pet owning parents): Lincoln Autism Pet Dog Impact Scale (LAPDIS) (Internal reliability Cronbach’s Alpha .71-.93 Internal factors: Adaptability and Social Skills = .20, Adaptability and Conflict Management = -.22, and Social Skills and Conflict Management = .17; indicating that the factors measured separate

elements of the effects of pet dogs on children with autism. Cronbach's alpha for the three factor were all good: Adaptability α = .93, Social Skills α = .77 and Conflict Management α = .71.(Hall, Wright, Mills, & Schmitz, 2016) to measure parents perceptions of the impact of the dog on their child with ASD in particular areas including child Conflict Management, child Social Skills and child Adaptive Skills including Likert type scale responses include "strongly agree", "somewhat agree", "somewhat disagree" and "strongly disagree". This measure was selected as a way of gathering insight into the parent-pet attachment to inform insight into the influence this relationship may have and is proven to be effective in other research (Hall et al, 2016).

Child Questionnaire:

Child Report Quality of Life: The Kidscreen- 10 Index Child version (Cronbach's Alpha is .82) (Young, 2004) with test-retest reliability at $r = 0.43$ to $r = 0.63$ and Associations with self-reported psychosomatic complaints were $r = -0.52$ (-0.36) Ravens-Sieberer et al, (2010). A Likert type rating scale measuring child's quality of life and parents reports on the same. Responses include "Not at all", "Slightly", "Moderately" "Very" and "Extremely". This was selected due to its brief but well evidenced ability to capture the child's perceptions of their quality of life (Young, 2004) and standardised in its comparison of the parent reports of the same which research suggests (Ravens-Sieberer et al, 2010) both parent and child reports relate well to each other and give consistent indication of child quality of life.

Child report Self-esteem: Rosenberg Self-Esteem Scale (Rosenberg, 1965) 10-item scale measuring self-esteem. Likert type scale responses include "Strongly agree', "agree", "disagree" and "strongly disagree". Selected due to its longstanding evidence base utilised in several other studies (Higgin et al, 2016). This scale shows high ratings in reliability areas;

internal consistency was 0.77, minimum Coefficient of Reproducibility was at least 0.90 (Rosenberg, 1965) Alpha coefficients ranging from 0.72 to 0.87. Test-retest reliability for 0.85 (Higgin et al, 2016).

Child Report Family Functioning: The Brief Assessment of Family Functioning Scale (BAFFS) (Mansfield et al, 2018) a three-item version of the General Functioning Scale of the Family Assessment to assess family functioning. . Construct Validity −.40 to −.60, internal consistency, α = .71 Coefficient alpha 0.71 (95% CI 0.68, 0.73) (Mansfield et al, 2018). Children completed a Likert scale with responses including "strongly agree", "somewhat agree", "somewhat disagree" and "strongly disagree".

Child Report Pet Attachment: Short Attachment to Pets scale (SAPS) 9 item scale measuring child's attachment to pet-Internal reliability (Internal reliability: Cronbach's Alpha 0.89, Internal reliability ranged from ranged from 0.368 to 0.78, factor structure Principal Component Analysis (PCA) accounted for 67.78 % of the variance) (Marsa-Sambola, et al., 2016). Likert type scale responses include "Strongly agree", "Somewhat agree"," Somewhat disagree", "Strongly disagree". Selected as way of gathering insight into the child-pet attachment to inform insight into the influence this relationship may have.

Procedure

Participants which engaged with the online survey link were asked to answer initial questions to ensure they met inclusion criteria. The questions served to confirm that the child has a diagnosis of ASD and whether they have a pet or not. The information sheet and consent form (see Appendix D) were required to be read and completed electronically prior to access to the survey being granted. All participants were reminded that they may withdraw from the

study at any time during the consent process. They were also encouraged to contact the principal investigator directly if they experienced any distress as a result of the research process.

Ethical Considerations

The anonymous survey used Qualtrics, a web-based survey which meets recommended data protection and ethical approval criteria as its platform. The current study met IRAS and Level 2 University of Edinburgh Ethical approval standards. Children with ASD and their parents are both vulnerable groups. This vulnerability is due to participants with ASD being minors with developmental disabilities. Their parents are also considered a vulnerable group as they may be more at risk of mental health problems due to the experience of stressors associated with parenting a child with ASD. The research process may be considered an additional stressor to both parents and children with ASD alike. Consideration was given to the ethical issue of disclosures of animal abuse. Children may be referred to the new Scottish SPCA Animal Guardians programme for further support child protection procedures. Families will also be followed up if anything related to child safety or health emerges. This should correspond to the appropriate referral agency's' child protection policy e.g. National Health Service (NHS).

Analysis

Data was analysed using SPSS version 25; tests of difference were used to compare differences between the two groups (dog owners and non-dog owners). Groups were matched randomly with dog parent responses compared to non-dog parent responses and dog child responses compared to non-dog child responses. Exploratory Linear Regression analysis was used to explore predictive associations between dog ownership and to further strengthen the statistical rigor of the study. This analysis should be considered within the

context of exploratory analysis. Regression was carried out based on one Independent Variable Presence/Absence of Dog and applied to Family Functioning, Parental Stress, Child Quality of Life, Child Self-Esteem and Child Social Communication data. Finally data from the dog group was also analysed using a with-in group design to examine associations between child-animal interaction variables (i.e. pet attachment) with parent-animal interaction measures (i.e., parents' attachment to dog). Distribution of the data was tested using the Kolmogorov-Smirnov test of normality which indicated normally distributed sample (ranging from sig values 0.00-0.05). The statistical tests selected to identify effects provide limited information due to low sample size. Therefore, bootstrapping (a type of resampling method) was applied while it is acknowledged that there may be some bias in the sample bootstrapping can only occur based on the data available, this method was applied in an attempt to strengthen the power and validity of the analysis and subsequently reported results. As bootstrapping was applied, the subject of missing data was not addressed as it was agreed that the resampling method would serve to improve power of the study. Bootstrapping was based on a standard of 1000 samples (Rutherford, 2017).

Results

Participants

Table 1: Demographic Information for Dog and No Dog Groups

	Dog (N=46)	**No Dog (N=30)**
Number of Children with ASD	1= 21 (70%) 2= 6 (20%) 3= 2 (6.6%) 4= 1 (1.2%)	1=26(86.6%) 2=3(10%) 3=1(3.3%)
Age of Diagnosis	Mean 6.25 SD 2.5	Mean 6.0 SD 2.1
Child Current Age	Mean 10.89 SD 2.9	Mean 9.7 SD 2.6

Child Gender	8 Female (17.4%) 1 Trans Male (2.1%) 37 Male (80.4%)	8 Female (26.6%) 22 Male (73.3%)
Support Services	No Support Services: 18 (39.1%) Support Services Involved: 28 (60.8%)	No Support Services: 6 (20%) Support Services: 24 (80%)
Parent Gender & Age	2 Male (4.3%) 42 Female (91.3%) 2 Male & Female (4.3%) (Both Parents contributed to responses) M=40.4 SD 6.2	3 Male (10%) 27 Female (90%) M=39.3 SD 5.9
Parent Level of Education	Primary School 1 (2.1%) Secondary School 16 (34.8%) University 29 (63%)	Primary School= 0 Secondary School= 8 (26.6%) University= 22 (73.3%)
How long had dog	Min: 4 Months Max: 14 years M=4.33 SD=2.9	N/A

Table 1a: Breakdown of support services

	Dog (46)	No Dog (30)
CAMHS	9	15
Autism Support Service	5	7
Special School Placement/ASL support in school	3	4
No support services mentioned	18	6
Social work post adoption services	1	0
Paediatrician	1	4
Educational Psychologist	2	3
Children's hospital	1	0
Dietitian	1	0
Occupational Therapist	2	1

Table one above illustrates the commonalities and differences in demographics in both Dog and No Dog groups. Most commonly the number of children with ASD was one in both groups however one family in the dog group reported having 4 children with a diagnosis of ASD. Age of child at diagnosis and current age was similar across both groups. Education across both groups was similar in proportion to group numbers. Parents completing the survey were predominantly female across both groups.

Table one A above illustrates support services cited by families; 55.7 % of total sample respondents indicated having support service involvement and 45.3% of respondents indicated that there were no support services involved currently. Overall, the most frequently reported support service involved is CAMHS (27.9%) indicating perhaps the need for additional support with mental health or post diagnostic support. 80% of the no dog group reported having support services involved compared to 60.8% of the Dog Group.

Family's with dogs most commonly reported dog breed was Labrador (12 families), one participant reported owning nine dogs (while this does not indicate in particular what breeds this is certainly a significant number of dogs to have in one family home). Seven families cited cockapoos and 5 families cited cocker spaniels. Family's also indicated the temperament of their dog, illustrated below (see Figure 2) playful and energetic were most commonly cited characteristics for dogs' temperaments. Dog group respondents were asked why they chose to get a dog, commons themes amongst respondents included support for ASD child with feelings and the world around them and family have always had dogs, two respondents indicated seeing tv programmes about the benefit of dogs for people with ASD and noting popular personalities like Chris Packham as inspiration for getting a dog.

Figure 1. Dog Breed Demographics

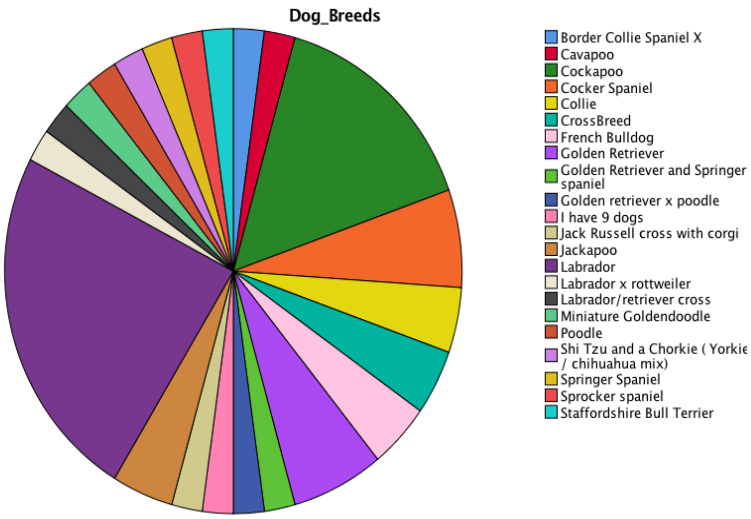
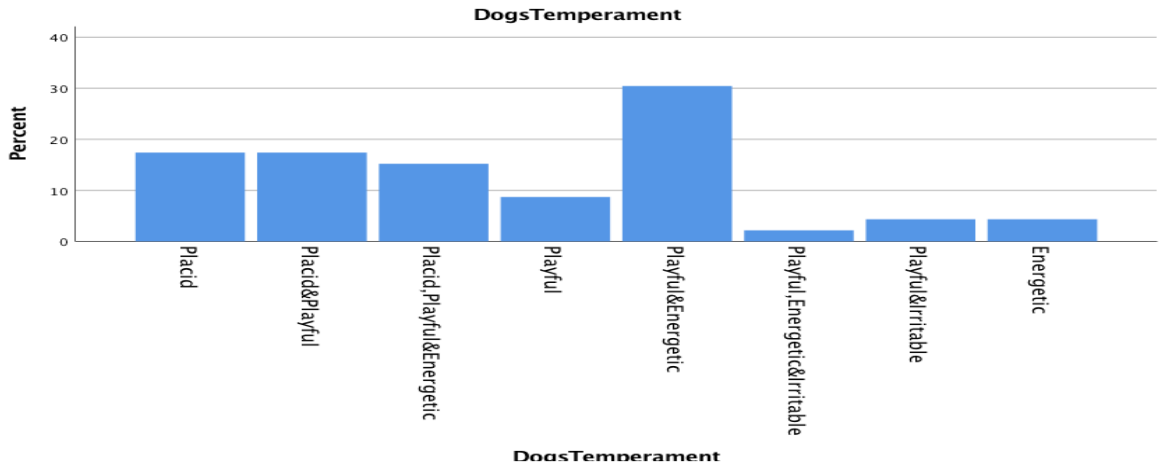


Figure 2. Dog's Reported Temperament

	Frequency	*Percent*	*Cumulative Percent*
Placid	*8*	*17.4*	*17.4*
Placid&Playful	*8*	*17.4*	*34.8*
Placid, Playful& Energetic	*7*	*15.2*	*50.0*
Playful	*4*	*8.7*	*58.7*
Playful&Energetic	*14*	*30.4*	*89.1*
Playful, Energetic &Irritable	*1*	*2.2*	*91.3*
Playful&Irritable	*2*	*4.3*	*95.7*
Energetic	*2*	*4.3*	*100.0*
Total	*46*		*100.0*



Dog Ownership, Family Functioning and Quality of Life

It was hypothesised that the presence of a dog in the family would have a positive effect on the family functioning and quality of life of the dog group. The parent and child report BAFFS scores were compared in both groups using Bootstrapped Independent T-Tests to assess family functioning. As Table 2 shows there was a statistically significant difference between the parent dog group (N=33) and parent no dog group (N=23) for family functioning

and parent reported child quality of life. Parents in the dog group report better family functioning compared to the no dog comparison group p=0.01** (lower scores on the BAFFS measure indicate better family functioning). This is echoed in the child report family functioning as illustrated in Table 2 below; there is also a statistically significant difference noted in the child report child family functioning of child-dog group (N=33) compared with the child no-dog group (N=23)

Table 2 Family functioning Parent and Child report

Outcome Measure	*Parent*		*P Value (Sig. 2 Tailed)*	*Child*		*P Values (Sig. 2 Tailed)*
Family Functioning	*Dog* M=5.8 SD 1.67	*No Dog* M=7.3 SD .916	P=0.03*	*Dog* M=6.5 SD.85	*No Dog* M=7.7 SD .669	P=0.01**

*indicates significances levels less than 0.05 **indicates significance levels equal to or less than 0.01

Exploratory Linear Regression (Independent Variable Presence/Absence of Dog and Dependent Variable Family Functioning) indicated no significant results for parent report family functioning however, the absence of a dog in the family home has an influence on the relationship to poorer child reported family functioning (t=3.3, p-0.01) to a statistically significant level.

Table 3 Linear Regression Independent Variable Presence/Absence of Dog

Dependent Variable	**Parent Report**	**Child Report**
Family Functioning	t=2.1 p=0.37	t=3.3 p=0.01*

*indicates significances levels less than 0.05 **indicates significance levels equal to or less than 0.01

Dog Ownership and Child Quality of Life

Parent and child report Kid-screen 10 to assess child quality of life responses for families with a dog compared to families with no-dog were compared using Bootstrapped Independent T-Tests is illustrated in Table 4. Parents in the dog group reported a higher

quality of life in relation to their child compared to the no dog group (p=0.01**) This is echoed in the child report comparison, as illustrated in Table 4, there is also a statistically significant difference noted in the child report of the child quality of life child-dog group (N=33) compared with the child no-dog group (N=23).

Table 4 Child Outcomes Parent and Child report Quality of Life

Child Outcome Measure	*Parent Report*		*P Value (Sig. 2 Tailed)*	*Child Report*		*P Values (Sig. 2 Tailed)*
Quality of Life	*Dog* M= 33.5 SD 3.7	*No Dog* M=29.2 SD 3.3	P=0.01**	*Dog* M= 32.5 SD 4.7	*No Dog* M=26.8 SD 4.1	*P=0.01***

*indicates significances levels less than 0.05 **indicates significance levels equal to or less than 0.01

Exploratory Linear Regression Analysis on Presence/Absence of a Dog (Independent Variable) and the Quality of Life (Parent and Child Report) measures (Dependent Variable) indicate that the presence of a dog has a significant influence on Child reported QoL (t=-4.55 p=0.00). The presence of a dog potentially indicates associations in improvements in child QoL (based on child reports).

Table 5 Presence/Absence of Dogs and Child QoL

Dependent Variable	**Parent Report**	**Child Report**
Child Quality of Life	t=-1.5 p=.137	t=-4.55 p=0.00*

*indicates significances levels less than 0.05 **indicates significance levels equal to or less than 0.01

Dog Ownership and Parental stress

To answer secondary research question 2 the parents in both groups completed the Parental Stress Scale (Berry & Jones, 1995). Their responses were compared using Independent Sample T-Tests (See Table 6 below). No significant difference (p=0.32) was found between parent stress levels of the dog group (N=39 Mean 39.5 SD 6.8) compared to the control group (N=29 Mean 39.5 SD 4.2).

Table 6 Parent Outcomes Parent Stress

Parent Outcome Measure	*Parent*		*P Values (Sig 2 Tailed)*
Parent Stress	*Dog* M=39.5 SD 6.8	*No Dog* M=39.5 SD 4.2	P=0.32

*indicates significances levels less than 0.05 **indicates significance levels equal to or less than 0.01

The results of exploratory Linear Regression Analysis with Presence/Absence of a Dog (Independent Variable) and the outcomes Parent Stress (Dependent Variable) provided no significant findings (see Table 7).

Table 7 Linear Regression Presence/Absence of Dog & Parent Stress

Dependent Variable	**Parent Report**
Parent Stress	t=-.219 p=.827

*indicates significances levels less than 0.05 **indicates significance levels equal to or less than 0.01

Dog ownership and Child Social Communication

No significant difference was found between the social communication of children in the dog group compared to the no-dog group (see Table 8). Cut-offs for ASD on the SCQ is 15. Mean group scores are illustrated above (see Table 8) the dog group (Mean 27.4, SD 7.87) has a slightly lower than the control group (Mean 29.7, SD 6.5) SCQ score indicating better social communication skills for the dog group, this is not to a statistically significant level however this may be due to smaller sample size.

Table 8 Parent report Child Social Communication

Child Outcome Measure	*Parent Report*		*P Value (Sig. 2 Tailed)*
Social Communication	*Dog* M= 27.4 SD 7.87	*No Dog* M=29.7 SD 6.58	P=.337

*indicates significances levels less than 0.05 **indicates significance levels equal to or less than 0.01

Results of the exploratory Linear Regression carried out for social communication did not identify significant results influence of presence or absence of a dog on child's social communication (t=1.9 p=0.57)

Dog Ownership and Child Self-Esteem

The means of both child groups scores on the Rosenberg (Rosenberg, 1965) were also compared using a bootstrapped independent t-tests to assess their level of self-esteem (See Table 9). Both groups reported levels of self-esteem in the normal range. In fact, the No Dog group reported higher self-esteem, but this difference was not significantly different.

Table 9 Child Report Self-Esteem

Child Outcome Measure	*Child Report*		*P Value (Sig. 2 Tailed)*
Self Esteem	*Dog* *Dog* M=21.6 SD 5.8	*No Dog* M=25.8 SD 6.0	*P=0.41*

*indicates significances levels less than 0.05 **indicates significance levels equal to or less than 0.01

In contrast the results of the child report self-esteem exploratory Linear Regression did identify a significant influence on the relationship with the absence of a dog (t=3.5 p=0.01) as illustrated in Table 10.

Table 10 Linear Regression Presence/Absence of a Dog & Child Self-Esteem

Child Outcome Measure	Child Report
Self-Esteem	t=3.5 p=0.01*

*indicates significances levels less than 0.05 **indicates significance levels equal to or less than 0.01

Dogs and family, parent and child outcomes

Turning attention to examining data for families with dogs in more detail Pearson's Correlations were carried to explore relationships between attachment to dogs, parent stress, child quality of life, family functioning and child/ social communication for the dog-owner group (see Table 11).

Pet Attachment and Family Functioning

Parent attachment to their dogs was positively correlated with child's attachments to the dog, indicating a stronger parent-dog attachment influenced a stronger child-dog attachment (.465 p=0.04*). Parental attachment to their dog was also significantly correlated with parental family functioning (-.611, p=0.03**); the better the parent-dog relationship, the better parents reported family functioning to be. However, child attachment to the dog was not correlated significantly with child family functioning scores (-.393 p=.034). Interestingly, pet parent attachment correlated on the Adaptive Skills (-.736** p=.000) and Conflict Management (-.543** p=.009) subscales suggesting a stronger parental relationship with the dog results in reduced perceived impact of the dog on the child autism or perhaps due to the parent's attachment with the dog the perceived benefits are for the parent and less so for the child.

Parent Stress levels and child QoL

Parent Stress and Child QoL were correlated negatively and to a statistically significant level (-.655** .001). Indicating a significant relationship between lower parental stress and higher child QoL.

Impact of the Dog on the Child's Autism (LAPDIS measure) on Family Functioning, Child QoL, Social Communication and Self-Esteem

LAPDIS was used to explore parents' views of the impact of dogs on their child with ASD. Parental family functioning was correlated significantly with the LAPDIS subscales (Adaptive Skills, .759**, p=.000, Social Skills, .710** p=.001 and Conflict Management .686**, p=.000) (See Table 11 below). Parental reports of better family functioning correlated to improved child adaptive skills, child social skills and child conflict management

skills. Child family functioning correlations with LAPDIS subscales were approach significance with Conflict Management Skills at a significant level (Adaptive skills .056 p=.007 Social Skills .710 p=.001 and Conflict Management .212 p=.000*).

Child reported QoL was correlated negatively with the LAPDIS subscales. Significant correlations were noted in the relationship of QoL and the impact of the pet on autism scale (LAPDIS). The impact the pet has on the child's adaptive skills (-686 p=.000**), Social Skills (-.759, p=.000**) and Conflict Management (-.710, p=.000**) were all negatively correlated with child QoL reports. Child Social Communication and Child Self-Esteem scores did not correlate to a significant level with LAPDIS scores (see Table 11 below).

Table 11 Pearson's Correlations

Pearson Correlation sig-2 Tailed	Parent Family Functioning	Child Family Functioning	Child QoL Report	Parent QoL Report	Parent Stress	Self-Esteem	Social Communication	Child Pet Attachment	Parent Pet Attachment	LAPDIS Adapt	LAPDIS Social Skills	LAPDIS Conflict Management
Child QoL	-.655** .001	-.424 .003	1	.650** .001	-.655** .001	.241 .281	-.190 .010	-.280 -.010	.369 -.001	-.759** .000	-.686** .000**	-.710** .001
Parent QoL	-.337 .126	.326 -.011	.650** .001	1	.359 -.005	-.684** .001	.113 -0.33	-.119 .598	.252 .257	.169 -.004	.024 -.008	.197 -.003
Child Family Functioning	.326 -.011	1	-.424 .003	-.207 -.006	.184 -.007	.001 -.009	.016 .019	-.393 .034	.054 -.004	.056 .007	.224 .007	.212 .000
Parent Family Functioning	1	.326 -.011	-.655** .001	-.337 .126	-.169 .451	-.213 -.023	-.201 .037	.184 .413	-.611** .003	.759** .000	.710** .001	.686** .000
Parent Stress	-.169 .451	.184 -.007	-.655** .001	.359 -.005	1	-.488 .066	.184 .425	.122 .588	.040 .281	.091 .001	.013 -.004	.326 .001
Self-Esteem	-.213 -.023	.001 -009	.241 .281	-.684** .001	-.488 .066	1	-.274 .230	.205 .359	.385 .077	-.124 -.015	.160 -.016	-.106 -.009
Social Communication	-.201 .037	.016 .019	-.190 .010	.113 -0.33	.184 .425	-.274 .230	1	-.103 .359	.160 .476	-.245 .006	-.236 .013	-.208 .011
Child Pet Attachment	.184 .413	-.393 .034	-.280 -.010	-.119 .598	,122 .588	.205 .359	-.103 .650	1	.465* .004	.012 .959	.250 .261	.328 .137
Parent Pet Attachment	-.611** .003	.054 -.004	.369 -.001	.252 .257	.040 .281	.385 .077	.160 .476	.465* 0.04	1	-.736** .000	-.543** .009	-.410 0.58
LAPDIS Adapt	-.759** .000	.224 .007		.169 -.004	.091 .001	-.124 -.015	-.245 .006	.012 .959	-.736** .000	1	.902** .000	.816** .000
LAPDIS Conflict Management	-.710** .001	.212 .000	-.686** .000**	.024 -.008	.013 -.004	.160 -.016	-.236 .013	.250 .261	-.543** .009	.902** .000	.823** .000	1
LAPDIS Social Skills	-.686** .000**	-.710** .001		.197 -.003	.326 .001	-.106 -.009	-.208 .011	.328 .137	-.410 0.58	.816** .000	1	.823** .000

Discussion

The current study gathered a significant amount of information on the lives of families with children with ASD who have dogs and who do not have dogs. Results of the current study confirm the original hypothesis that the presence of a dog in a family with children with ASD will have a positive influence on outcomes.

Family Functioning

Results of the current study identify better family functioning (both parent and child report) for families who that have dogs compared to families that do not have dogs. When the impact of the dog on these families was explored this benefit was further reinforced with parental reports of better family functioning correlating to improved child adaptive skills, child social skills and child conflict management skills. Child family functioning supported this with Adaptive Skills and Social Skills approaching significance and Conflict Management Skills at a significant level.

The presence of the pet in the family home may offer opportunities for more positive interactions. It is suggested that animals may be more behaviourally salient with regards to signalling some emotions than humans (Harris & Williams, 2017). This is a preliminary finding which warrants further exploration and evidencing. It is suggested that animals may convey some emotions in an explicit and less complex way in comparison to humans therefore making them more likely to be interpreted successfully. For example, a dog will wag his tail when happy, in the main this is an explicit indication of happiness and provides an opportunity for appropriate response to and interaction with another. This may provide individuals with ASD a strong basis for responding in a socially appropriate manner with their family members, which may require scaffolding for some individuals (Harris & Williams, 2017). Increased appropriate parent-child interactions will serve to improve family

functioning. This may not be true for all families and is of course based on individual differences, this area would benefit from closer exploration beyond the scope of this thesis. Furthermore, the human-animal relationship is not hampered by judgment instead pets offer unconditional positive regard. Therefore, a failure to respond in a socially appropriate way will not result in a rupture of the relationship or judgement from the animal again providing increased positive/a reduction unsuccessful interactions for the individual with ASD. Finally, animals may serve a transitional object (Winnicott, 1971) to modulate arousal and stress improving the child's experience of family functioning. For example, children with ASD may find social interaction stressful (even with close family members). The presence of an animal has been found to reduce arousal and improve social interaction in children with ASD both in therapeutic and non-therapeutic scenarios (Wright et al., 2015). Improved social skills in animal intervention groups is in keeping with research in this area (Wijker et al, 2019; Gabriels et al, 2015; Gabriels et al, 2018) and is consistent with findings of chapter one of this thesis. These combined factors may serve to improve the child and parents experience of family functioning.

Child Quality of Life

Results support the proposed study hypothesis around improved quality of life with the presence of a dog. A positive impact on child QoL for children with dogs' present compared to those who do not have dogs present. This is illustrated in both primary analysis and exploratory regression analysis. The same difference was reported in the comparison of outcomes for parent groups. Significantly improved parent report child QoL mirrors the child reports and results. This serves to strengthen the study's hypothesis and contributes to the evidence base in this area (McNicholas and Collis, 2010; Grandgeorge et al, 2012). Existing literature serves to support the current findings with Lanning (2014) reporting improved QoL

for the dog group. Others support these findings identifying outcomes such as reduced conflict, improved empathy and increased prosocial behaviours all which influence quality of life (Grandgeorge et al, 2012; Harris & Williams, 2017).

Demographic information

Demographic information illustrates similarities across the group in terms of family composition, age of diagnosis, parental level of education; however, one difference of interest was the percentage of families that had support services currently. Sixty percent of dog families had service involvement compared to 80% of no-dog families. This is a marked difference and while other factors may influence the need for support services the presence of a dog in the families who require less input is certainly something to consider. The families who do not have a dog may be experiencing higher levels of challenge with regards to their child with ASD and therefore require more support this is something for future researchers to consider exploring in more depth particularly with regards to focusing on confounding variables which may influence choice/need to access support services; For example level of resilience within the family/child (Greeff & Van Der Walt, 2010). This may also have influenced their choice not to have a dog. Hall et al (2016) identified parental perceived ability to cope increased with the presence of a dog in the house. Therefore, perhaps families with a dog experience similar challenges with regards to their child with ASD, certainly Social Communication levels were similar as were parental stress levels across both groups. Perhaps the dog has an influence on parents' resources and perception of ability to cope; therefore, these families are less likely to seek support from external agencies. It may be appropriate to surmise that families who have children with ASD and a dog present are better resourced to manage the challenges that they are presented with. The role of the dog in the

family serves to improve parent perception of coping, improve parent and child reports of child QoL and reports of family functioning.

Parent Stress

Parent stress levels in both groups were not significantly different This does not support the current study's proposed hypotheses however it is supported by Hall's (2015) findings which identified the presence of a dog had no significant effect on parental stress levels; however, other studies noted an improvement in parental stress levels (Wright et al, 2016; Hall et al, 2016) due to the presence of a dog in the family. It may be helpful to consider the context and potential additional stressors families were exposed to when completing the current survey. The current study took place during the COVID-19 pandemic (discussed further below) which may have had an impact on parental stress levels. The unprecedented challenges presented due to the COVID-19 pandemic may have influenced parental stress levels beyond the scope of the current study. The reported parental stress levels were relative to parental stress levels recorded in similar studies with similar populations (Hall et al, 2016) which did not occur during a pandemic. Further exploration of parental stress levels in this population and during this period may be useful, the addition of qualitative interviews may also give context to these scores.

Child Social Communication

Hypothesis with regards to social communication was not supported. Presence of a dog did not impact significantly on parent reported child social communication. Research does support the improved social communication hypothesis (Gabriels, 2018; Pan et al,2019; Chapter 1 current study). For example, animals may facilitate social communication and interactions between humans (O'Haire, 2017). This is illustrated in animals providing a

neutral focal point for individuals around which spontaneous social interaction may take place (Marsa-Sambola, et al, 2017). McNicholas and Collis (2010) found that the presence of a dog facilitated more social interactions than when a dog was not present. AAIs may also increase empathy and understanding of other's minds, which are both required for social interaction and social communication.

Child Self-Esteem

Hypothesis with regards to self-esteem was also not supported. Presence of a dog did not impact significantly on child reported self-esteem. Self-esteem within both dog and no dog groups was within a normal range and was not influenced by other factors including parental stress, family functioning etc. Exploratory Linear Regression analysis suggests an influence on the relationship with self-esteem and the absence of a dog. This requires further investigation in future studies. Research exploring self-esteem and animal interaction has identified the presence of an animal on individual's self-esteem (Wijker, 2019; Harris & Williams, 2018) however the current study does not support these findings.

Attachment to the family dog

The parent's attachment dog was high and was found to be significantly correlated to the child's attachment to their dog. Indicating the more attached the parent was to the dog the more attached the child was to the dog and vice versa. Parents relationship with the dog also had a significantly positive influence on parent reported family functioning. In addition, a stronger parental relationship with the dog was negatively correlated with the perceived impact of the dog on the child autism. This may relate to the perceived role the parent allocates to the dog. Perhaps if parent-dog attachment is higher the parent benefits are more readily observed, and less emphasis is placed on influence of the dog on the child with ASD.

Child-pet relationship correlation results do not indicate particular benefits on other child outcomes. This may relate to the level of insight or ability to generalise an individual with ASD may have (Wijker et al, 2019). Hall et al. (2016) identified that pet training approach and child time with the pet has an influence on the pets' impact on children with ASD. Information regarding family approaches to training pets may be useful to gather for future studies.

Strengths, Limitations and Future Research

The current study contributes a novel family perspective to a growing area of research. It serves to improve our understanding of the role and mechanisms a pet dog has within families with child with ASD while also highlighting the benefits pet dogs provide by comparing this group to a control group within the same population.

As identified above parenting a child with ASD can be a stressful experience. The restrictions of COVID-19 meant that most families were confined to their home with no support from extended family and/or services including health, education, mental health and social work. This unanticipated and sudden change in routine and activity may prove extremely stressful for children with ASD and their families. Individuals with ASD seek routine and sameness; an unprecedented event such as a pandemic may lead to an increase in already heightened anxiety levels. Autistic people who do not have extended access to support networks of family and friends might be particularly at risk, especially as the patterns of predictable daily life are thrown into chaos by the ever-changing demands of a society living with COVID-19 (Houting, 2020). Nonetheless families who completed the current study indicate benefits of having a dog even within the context of a global pandemic. In spite of this novel and no doubt stressful experience both parent and child reports in the dog group reported better family functioning and better QoL for the child. With consideration of the

well-being of the animal having family members present more regularly may be a positive change, offering more attention and less time without company. However, with families in such close proximity for prolonged periods there is also the potential for an increase in harmful behaviours towards the animal due to increased stress levels of the child with ASD. The animal may act a source of structure for the family (e.g., going for family walks with the dog, engaging in care activities such as feeding and grooming the dog which may serve to improve outcomes for the family).

Engagement with the current survey may have appealed more to families who have a positive experience with their dog or who are in fact interested in the benefits of having a dog. For this reason, there may be a bias in the data, which is unavoidable, the study may not reflect the challenges some ASD families may experience with their dogs. Finally, the limited sample size is also a symptom of the target population, ASD families tend to be more difficult to reach and engage with regards to research participation (Hass et al, 2016). The sample size in the current study is relative and in fact larger than some published works referenced throughout this paper. With this in mind, while it is desirable for further research to build on the current findings and expand the sample size the limited numbers in the current study may in fact be reflective of the population and niche subsection of ASD and animal research. The current study does however serve to contribute to the growing body of research in this area.

Research Design and Data gathered

While anticipated sample sizes were not reached the current study did engage a significant number of participants (both parent and child) from a hard-to-reach population in the midst of a global pandemic. The data analysis carried out was applied to explore the sample to its

potential. The sample was also bootstrapped in an attempt to strengthen the power and validity of the analysis and subsequently reported results. While bootstrapping based on a small sample (particularly with dropout/missing data) may result in some bias within the data and therefore produce results which are not representative of a population, it is a method of resampling which serves strengthen the power of the results reported. Due to dropout in the survey questionnaires later in the survey were resampled based on fewer numbers however bootstrapping was still appropriate and provided more robust information had this process not been applied (Rutherford, 2017). Exploratory regression was carried out to explore the data further. There are limitations to this as it is a cross sectional design it does not account for the impact of a having a dog over time and a more longitudinal design may but helpful to consider for future research.

Original anticipated design for the study was mixed methods qualitative and quantitative. There may be potential for future research to build on the data gathered and engage in longitudinal research incorporating qualitative and/or mixed methods design to build on the results identified in the current study. The use of technology e.g., teleconference calls were considered as an alternative however, participation of the online survey was anonymised. While this adjustment in design was an unavoidable development it does however also limits the scientific rigor of the study. It may be beneficial to gather qualitative data from parents to inform the interpretation of the data gathered to date. This was an aim for the current study however due to pandemic-based limitations this was not possible. Burgoyne et al, (2014) is an illustration of gathering rich data on parental perspective of acquiring a dog for a child with ASD. This improves the scope and depth of understanding research in this area therefore strengthening the evidence base. Qualitative information may provide insight into the potential ways in which dogs facilitate positive therapeutic change and also negative

aspects of dog ownership as has been experienced by some during COIVD lockdown. Future studies would benefit from utilising a mixed methods design to ensure this is achieved.

The length of the survey may have been a limitation and deterrent for participants completing the online survey. The SCQ (Rutter, 2003) used included forty responses which upon reflection may have been overly lengthy and result in participants losing interest in the survey resulting in partially completed responses. The use of this measure was to ensure participants met cut-off diagnostic criterion for ASD however other measures may have also achieved this aim e.g. AQ-10 (Allison et al 2012). A shorter screening measure may be more appropriate to utilise in future research as reducing the length of the survey may ensure completion of the survey. The aim of assessing severity of social communication among the sample may not have accounted for confounding influencing variables which presence/absence a dog may not have accounted for. The pet based questionnaires were appropriately selected due to their specific nature; however, they are relatively recent in their development and as with research in this area further evidence may serve to improve their scientific prowess. Using parent and child report questionnaires e.g. Kidscreen-10 (Ravens-Sieberer et al, 2010) served to provide within family comparison however this is a general scale and was not developed for this particular population.

Demographic information gathered illustrated a number of interesting aspects of ASD family's lives however it did not record composition of family for example whether there were two care givers residing in the family home or one primary care giver. This may have influenced parental stress levels and family functioning scores as single parent families may be more at risk of heightened stress levels , particularly when considering parenting children with ASD is more stressful than a child without a neurodevelopmental disorder (Dunn,

Burbine, Bowers, & Tantleff-Dunn, 2001; Weiss et al., 2013) this is an important and potentially influential factor which may have affected the data but the effect cannot be analysed due to lack of collection. Future studies should take this into consideration. Furthermore, co-morbid diagnoses (e.g., ADHD) were not recorded and included in demographic information, particularly with a move towards neurodevelopmental diversity and Chris Gillberg's ESSENCE model (Gillberg, 2013) the presence of other neurodevelopmental disorders may influence outcomes as animal presence may be more effective in improving outcomes more widely for these families but also families included data may be influenced by more than the presence of ASD. The financial cost of having a dog was not considered as an additional factor. While there were no particular differences between education and occupation levels of parents in the dog and no dog group, the additional cost and commitment a dog presents may be a factor to consider in future studies.

Implications for Clinical Practice

Consideration for clinical implications of the influence of animals on ASD for clinical practice is required. Given the limited resource of services and capacity of families and carers consideration must be given to developing accessible complementary and alternative therapies to support and enhance families and carers available resources. The results above illustrate particular benefits of pet dogs for individuals with ASD and their families and is in keeping with research in this area (Hall et al, 2016; Lanning, 2014**;** Grandgeorge et al, 2012; Harris & Williams, 2017). Of particular note is that families with dogs were less likely to require access to support services .This serves to alleviate demand on finite resources within public health services (e.g., NHS). This information requires further investigation with particular consideration of potential confounding factors with particular consideration of what factors influence individuals/families seeking support (Greeff &. Van der Walt, 2010).

It is noteworthy that the current study did not gather information regarding other pets present within the family e.g. cats or horses. Future studies may benefit from broadening the scope of information gathered. As other studies have identified the benefits of horses for example (Harris & Williams, 2018). Further consideration into the presence of therapets and animals incorporated into treatment as usual may be of benefit to ASD support services, particularly family-based services such as Child and Adolescent Mental Health Services (CAMHS). The presence of an animal improves outcomes for families and reduces the need for access to services. For example, parental coping (Hall et al, 2016) and social communication in individuals with ASD (see Chapter 1 for meta-analysis results), this provides evidence for incorporation of animals into clinical practice.

A pet is part of the family's system and therefore has an impact on the individuals in that system (Bronfenbrenner, 1974). Clinical consideration of the influence pet animals have on the family system can be incorporated into the clinical assessment of the family's particular strengths and areas of difficulty during clinical assessment. This assessment serves to inform a formulation on which intervention is based. If for example, the dog provides particular comfort and a source of soothing for child, this can be incorporated into their emotion regulation strategies. Building on interactions with pet dogs can also serve to improve social and adaptive skills as outlined in the current study (and in Chapter one). This is an opportunity on which clinicians can capitalise and utilise in their intervention. Continued evidence is required to inform clinical practice and build the evidence base to standardise and AAT/Is, however, consideration of domestic animals as avenues of therapeutic benefit is supported in the current study and should be considered as a beneficial addition to clinical practice.

Conclusions

The current study served to contribute to the evidence base in the area of understanding the role of pets within the families of children with ASD. Particular benefits are noted in family resources (reduced need to access support services), improved parent and child reported family functioning, improved parent and child reported child QoL, and parents' perceptions of the impact on the dog on their child with ASD (Social Skills, Conflict Management and Adaptability). Future studies may benefit from expanding the current design to include qualitative accounts of the child and parent experience of having a pet and increasing the sample size to strengthen further these findings.

References

Albuquerque, N., Guo, K., Wilkinson, A., Savalli, C., Otta, E., & Mills, D. (2016). Dogs recognize dog and human emotions. *Biology Letters*, *12*(1), 20150883. https://doi.org/10.1098/rsbl.2015.0883

Allen, Karen PhD; Blascovich, Jim PhD, and; Mendes, W. B. M. (n.d.).(2018). Cardiovascular Reactivity and the Presence of Pets, Friends : Psychosomatic Medicine. https://journals.lww.com/psychosomaticmedicine/Abstract/2002/09000/Cardiovascular_Reactivity_and_the_Presence_of.5.aspx

Allison C, Auyeung B, and Baron-Cohen S, (2012) *Journal of the American Academy of Child and Adolescent Psychiatry* 51(2):202-12.

Baumeister, R. F., Campbell, J. D., Krueger, J. I., & Vohs, K. D. (2003). ROSENBERG SELF-ESTEEM SCALE. Retrieved from http://fetzer.org/sites/default/files/images/stories/pdf/selfmeasures/Self_Measures_for_Self-Esteem_ROSENBERG_SELF-ESTEEM.pdf

Beetz, A.M, (2017). Theories and possible processes of action in animal assisted interventions, *Applied Developmental Science*, 21:2, 139-149, DOI: 10.1080/10888691.2016.1262263

Bölte, S., Holtmann, M., & Poustka, F. (2008). The Social Communication Questionnaire (SCQ) as a screener for autism spectrum disorders: Additional evidence and cross-cultural validity. *Journal of the American Academy of Child & Adolescent Psychiatry, 47*(6), 719–720. https://doi.org/10.1097/CHI.0b013e31816c42bd

Bondemark, L., Ruf, S. (2015). Randomized controlled trial: the gold standard or an unobtainable fallacy? *European Journal of Orthodontics*, 37 (5), 457–461. https://doi.org/10.1093/ejo/cjv046

Borgi et al, M, Lovliva, D, Cerino, S, Chiarotti, F, Venerosi, A., Bramini, M., Nonnis, E., Marcelli, M., Vintin, C., De Santis, C., Bisacco, F., Fagerlie, M, Frascarelli, M, Cirulli, F.(2015). *Journal of Autism Developmental Disorders* 45 (8), 1-11. DOI 10.1007/s10803-015-2530-6

Berry, JD, & Jones, W,H, (1995) The Parental Stress Scale : initial psychometric evidence. Journal of Social and Personal Relationships, 12, 463 – 472.

Braun, V., & Clarke, V. (2006). Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. Qualitative Research in Psychology, 3 (2). pp. 77-101. ISSN 1478-0887 Available from: http://eprints.uwe.ac.uk/11735. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Buescher, A., Cidav, Z., Knapp, M., Mandell, D.S. (2014). Costs of Autism Specrtum Disorders in the United Kingdom and the United States. *JAMA Pediatr*. 168(8), 721-728. doi:10.1001/jamapediatrics.2014.210

Bronfenbrenner, U. (1974). Developmental research, public policy, and the ecology of childhood. *Child development, 45*(1), 1-5.

Carlisle, G. K. (2014). Pet Dog Ownership Decisions for Parents of Children With Autism Spectrum Disorder. *Journal of Pediatric Nursing*, *29*(2), 114–123. https://doi.org/10.1016/j.pedn.2013.09.005

Chandler, S., Charman, T., Baird, G., Simonoff, E., Loucas, T., Meldrum, D. & Pickles, A. (2007). Validation of the social communication questionnaire in a population cohort of children with autism spectrum disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *46*(10), 1324–1332. https://doi.org/10.1097/chi.0b013e31812f7d8d

Chesnut, S. R., Wei, T., Barnard-Brak, L., & Richman, D. M. (2017). A meta-analysis of the social communication questionnaire: Screening for autism spectrum disorder. *Autism*, *21*(8), 920–928. https://doi.org/10.1177/1362361316660065

Daly, B., & Morton, L. L. (2006). An investigation of human-animal interactions and empathy as related to pet preference, ownership, attachment, and attitudes in children. *Anthrozoös*, *19*(2), 113–127. https://doi.org/10.2752/089279306785593801

den Houting, J. (2020). Stepping out of isolation: Autistic people and COVID-19. *Autism in Adulthood*. Advance online publi- cation. https://doi.org/10.1089/aut.2020.29012.jdh

Faul, F., Erdfelder, E., Buchner, A. *et al.* Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods* **41,** 1149–1160 (2009). https://doi.org/10.3758/BRM.41.4.1149

Fung, S. & Leung, A. (2014). Pilot Study Investigating the Role of Therapy Dogs in Facilitating Social Interaction among Children with Autism. *Journal of Contemporary Psychotherapy* (44), 253–262. DOI 10.1007/s10879-014-9274-z

Gabriels et al, R., Pan, Z.,, Dechant, B, Agnew, J., Brim, N. & Mesibov, G. (2015). Randomized Controlled Trial of Therapeutic Horseback Riding in Children and Adolescents With Autism Spectrum Disorder. Journal of the American Academy of Child & Adolescent Psychiatry, 54 (7) 541-549.

Gabriels et al, R., Pan, Z, Guerin, N., Dechant, B. & Mesibov, G. (2018). Long-Term Effect of Therapeutic Horseback Riding in Youth with Autism Spectrum Disorder: A Randomized Trial. 5 (156), doi: 10.3389/fvets.2018.00156

Grandgeorge, M.; Tordjman, S.; Lazartigues, A.; Lemonnier, E.; Deleau, M.; Hausberger, M. (2012). Does pet arrival trigger prosocial behaviors in individuals with autism? *PLoS ONE*, *7*.

Garrity, T. F., Stallones, L., Marx, M. B., & Johnson, T. P. (1989). Pet ownership and attachment as supportive factors in the health of the elderly. *Anthrozoos, 3*(1), 35–44. https://doi. org/10.2752/089279390787057829.

Gillberg, C., Fernell, E., & Minnis, H. (2014). Early symptomatic syndromes eliciting neurodevelopmental clinical examinations. *TheScientificWorldJournal*, *2014*, 710570. https://doi.org/10.1155/2013/710570

Greeff, A. P. & van der Walt, K, (2010). R**esilience in Families with an Autistic Child.** ***Education and Training in Autism and Developmental Disabilities, 2010, 45(3), 347–355***

Hall, S. S., Wright, H. F., Mills, D. S., & Schmitz, C. (2016). What Factors Are Associated with Positive Effects of Dog Ownership in Families with Children with Autism Spectrum Disorder? The Development of the Lincoln Autism Pet Dog Impact Scale. https://doi.org/10.1371/journal.pone.014973

Harris, A & Williams, J. (2017). The Impact of a Horse Riding Intervention on the Social Functioning of Children with Autism Spectrum Disorder. International Journal of Environmental Research and Public Health. *14*, 776; doi:10.3390/ijerph14070776

Haskett, M. E., Ahern, L. S., Ward, C. S., & Allaire, J. C. (2006). Factor Structure and Validity of the Parenting Stress Index-Short Form. *Journal of Clinical Child & Adolescent Psychology*, *35*(2), 302–312. https://doi.org/10.1207/s15374424jccp3502_14

Haas, K., Costley, D., Falkmer, M. et al *(2016).* Factors Influencing the Research Participation of Adults with Autism Spectrum Disorders. *J Autism Dev Disord* **46,** 1793–1805. https://doi.org/10.1007/s10803-016-2708-6

Higgins, D. J., Bailey, S. R., & Pearce, J. C. (2005). Factors associated with functioning style and coping strategies of families with a child with an autism spectrum disorder. *Autism*, *9*(2), 125–137. https://doi.org/10.1177/1362361305051403

Johnson, T. P., Garrity, T. F., & Stallones, L. (1992). Psychometric evaluation of the Lexington Attachment to Pets Scale (LAPS). *ANTHROZOÖS*, 5(3), 160–175

International Association of Human-Animal Interaction Organizations (IAHAIO), (2018). The IAHAIO definitions for animal assisted intervention and guidelines for wellness of animals (2014-2018). https://iahaio.org/wp/wp-content/uploads/2020/07/iahaio_wp_updated-2020-aai-adjust-1.pdf

Islam, A. & Towell, T. (2013). Cat and Dog Companionship and Well-being: A Systematic Review *International Journal of Applied Psychology,* 3(6), 149-155. doi:10.5923/j.ijap.20130306.01

Kazdin, A. E. (2015). Methodological Standards and Strategies for Establishing the Evidence Base of Animal-Assisted Therapies. In *Handbook on Animal-Assisted Therapy* (pp. 377–390). Elsevier. https://doi.org/10.1016/B978-0-12-801292-5.00027-4

Leaf, J. B. (n.d.). *Handbook of social skills and autism spectrum disorder : assessment, curricula, and intervention*.

Lionetti, F., Mastrotheodoros, S., & Palladino, B. E. (2018). Experiences in Close Relationships Revised Child version (ECR-RC): Psychometric evidence in support of a Security factor. *European Journal of Developmental Psychology*, *15*(4), 452–463. https://doi.org/10.1080/17405629.2017.1297228

Marsa-Sambola, F., Williams, J., Muldoon, J., Lawrence, A., Connor, M., Roberts, C., … Currie, C. (2016). Sociodemographics of Pet Ownership among Adolescents in Great Britain: Findings from the HBSC Study in England, Scotland, and Wales. *Anthrozoös*, *29*(4), 559–580. https://doi.org/10.1080/08927936.2016.1228756

Mansfield A. K., Keitner, G. I. & Sheeran K, (2018). The Brief Assessment of Family Functioning Scale (BAFFS): a three-item version of the General Functioning Scale of the Family Assessment Device. Psychotherapy Research Vol 29, 8, 824-831. https://doi.org/10.1080/10503307.2017.1422213

Melson, G. F. (1990). Studying Children's Attachment to their Pets: A Conceptual and Methodological Review. *Anthrozoös*, *4*(2), 91–99. https://doi.org/10.2752/089279391787057297

Montacute, R. (2020, April). *Social mobility and COVID-19: Implications of the COVID-19 crisis for educational ine- quality*. The Sutton Trust. https://www.suttontrust.com/wp-content/uploads/2020/04/COVID-19-and-Social-Mobility- 1.pdf

Muldoon, J.C., Williams, J.M., Lawrence A. & Currie C.E. (2019). Differences in boys' and girls' attachment to pets in early-mid adolescence. *Journal of Applied Developmental Psychology*, 62, 5-58.

Muldoon, J.C., Williams, J.M., & Lawrence A. (2019). The nature and psychological impact of child/adolescent attachment to dogs compared with other companion animals. *Animals and Society,* 27, 55-74.

Nancy R. Gee, WALTHAM Centre for Pet Nutrition, James A. Griffin, Eunice Kennedy Shriver National Institute of Child Health and Human Development, Peggy McCardle, & Haskins Laboratories. (n.d.). Human–Animal Interaction Research in School Settings: Current Knowledge and Future Directions. *AERA Open*, *3*(3), 1–9. https://doi.org/10.1177/2332858417724346

Nimer, J., & Lundahl, B. (2007). Animal-Assisted Therapy: A Meta-Analysis, *203*, 225–238. https://doi.org/10.2752/089279307X224773doi.org/10.2752/089279307X224773

O'Haire, M. E. (2013). Animal-Assisted Intervention for Autism Spectrum Disorder: A Systematic Literature Review. *Journal of Autism and Developmental Disorders*, *43*(7), 1606–1622. https://doi.org/10.1007/s10803-012-1707-5

Ozsivadjian, A., Knott, F., & Magiati, I. (n.d.). Parent and child perspectives on the nature of anxiety in children and young people with autism spectrum disorders: a focus group study. *Autism*, *16*(2), 107–121. https://doi.org/10.1177/1362361311431703

Pan, Z., Granger, D., Geurin, N., Shoffner, A. & Gabriels et al, R., (2019). Replication Pilot Trial of Therapeutic Horseback Riding and Cortisol Collection with Children on the Autism Spectrum. Frontiers in Veterinary Science, *5* (312) https://www.frontiersin.org/articles/10.3389/fvets.2018.00312/full.

Pellicano E. and Stears, M. (2020), **T**he hidden inequalities of COVID-19, Autism, Vol. 24(6) 1309–1310

People, Y. (2004). KIDSCREEN instruments, 2000–2751. Retrieved from www.kidscreen.org

Ravens-Sieberer, U., Erhart, M., Rajmil, L., Herdman, M., Auquier, P., Bruil, J., Power, M., Duer, W., Abel, T., Czemy, L., Mazur, J., Czimbalmos, A., Tountas, Y., Hagquist, C., Kilroe, J., & European KIDSCREEN Group (2010). Reliability, construct and criterion validity of the KIDSCREEN-10 score: a short measure for children and adolescents' well-being and health-related quality of life. *Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation*, *19*(10), 1487–1500. https://doi.org/10.1007/s11136-010-9706-5

Purewal, R., Christley, R., Kordas, K., Joinson, C., Meints, K., Gee, N., & Westgarth, C. (2017). Companion Animals and Child/Adolescent Development: A Systematic Review of the Evidence. *International Journal of Environmental Research and Public Health*, *14*(3), 234. https://doi.org/10.3390/ijerph14030234
Rhodes RE, Baranova M, Christian H*, et al(2020).*Increasing physical activity by four legs rather than two: systematic review of dog-facilitated physical activity interventions. *British Journal of Sports Medicine, 54:*1202-1207.

Robinson, A. 2020). Dogs have a magic effect: how pets can improve our mental health. The Guardian. https://www.theguardian.com/society/2020/mar/17/dogs-have-a-magic-effect-the-power-of-pets-on-our-mental-health

Rutter, M., Bailey, A., & Lord, C. (2003). *The social communication questionnaire*. Los Angeles, CA: Western Psychological Services.

Rutherford, M. W., Pollack, J. M., Mazzei, M. J., & Sanchez-Ruiz, P. (2017). Bootstrapping: Reviewing the Literature, Clarifying the Construct, and Charting a New Path Forward. *Group & Organization Management*, *42*(5), 657–706. https://doi.org/10.1177/1059601117730574

Sedgewick, F., Hill, V., Yates, R., Pickering, L., & Pellicano, E. (2016). Gender Differences in the Social Motivation and Friendship Experiences of Autistic and Non-autistic Adolescents. *Journal of Autism and Developmental Disorders*, *46*(4), 1297–1306. https://doi.org/10.1007/s10803-015-2669-1

Silva, L. M. T., & Schalock, M. (2012). Autism parenting stress index: Initial psychometric evidence. Journal of Autism and Developmental Disorders, 42, 566-574.

Wright, H. F., Hall, S., Hames, A., Hardiman, J., Mills, R., Mills, D. S., & Mills, D. S. (2015). Acquiring a Pet Dog Significantly Reduces Stress of Primary Carers for Children with Autism Spectrum Disorder: A Prospective Case Control Study. *Journal of Autism and Developmental Disorders*, *45*(8), 2531–2540. https://doi.org/10.1007/s10803-015-2418-5

Stoeckel, L. E., Palley, L. S., Gollub, R. L., Niemi, S.M. & Evins, A. E. (2014). Patterns of Brain Activation when Mothers View Their Own Child and Dog: An fMRI Study. PLOS ONE 9(10): e107205 https://doi.org/10.1371/journal.pone.0107205

Winnicott, D. W. (1971). Playing and reality. New York: Routledge Press.
Zelman, J & Ferro, M (2018). The Parental Stress Scale: Psychometric Properties in Families of Children with Chronic Health Conditions, Family Relations
67, (2) 240-252

Appendices

Appendix A: Favourable Ethical Opinion Letter

NHS
Health Research Authority
London - London Bridge Research Ethics Committee

26 February 2020

Mrs Lianne White
Atholl House
Main street
Bridge of Earn
PH2 9PJ

Dear Mrs White

Study title:	**Man's best friend: What is the difference in family functioning, parent-child relationship and child social communication of having a dog in a family with children with Autism Spectrum Disorder (ASD): A control comparison study to families with ASD children who are seeking a pet dog but do not currently have one.**
REC reference:	**19/LO/0831**
Protocol number:	**CAHSS1808/04**
Amendment number:	**Amendments Number 1 13 November 2019**
Amendment date:	**24 January 2020**
IRAS project ID:	**251276**

The above amendment was reviewed by the Sub-Committee in correspondence.

1 Ethical opinion

The members of the Committee taking part in the review gave a favourable ethical opinion of the amendment on the basis described in the notice of amendment form and supporting documentation.

2 Approved documents

The documents reviewed and approved at the meeting were:

Document	*Version*	*Date*
Copies of advertisement materials for research participants [ASD and Dog online advert]	2	26 February 2020

Non-validated questionnaire [ASD and Pets - Online version of survey]	1	01 November 2019
Notice of Substantial Amendment (non-CTIMP)	Amendments Number 1 13 November 2019	24 January 2020
Research protocol or project proposal [Tracked and clean]	2	01 October 2019
Validated questionnaire [Brief Family functioning Questionnaire]		

3 Membership of the Committee

The members of the Committee who took part in the review are listed on the attached sheet.

4 Working with NHS Care Organisations

Sponsors should ensure that they notify the R&D office for the relevant NHS care organisation of this amendment in line with the terms detailed in the categorisation email issued by the lead nation for the study.

5 Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

6 HRA Learning

We are pleased to welcome researchers and research staff to our HRA Learning Events and online learning opportunities– see details at: https://www.hra.nhs.uk/planning-andimproving-research/learning/

19/LO/0831:	**Please quote this number on all correspondence**

Yours
sincerely

pp. 

7 Dr Ralph White Chair

E-mail: nrescommittee.london-londonbridge@nhs.net

Enclosures: List of names and professions of members who took part in the review

Copy to: *Charlotte Smith, College of Arts, Humanities & Social Sciences of Edinburgh* **London - London Bridge Research Ethics Committee**

Attendance at Sub-Committee of the REC meeting on 31 January 2020

Committee Members:

Name	*Profession*	*Present*	*Notes*
Mrs Alice Shortland	Medical Science Liaison	Yes	
Dr Ralph White (Chair)	Pharmacist	Yes	

Also in attendance:

Name	*Position (or reason for attending)*
Mrs Amanda Carr	Approvals Administrator

Appendix B: NHS Tayside and Fife Approval R&D

NHS

Tayside

29 January 2020

Mrs Lianne White
NHS Tayside
Psychologial Services
Dudhope House
15 Dudhope Terrace
Dundee DD3 6HH

Dear Mrs White,

7.1 ACCEPTANCE OF AMENDMENT LETTER

Title: Man's best friend: What is the difference in family functioning, parent-child relationship and child social communication of having a dog in a family with children with Autism Spectrum Disorder (ASD): A control comparison study to families with ASD children who are seeking a pet dog but do not currently have one.

Chief Investigator: Mrs Lianne White

Principal Investigator/Local Collaborator: Mrs Lianne White

Tayside Ref: 2019PZ01IRAS ID: 251276

REC Ref: 19/LO/0831

Amendment Number: SAOIAmendment Date: 13 November 2019

Thank you for submitting the above amendment for review by the R&D Office here in NHS Tayside. Following my assessment of the proposed changes I am pleased to confirm that subject to the following condition NHS Tayside has no objection to these being implemented locally:

- You may not implement this amendment until and unless you receive, and forward to the R&D Office, all required ethical and/or regulatory approvals (where applicable).

7.2 Approved Documents

Document	Version	Date
Notice of Substantial Amendment non-CTIMP		13 November 2019

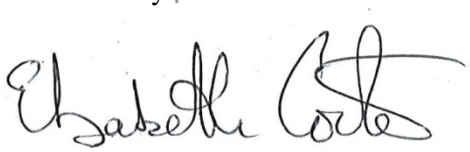
ASD and Pets Online Surve	1.0	01 November 2019
Research rotocol or ro•ect ro osal	2.0	01 October 2019
Brief Famil Functionin Questionnaire	1.0	17 November 2019

Version 1.0 dated 28/01/19
Non-NRS Study Amendment Approval

- 1 -

I thank you for keeping the R&D Office informed of the study progress.

Yours Sincerely



Elizabeth Coote
Head of Non-Commercial Research Services

TAyside medical Science Centre (TASC)
Ninewells Hospital & Medical School
TASC Research & Development Office
Residency Block, Level 3
George Pirie Way
Dundee DDI 9SY
Email: liz.coote@nhs.net
Tel: 01382 383876 Fax: 013812 740122

C.c. Miss Charlotte Smith — charlotte.smith@ed.ac.uk

Non-NRS Study Amendment Approval

Medical Director

Hayfield House
Hayfield Road
KIRKCALDY
KY2 5AH

Fife

Mrs Lianne White
Atholl House
Main Street
BRIDGE OF EARN
PH2 9PJ

Date: 3 March 2020
Our Ref: 19-069 19/LO/0831
IRAS: 251276
Enquiries to: Fife Research Approvals
E-mail: fife-uhb.fiferesearchapprovals@nhs.net

Telephone: 01383 623 623 Ext 20940
Website: www.nhsfife.org

Project Title: Man's best friend: What is the difference in family functioning, parent-child relationship and child social communication of having a dog in a family with children with Autism Spectrum Disorder (ASD): A control comparison study to families with ASD children who are seeking a pet dog but do not currently have one.

Thank you for your application to carry out the above project. Your project documentation (detailed below) has been reviewed for resource and financial implications for NHS Fife and I am happy to inform you that NHS permission for the above research has been granted on the basis described in the application form, protocol and supporting documentation. The documents

reviewed were:

Document	Version	Date
GP Letter	1	6 Februa 2019
Poster	1	1 March 2019
Interview Schedule — Child	1	1 March 2019
Interview Schedule — Parent	1	1 March 2019
Partici ant Information Sheet — Parent	1	1 March 2019
Consent Form — Parent	1	1 March 2019
Consent Form — Older Child	1	1 March 2019
IRAS Form	5.11	17 A ril 2019
REC Final Favourable O inion Letter		3 June 2019
Protocol	2	1 October 2019
Online version of surve	1	1 November 2019
Online advertisement	2	26 Februa 2020
REC favourable o inion letter for SAOI		26 Februa 2020
Stud -Wide Governance Re ort		27 Februa 2020
IRAS OID Form		28 Februa 2020

The terms of the approval state that you are the Principal Investigator authorised to undertake this study within NHS Fife, with assistance from Katrina Johnston, Clinical Psychologist and Local Area Tutor in Fife.
I note that the favourable ethical opinion applies to all NHS sites taking part in the study therefore no separate Site Specific Review is required in this case. The sponsors for this study are University of Edinburgh. Please note that it is the responsibility of the Sponsor to ensure that adequate and appropriate insurance is maintained throughout the course of the study

Details of our participation in studies will be included in annual returns we are NHS complete as part of our agreement with the Chief Scientist Office. Regular require to be submitted. Your first report should be submitted to Dr A Wood, R&D Mmæer, R&D Department, Queen Margaret Hospital, Whitefield Rd, Dunfermline, KY 12 OSU (Amanda.wood3@nhs.net) in 12 months time and subsequently at yearly intervals until the work is completed. A Lay Summary will also be required upon completion of the project.

In addition, approval is granted subject to the following conditions:-

All research activity must comply with the standards detailed in the UK Policy Framework for Health and Social Care Research:
http://www.nhsresearchscotland.org.uk/uploads/tinvmce/ukpolicv-framework-health-social-care-research.pdf health & safety regulations, data protection principles, other appropriate statutory legislation and in accordance with Good Clinical Practice (GCP).

Any amendments which may subsequently be made to the study should also be notified to Fife Research Approvals: fife-uhb.fiferesearchapprovals@nhs.net as well as the appropriate regulatory authorities. Notification should also be given of any new research team members post approval and/or any changes to the status of the project.

This organisation is required to monitor research to ensure compliance with the UK Policy Framework for Health & Social Care Research and other legal and regulatory requirements. This is achieved by random audit of research. You will be required to assist with and provide information in regard to monitoring and study outcomes (including providing recruitment figures to the R&D office as and when required).

As custodian of the information collated during this research project you are responsible for ensuring the security of all personal information collected in line with NHS Scotland IT Security Policies, until the destruction of this data. Permission is only granted for the activities for which a favourable opinion has been given by the REC (and which have been authorised by the MHRA where appropriate).

The research sponsor or the Chief Investigator or local Principal Investigator at a research site may take appropriate urgent safety measures in order to protect research participants against any immediate hazard to their health or safety. The R&D office (fife uhb.fiferesearchapprovals@nhs.net should be notified that such measures have been taken. The notification should also include the reasons why the measures were taken and the plan for further action. The R&D office should be notified within the same time frame of notifying the REC and any other regulatory bodies.

I would like to wish you every success with your study and look forward to receiving a summary of the findings for dissemination once the project is complete.

Yours sincerely

8 DR CHRIS MCKENNA

Medical Director NHS Fife cc : Fife Research Approvals, NHS Fife
fife-uhb.fiferesearchapprovals@nhs.net

Appendix C Study Protocol

Non-CTIMP Study Protocol

Man's best friend: Having a pet dog in ASD families

	The University of Edinburgh College of Arts, Humanities and Social Sciences Edinburgh EH8 9JU
Protocol authors	**Lianne White**
Chief Investigator	**Lianne White**
Sponsor number	CAHSS1808/02
REC Number	**251276**
Version Number and Date	**Version 2, February 2020**

CONTENTS

LIST OF ABBREVIATIONS

Insert abbreviations as required

LIST OF ABBREVIATIONS

ACCORD	Academic and Clinical Central Office for Research & Development - Joint office for The University of Edinburgh and Lothian Health Board
AAI	Assisted Animal Intervention
ASD	Autism Spectrum Disorder
CI	Chief Investigator
CRF	Case Report Form
GCP	Good Clinical Practice
HAI	Human Animal Interaction
PI	Principal Investigator
QA	Quality Assurance
REC	Research Ethics Committee
SOP	Standard Operating Procedure

INTRODUCTION

8.1 BACKGROUND

The area of human-animal interaction (HAI) has attracted increasing attention in recent years (Mills & Hall, 2014). Emerging research has investigated the benefits of Animal-Assisted Intervention (AAI), Animal-Assisted Activities (AAA), Animal-Assisted Therapy (AAT) and the benefits of service and companion animals for individuals in a range of populations and settings (Nimer & Lundahl, 2007); (O'Haire, 2013); (Wright et al., 2015)). Subjectively, the benefits of interaction with animals have been observed with around 70% of UK families owning pets (Marsa-Sambola et al., 2016). However, with emphasis on empirical studies and evidence-based practice, further research is required to formally quantify these potential benefits. Research to date have identified an improvement in physical, social, emotional and cognitive functioning to those who interact with animals for both adults and children. O'Haire's (2013) systematic review of AAIs for ASD reported a tentative "proof of concept" however, she argued that more rigorous empirical studies are required in order to further establish a convincing evidence base for AAIs in relation to ASD.

Animal interventions have been investigated in a range of clinical and non-clinical populations including older people, children with disabilities, hospital in-patients and families with children with ASD. The latter is the focus of the current study. O'Haire (2013) carried out a systematic review of 14 studies of AAI with young ASD

participants. Findings indicated a notably small range of samples sizes with studies using 1-42 participants. The target population of the studies reviewed was children and adolescents (age range: 3–17 years), with no studies on adults with ASD. There was also a homogeneity identified with regards to diversity of participants. The average percentage of dominant cohort were males, making up 80.9% of all study participants. The paucity of control groups in the area of human-animal interaction has been well acknowledged (Kazdin, 2015; O'Haire, 2013; Nimer, 2007). However, there has been an increase in controlled studies and use of follow up studies in recent years. Halle et al (2016) carried out a two and a half year follow up on the benefits of animals in families with children with ASD. This review takes into account AAIs; however, little attention has been given to non-assistance trained pet dogs in the home. This is a gap in the literature which the current study aims to investigate further.

Autism Spectrum Disorder

ASD is a heterogeneous condition defined by the DSM-5 as a person experiencing persistent difficulties in social interaction in a range of contexts and as showing restricted, repetitive behaviors. These problems must have been evident in early childhood, cause significant impairment in functioning and not be explainable by intellectual disorders or developmental delays (DSM-5, APA, 2013). Severity of symptoms, impairments in social communication and functional impact will vary across individual cases. There is also an increasingly recognized gender difference with regards to female and male presentations with females appearing more socially driven than males (Sedgewick, Hill, Yates, Pickering, & Pellicano, 2016).

Pets and ASD

Most studies on pets and children and families have involved typically developing children. The benefits of pets have been documented for children with ASD in therapeutic contexts, however, little research has been carried out investigating the benefits of pets at home for children with ASD. In addition, fewer studies have considered the family perspective where children have ASD. Indications that pet owners feel a sense of safety with their pets, which provides support, comfort and relief allowing engagement in activities and measured risk taking has been well-established (Allen, Blascovich & Mendes, 2002; Kurdek, 2008). Pet dogs seem to have a particularly beneficial influence on children and families. Recent research (Muldoon, Williams & Lawrence, 2018; Muldoon Williams, Lawrence & Currie, 2019) has highlighted that children's mental health benefits most from attachment to pet dogs. Focusing on one animal type also allows exploration of the features of the animal and how it interacts with humans. For example, dogs can recognize human emotions and seek out human company in a way that other pets do not (Albuquerque et al., 2016) and thus there is a focus on dogs in this proposal.

Theoretical keystones of Human-Animal Interaction (HAI) in ASD

Therapeutic benefits of animal interventions have been theorized to be successful due to the attributes of the animal which contribute to therapeutic change. There is also a suggestion that forming a relationship with an animal can lead to cognitive and behavioural benefits through development of skills and improvement of personal agency (O'Haire, 2013). Pets are part of a child's family and therefore social context, which will

influence the child's development (Bronfenbrenner, 1979). A child's interactions with animals are part of a larger social network of interactions; these interactions may encourage further social development and interaction within their wider systems including family, school, community and wider society. The presence of an animal within a child's family will influence these systems and affect developmental (Gee, 2017).

Social, Cognitive & Emotional Development

Companion animals have been found to influence cognitive (perspective taking), emotional (reduction in stress and anxiety) and social (improved social interaction and reduced loneliness) development in typically developing children (TDC) (Purewal et al., 2017). HAI has been conceptualized in relation to attachment theory which was first proposed by Bowlby (1960) to explain human infant/caregiver relationships then expanded further to explain the relationship between a child and their pet (Melson, 1990). The role and strength of this relationship has been found to impact development. For example, TDC who reported a strong bond with their pets were seen to display greater empathy to others (Daly & Morton, 2006).

Children with ASD have deficits socially and can also experience developmental delay in relation to emotional and cognitive domains. Animals may facilitate socio-emotional development in children with ASD (O'Haire, 2013; Harris & Williams, 2017). Literature on children with ASD and their relationship with their pets is sparse. ASD inevitably leads to a deficit in the ability to form social relationships. Improvements in social connectivity and interaction have been noted from research in HAI, therefore there is potential for children with ASD to benefit in similar ways. The opportunity to form a relationship with an animal offers the prospect of improved social engagement. Animals may also serve as transitional objects (Winnicott, 1971) to modulate arousal and stress. For example, children with ASD may find social interaction stressful. The presence of an animal has been found to reduce arousal and improve social interaction in children with ASD both in therapeutic and non-therapeutic scenarios (Wright et al., 2015).

Parenting children with ASD

Parenting children with ASD is associated with higher levels of stress, anxiety and social isolation in comparison to parents of typically developing children, or children with other non-developmental disabilities (Dunn, Burbine, Bowers, & Tantleff-Dunn, 2001; Weiss et al., 2013). High stress levels have a negative impact on the well-being of the individual; elevated stress levels can also limit the effectiveness of the outcomes of ASD interventions and have a negative impact on family functioning (Robbins et al., 1991; Burgoyne, 2014; Osborne et al., 2008). Wright et al (2015) completed a more robust cross-sectional study gathering data from parents of children with ASD who were acquiring a dog and a control group of parents who were not. This study found that physical contact and companionship with a dog, increased physical activity and exposure to natural environments, reduced stress and anxiety, improving parental mental health. Parents have also reported having 'time away' while walking the dog has improved their stress levels and increased perceived levels of coping (Hall et al., 2016). Having an assistance dog was found to lead to improved child safety and acceptability within the community and improved perceived parental competence. However, in contrast to other studies (e.g. Hall et al., 2015) parental stress levels were not impacted significantly. The population of children as with other studies is relatively homogenous with 87-91% of the participants being male. Burgoyne et al. (2014) assessed

parent's perspectives of assistance dogs for children with ASD. Gaining a parental perspective on the perceived benefits is helpful. Unlike others in this area, the study is well powered (using 77 participants with a dog and 70 waiting list control participants) and gathered both qualitative and quantitative data. This study, however, uses control participants who wish to seek a dog, arguably the characteristics of both family groups may be similar as both groups have identified the potential benefits of acquiring a dog. The current proposed study will use a control family group which has not sought to acquire a dog. This may highlight characteristics which are novel to each group and serve to inform the evidence base further. Comparably the current study will utilise a mixed methods design to provide richer data in an under researched area.

8.2 RATIONALE FOR STUDY

Rationale for Current Study

HAI is a developing area of research and has been hampered by methodological and measurement limitations (Kazdin, 2015). The proposed study aims to contribute to the research on HAI by taking a novel family perspective, including both child and parent perspectives focusing on ASD. The study will explore the impact of pet dogs on parents and children with ASD, rather than focusing solely on the child or the parent. There is also a lack of studies which utilise a control group within this population. While there are significant benefits to long-term follow up studies, the proposed study aims to include a mixed method cross-sectional design in order to initially explore and contribute to knowledge regarding the mechanisms which contribute to ASD families' experiences of having a pet dog. There may be potential for future research to build on the data gathered and engage in longitudinal research.

STUDY OBJECTIVES

8.3 OBJECTIVES

8.3.1 Primary Objective

The primary objective of the research project is to:

Investigate compare family functioning and mental health of families with children with ASD who have a dog compared to families of children with ASD who do not have a dog?

8.3.2 Secondary Objectives

The secondary objectives of the research project are to investigate:

1. What is the quality of the child's and parents' relationship with the dog?
2. How does the level of social communication vary in a child with ASD who has a dog present in the home compared to a child with ASD who does not?

3. How do parental stress levels vary in families with children with ASD and a dog present compared to families with children with ASD and no dog present?

How is the parent-child relationship influenced by the presence of a dog in the family compared to families who do not have a dog

9 STUDY DESIGN

Design
The study will be a cross-sectional within group and between group design. Families with children with ASD and a pet dog and a comparison group of families with children with ASD without a pet dog will be included in the study. Data from the two groups will be matched on a range of criteria such as age of child, number of siblings, family composition. The data from the pet dog group will also be analysed using a with-in group design to examine associations between child-animal interaction variables (e.g. pet attachment) compared to parent-animal interaction measures (parents attachment to dog) by using the Lincoln Autism Pet Dog Impact Scale (LAPDIS) (Hall, Wright, Mills, & Schmitz, 2016) and child's reports on the Short Attachment to Pets Scale (SAPS) (Marsa-Sambola et al., 2015).

Demographic information will be gathered for each participant (including age and gender). Parents will be asked to report when their child was diagnosed with ASD and whether they themselves or another family immediate member have a diagnosis of ASD, the family's socioeconomic status will be recorded by using the family's postcode and parental level of education. Information on past and current intervention and support services which the family have access to will also be recorded in an effort to control for group differences. It is anticipated by using a control group of families who are seeking a dog this will reduce and control for some group differences.

Quantitative data will be gathered by means of questionnaires which will be administered individually to parents and children with high functioning ASD. Parent Questionnaires will measure:
Parent stress levels (Autisim Parent stress index (APSI) Silva, L. M. T., & Schalock, M. (2012) and the Parent Stress Index (PSI).
Parent-Child relationship by using the Experiences in Close Relationships-Revised Parent Version (ECR-R) (Internal reliability: Cronbach's alpha .91-.94) (Lionetti, Mastrotheodoros, & Palladino, 2018)

- **The Brief Assessment of Family Functioning Scale (BAFFS): a three-item version of the General Functioning Scale of the Family Assessment Device Mansfield et al, (2018)**

  https://doi.org/10.1080/10503307.2017.1422213

- Child social communication using the Social Communication Questionnaire (SCQ) (Chandler et al., 2007)(Cronbach's alpha .87-.91)
- Lexington Attachment to Pets Scale (LAPS) (Internal reliability: Cronbach's alpha:.92) (Johnson et al., 2015)
- Lincoln Autism Pet Dog Impact Scale (LAPDIS) (Internal reliability: Cronbach's Alpha .71-.93) (Hall, Wright, Mills, & Schmitz, 2016) to measure parents perceptions of the impact of the dog on their child with ASD.

Child Questionnaire will include:
- Short Attachment to Pets scale (SAPS)-Internal reliability (Internal reliability: Cronbach's Alpha 0.89) (Marsa-Sambola, 2016)
- Experiences in Close Relationships-Revised Child Version (ECR-RC) (Internal reliability: Cronbach's alpha .82-.93) (Lionetti et al., 2018)

- **The Brief Assessment of Family Functioning Scale (BAFFS): a three-item version of the General Functioning Scale of the Family Assessment Device Mansfield et al, (2018)**

  https://doi.org/10.1080/10503307.2017.1422213

- Quality of life: Kidscreen- 10 Index (Cronbach's Alphas is .82) (Young, 2004)
- Self-esteem: Rosenberg Self-Esteem Scale (Rosenberg, 1965)

Qualitative data will be gathered through the means of focus groups with parental focus groups and ASD child focus groups. These will explore the impact of the dog on daily activities and qualitative assessments of the impact of the dog on the children and families.

As identified above research is sparse with regards to comparing parents and children with ASDs' experiences of family pet dogs. There is even less research which takes a family approach and utilises comparison with a control group. The above measures have been selected based on evidence which suggests that interaction with a pet dog in typically developing children is associated with benefits in in social communication and attachment relationships. Parental research identifies reduced stress levels and improved perceived relationships and family functioning.

Participants
Participants will be children (age 8-16 years old) who have received a diagnosis of Autism Spectrum Disorder (ASD) based on the DSM-IV or DSM V criteria and the parents of these children. The study requires a group of families who have a pet and a group who do not in order for comparison to be carried out. The rationale for the selected age range includes suitability for age ranges for selected measures. Middle childhood and adolescence is a developmental phase when social demands and the complexities of relationships both within and out with families increase. Therefore, during this age range is the role of a companion animal may be particularly important in family life.

Procedure
Participants will be invited to take part in the study through two sampling pathways.

Firstly, posters advertising the study will be displayed in tertiary organisations who offer support to families with children who have diagnosis of ASD. These include local organisations including SPECTRUM, National Autistic Society's One Stop Shop These organisations have been contacted via email to request consent to take part in the study. Families who are supported by these organisations will have the opportunity to contact the researcher via email or phone should they have questions regarding the study and also to indicate their desire to take part. Information will be given to all organisations regarding the inclusion and exclusion criteria of the study. Once families have contacted the researcher and indicated their consent to take part, the researcher will confirm whether the families meet criteria for inclusion. Should participants meet inclusion criteria further telephone/email contact will be made to arrangements for participants to complete questionnaires. Potential participants will always have 48 hours to consider the participant information sheet before being invited to meet with the research, where the consent form will be completed and the study will commence.

In the second recruitment pathway, families who attend the Child and Adolescent Mental Health Service (CAMHS) diagnostic and ASD clinics will be informed about the study by their identified or assessing clinician. They will be offered the opportunity as with participants above to consider whether they would like to take part in the study and given details for contacting the researcher by phone or email should they wish to do so or should they have questions about the study. Clinicians may also acquire verbal consent from potential participants to be contacted by the researcher so assessment of suitability for the study can be completed. As above if participants meet inclusion criteria they will be invited to meet with researcher to complete questionnaires and given 48 hours to consider the participant information sheet prior to meeting the researcher, where the consent form will be completed.

The participants will be invited to complete questionnaires in an environment which is familiar to them e.g. their CAMHS clinic or ASD support service premises. They will ideally be asked to complete questionnaires on the same day that they complete the consent form in order to reduce demand on the participant.

Focus groups will comprise of a sample of participants who have consented to taking part in the study. They will be asked open ended questions regarding their dog and how it influences family functioning, their child with ASD and the relationship they have with this child.

Ethical considerations

The proposed population of children with ASD and their parents are both vulnerable groups. This vulnerability is due to participants with ASD being minors with developmental disabilities. Their parents are also considered a vulnerable group as they may be more at risk of mental health problems due to the experience of stressors associated with parenting a child with ASD. The research process may be considered an additional stressor to both parents and children with ASD alike.

Consent will be sought from all parents for both themselves and their children's participation. Child consent will also be sought in line with BPS guidelines and the Charter for Ethical Research Involving Children. All study information and consent forms will be age and ASD appropriate. For example, we will use pictures to demonstrate the research process in consent forms.

All participants will be reminded that they may withdraw from the study at any time. As recommended by the BPS children's agreement will be monitored by attention to verbal and non-verbal signs that they are not wholly willing to continue with participation. Should participants experience any distress as a result of the research process, they will be signposted to support services or directed to their current service providers.

Level 2 University ethical approval will be required. If participants are to be recruited from CAMHS approval from IRAS will be required.

Participation in a focus group with parents from various other support services may lead to a breach in confidentiality with regards to sharing information out with the group. For example, discussion within the group regarding a family's personal details may be continued out with the group without the knowledge of the parent. Measures will be used to limit this by having each participant verbally agree to a clause of respect for others and their children as well as confidentiality within the group.

Results of the study may reveal benefits to having a pet dog in the family. Implications of this for families who do not currently have an animal and do not have the means or opportunity to acquire an animal will be considered in any policy-related recommendations that may emerge from the research. Implications should also be considered if the results of the study indicate that the presence of an animal within the family provides more stressors than benefits for the family. This may lead to distress for families who already have an animal in their family.

It is possible that high parental stress and poor family functioning may be recorded. Families will be referred back to their supporting agency if they are open to one, and if not, a signposting sheet will be provided giving information for local relevant services which families can seek support from.

Other considerations for the study include accounting for external or internal influences which may also explain any results found. The researcher must take into account other factors which may influence family functioning for example or parent-child relationships. These factors may include family's social support, service involvement and interventions currently and previously carried out, individual child/parent/family and animal characteristics. Attempts will be made to capture some of this information in the demographic information however it may be difficult to control for all potential influencing factors. For this reason, any findings should be reported with these limitations in mind.

Consideration has been given to the ethical issue of disclosures of animal abuse. Children can be referred to the new Scottish SPCA Animal Guardians programme for further support Child protection procedures will be followed if anything related to child safety or health emerges. This will correspond to the appropriate agency's' child protection policy e.g. NHS.

10 STUDY POPULATION

10.1 NUMBER OF PARTICIPANTS

In order to conduct a comprehensive, a priori estimation of the minimum sample size required to achieve sufficient power, multiple methods were utilised. Sample sizes for quantitative data was calculated based in comparison to similar studies and taking into consideration a g power calculation (Faul, Erdfelder & Buchner, 2009). Wright et al. (2015) completed a cross sectional study gathering data from parents of children with ASD who those who were acquiring a dog (38) and a control group of parents who were not acquiring a dog (24). Based on the information available, the categorical data gathered from measures and the anticipated method of statistical analysis (see above), a target sample size of 85 has been identified with 43 in the control group and 42 in the pet group. Verbal agreements have been made with colleagues who have close links with large ASD networks including NAS. Access to a wider source of participants is anticipated to provide additional power to the study.

In relation to qualitative data sample size is less empirically calculated. Smith et al. (2007) suggest that appropriate sample sizes depend on the degree to which the richness and detail of each case will be reported, the time constraints and the resources of the researcher. Researchers have suggested that smaller numbers of homogenous groups where rich data is reported is sufficient in many cases. There has also been an increase in single case designs where one case is reported in depth. Focus group studies for typically developing children and their care of pets have used a sample of 53 children (Muldoon et al., 2014). Other qualitative studies in the area of HAI have used sample sizes of 2 (Solomon, 2010) to 14 (Burrows et al., 2008). Based on the information available it is suggested that a focus group of sample size of 20-30 children (with 10-15 boys and 10-15 girls where possible), each group will consist of 5 children. Individual interviews may be more appropriate for children with ASD. Focus groups have been identified as the preferred method of data collection if possible. The rationale for this method is to facilitate discussion which may help stimulate and elicit children's views (Leung & Savithiri, 2009). Children with ASD may struggle to articulate their views, however, it is anticipated that hearing others responses to open ended questions this will provide prompts for contributing to the conversation. The social element of focus groups may pose an issue for children with ASD so a pilot group may be required prior to confirming focus groups as the main qualitative method of data collection.

A larger sample may be possible for parents, Carlisle interviewed 47 dog owners who were parents of children with ASD (Carlisle, 2014). If possible a similar number of parents will be interviewed in focus groups for the present study. All parents who are invited to complete quantitative data will also be invited to participate in focus groups.

Groups will ideally be sampled from various areas across the geographical health board in order to increase diversity of responses. The participants will be recruited from multiple sites.

10.2 INCLUSION CRITERIA

Inclusion criteria: Children (age 8-16 years old) who have received a diagnosis ASD based on the DSM-IV or DSM V criteria and parents of these children. Co-morbid diagnoses (e.g. ADHD) will be recorded and included in demographic information as this may influence outcomes.

Inclusion criteria for control group: Diagnosis of ASD. Exclusion criteria for control group: Presence of animal in immediate family environment.

Inclusion criteria for "active group": Diagnosis of ASD and pet dog present within the immediate family environment.

Inclusion criteria for Parents/Carer group: Primary parent/carer for child/children with diagnosis of ASD. This is appropriate for both active and control group. They must live with the child/children.

10.3 EXCLUSION CRITERIA

Exclusion criteria for parent/carer group: If the child does not live with the parent/carer they would not be eligible to take part in the study.

Exclusion criteria for control group: Presence of animal in immediate family environment.

Exclusion criteria for parent/carer group: If the child does not live with the parent/carer they would not be eligible to take part in the study.

Exclusion criteria for active group: Absence of animal in the immediate family environment.

Exclusion criteria include: Children with diagnosed comorbid learning disability. A family would be excluded also if the child is not currently living in the family home.

11 PARTICIPANT SELECTION AND ENROLMENT

11.1 IDENTIFYING PARTICIPANTS

Participants will be identified by CAMHS clinicians who are working with the families and by workers within ASD support services out with the NHS. Participants can also self-identify by reviewing posters and leaflets on display in CAMHS clinics and ASD support services. Inclusion criteria will be made explicit to CAMHS clinicians and support service staff. There will also be information on the leaflets and posters indicating to families the inclusion and exclusion criterion. The study will be advertised online on ASD relevant sites such as the National Autism Society (NAS), local ASD charities and organisations and potentially a closed Facebook page created for the survey.

11.2 CONSENTING PARTICIPANTS

Families who are supported by these organisations will have the opportunity to contact the researcher via email or phone should they have questions regarding the study and also to indicate their desire to take part. Information will be given to all organisations regarding the inclusion and exclusion criteria of the study. Once families have made contact with the researcher to indicate their consent to take part the researcher will confirm whether the families meet criteria for inclusion. Should participants meet inclusion criteria further telephone/email contact will be made to arrangements for participants to complete questionnaires. Potential participants will always have 48 hours to consider the participant information sheet before being invited to meet with the research, where the consent form will be completed and the study will commence.

In the second recruitment pathway, families who attend the Child and Adolescent Mental Health Service (CAMHS) diagnostic and ASD clinics will be informed about the study and given the information sheet by their identified or assessing clinician. They will be offered the opportunity as with participants above to consider whether they would like to take part in the study and given details for contacting the researcher by phone or email should they wish to do so or should they have questions about the study. Clinicians may also acquire verbal consent from potential participants to be contacted by the researcher so assessment of suitability for the study can be completed. As above if participants meet inclusion criteria they will be invited to meet with researcher to complete questionnaires and given 48 hours to consider the participant information sheet prior to meeting the researcher, where the consent form will be completed.

Consent will be sought from all parents for both themselves and their children's participation. Child consent will also be sought in line with BPS guidelines and the Charter for Ethical Research Involving Children. All study information and consent forms will be age and ASD appropriate. For example, we will use pictures to demonstrate the research process in consent forms.

Participants which engage with the online survey link will be asked to answer initial questions to ensure they meet inclusion criteria. The questions will serve to confirm that the child has a diagnosis of ASD and whether

they have a pet or not. The information sheet and consent form must be read and completed electronically prior to access to the survey is granted.

11.2.1 Withdrawal of Study Participants

Participants are free to withdraw from the study at any point or a participant can be withdrawn by the Investigator. If withdrawal occurs, the primary reason for withdrawal will be documented in the participant's case report form, if possible. The participant will have the option of withdrawal from
(i) all aspects of the trial but continued use of data collected up to that point
(ii) all aspects of the trial with removal of all previously collected data.
(iii) all aspects of the trial with removal of previously collected and stored participant samples.

All participants will be reminded that they may withdraw from the study at any time. As recommended by the BPS children's agreement will be monitored by attention to verbal and non-verbal signs that they are not wholly willing to continue with participation. Should participants experience any distress as a result of the research process, they will be signposted to support services or directed to their current service providers. The online survey will include a final page detailing local agencies which can provide support to families who have children with ASD.

12 STUDY ASSESSMENTS

12.1 STUDY ASSESSMENTS

See below for further information on measures. Each participant will be invited to complete their respective quantitative measures individually with the research present to answer questions and guidance on completion. Most measures are brief (taking 10-15 minutes to complete) however participants will be offered the opportunity to have a break if required when completing the measures. It is anticipated that parents will spend no more than 30-40 minutes completing questionnaires and children will spend 15-20 minutes completing questionnaires.

Qualitative Data will be collected with parents of children with ASD who have a pet dog using semi structured interviews in a focus group setting. Other studies have used focus groups with both children with ASD and their parents with good results. (Ozsivadjian, Knott, & Magiati, 2012). Groups will take place in a local venue which is familiar to participants e.g. if participants are recruited from CAMHS, interviews will take place within CAMHS. This should reduce anxiety and improve the likelihood of participants being able to access the venue, improving uptake. The discussion themes will include the impact of dogs within the family, the quality of the relationship the parent and child have with the dog and the benefits/burdens of having a dog in the family. See below for information on sample size and group numbers. Data will be recorded using encrypted audio devices and transcribed to a secure computer following the interviews. The data will be kept until the project has been submitted and approved by Viva processes at which point the data will be deleted.

Demographic information will be gathered for each participant (including age and gender). Parents will be asked to report when their child was diagnosed with ASD and whether they themselves or another family immediate member have a diagnosis of ASD, the family's socioeconomic status will be recorded by using the family's postcode and parental level of education. Information on past and current intervention and support services which the family have access to will also be recorded in an effort to control for group differences. It is anticipated by using a control group of families who are seeking a dog this will reduce and control for some group differences.

Quantitative data will be gathered by means of questionnaires which will be administered individually to parents and children with high functioning ASD. Parent Questionnaires will measure:
Parent stress levels (Autism Parent stress (APSI) (Silva, L. M. T., & Schalock, M. (2012) and the parent stress index (PSI).

- Parent-Child relationship by using the Experiences in Close Relationships-Revised Parent Version (ECR-R) (Internal reliability: Cronbach's alpha .91-.94) (Lionetti, Mastrotheodoros, & Palladino, 2018)

- **The Brief Assessment of Family Functioning Scale (BAFFS): a three-item version of the General Functioning Scale of the Family Assessment Device Mansfield et al 2018**

  https://doi.org/10.1080/10503307.2017.1422213

- Child social communication using the Social Communication Questionnaire (SCQ) (Chandler et al., 2007)(Cronbach's alpha .87-.91)
- Lexington Attachment to Pets Scale (LAPS) (Internal reliability: Cronbach's alpha:.92) (Johnson et al., 2015)
- Lincoln Autism Pet Dog Impact Scale (LAPDIS) (Internal reliability: Cronbach's Alpha .71-.93) (Hall, Wright, Mills, & Schmitz, 2016) to measure parents perceptions of the impact of the dog on their child with ASD.

Child Questionnaire will include:

- Short Attachment to Pets scale (SAPS)-Internal reliability (Internal reliability: Cronbach's Alpha 0.89) (Marsa-Sambola, 2016)
- Experiences in Close Relationships-Revised Child Version (ECR-RC) (Internal reliability: Cronbach's alpha .82-.93) (Lionetti et al., 2018)

- **The Brief Assessment of Family Functioning Scale (BAFFS): a three-item version of the General Functioning Scale of the Family Assessment Device Mansfield et al (2018)**

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- Quality of life: Kidscreen- 10 Index (Cronbach's Alphas is .82) (Young, 2004)
- Self-esteem: Rosenberg Self-Esteem Scale (Rosenberg, 1965)

Qualitative data will be gathered through the means of focus groups with parental focus groups and ASD child focus groups. These will explore the impact of the dog on daily activities and qualitative assessments of the impact of the dog on the children and families.

As identified above research is sparse with regards to comparing parents and children with ASDs' experiences of family pet dogs. There is even less research which takes a family approach and utilises comparison with a control group. The above measures have been selected based on evidence which suggests that interaction with a pet dog in typically developing children is associated with benefits in in social communication and attachment relationships. Parental research identifies reduced stress levels and improved perceived relationships and family functioning.

6 DATA COLLECTION

Quantitative data collection will take place in one sitting with the participant which will take up to 30 minutes. Participants who have consented to taking part in the focus groups will be invited back on a separate occasion within 3 months of completing the quantitative data to take part in a 30 minute focus group. The principle researcher will collect and store the data. See above for standardised measures which will be used. All participants will be guided through completion of the questionnaires by the principle researcher and will have the opportunity to ask any questions during this process. Participants will complete questionnaires in an environment which is familiar to them e.g. CAMHS clinic or ASD support service premises. Where possible the child will be asked to sit with the principle researcher to complete the questionnaires without parents present. The parent will be asked to wait in a nearby designated area so they can be accessed easily should the child become distressed at any stage. However if it is not possible for the child to complete the questionnaires

without the parent present due to the child's level of communication and/or anxiety the parent may be present for completion of the questionnaires. The presence/absence of the parent will be noted as this may influence the child's responses, particularly on the Family Functioning and parent-child relationship questionnaire.

Quantitative data which is collected online will be available for participants to access over the course of one week. Participants can save and return to the survey within this period. Participants can indicate whether they wish to be contacted to take part in the qualitative sessions when completing the online survey however this is optional.

6.1 Source Data Documentation

Demographic information and questionnaires identified above will be completed.

7 STATISTICS AND DATA ANALYSIS

7.1 SAMPLE SIZE CALCULATION

In order to conduct a comprehensive, a priori estimation of the minimum sample size required to achieve sufficient power, multiple methods were utilised. Sample sizes for quantitative data was calculated based in comparison to similar studies and taking into consideration a g power calculation (Faul, Erdfelder & Buchner, 2009). Wright et al. (2015) completed a cross sectional study gathering data from parents of children with ASD who those who were acquiring a dog (38) and a control group of parents who were not acquiring a dog (24). Based on the information available, the categorical data gathered from measures and the anticipated method of statistical analysis (see above), a target sample size of 85 has been identified with 43 in the control group and 42 in the pet group. Verbal agreements have been made with colleagues who have close links with large ASD networks including NAS. Access to a wider source of participants is anticipated to provide additional power to the study.

In relation to qualitative data sample size is less empirically calculated. Smith et al. (2007) suggest that appropriate sample sizes depend on the degree to which the richness and detail of each case will be reported, the time constraints and the resources of the researcher. Researchers have suggested that smaller numbers of homogenous groups where rich data is reported is sufficient in many cases. There has also been an increase in single case designs where one case is reported in depth. Focus group studies for typically developing children and their care of pets have used a sample of 53 children (Muldoon et al., 2014). Other qualitative studies in the area of HAI have used sample sizes of 2 (Solomon, 2010) to 14 (Burrows et al., 2008). Based on the information available it is suggested that a focus group of sample size of 20-30 children (with 10-15 boys and 10-15 girls where possible), each group will consist of 5 children. Individual interviews may be more appropriate for children with ASD. Focus groups have been identified as the preferred method of data collection if possible. The rationale for this method is to facilitate discussion which may help stimulate and elicit children's views (Leung & Savithiri, 2009). Children with ASD may struggle to articulate their views, however, it is anticipated that hearing others responses to open ended questions this will provide prompts for contributing to the conversation. The social element of focus groups may pose an issue for children with ASD so a pilot group may be required prior to confirming focus groups as the main qualitative method of data collection.

A larger sample may be possible for parents, Carlisle interviewed 47 dog owners who were parents of children with ASD (Carlisle, 2014). If possible a similar number of parents will be interviewed in focus groups for the present study. All parents who are invited to complete quantitative data will also be invited to participate in focus groups.

The researcher is confident that the above sample sizes will be reached due to the availability of local tertiary organisations who support several hundred families with children with ASD. Local NHS health board also have several hundred cases open for children who have an ASD diagnosis and see two to four children weekly in their diagnostic clinics, over half of whom also receive an ASD diagnosis. Local clinicians have suggested that a non-NHS recruitment process may be more appropriate for this study but they are confident that sufficient numbers can be acquired through these means.

7.2 PROPOSED ANALYSES

This is a mixed method study.

Quantitative questionnaires for parents and children with ASD data will be analysed using tests of differences such as t-tests and ANOVA to examine group differences in key variables. Post-hoc analysis will also take place if appropriate. Within group analyses will use correlations to explore associations between key child and parent variables. Should a larger sample be attained more complex regression model analysis can be carried out. This analysis is appropriate based on the primary and secondary research questions regarding a comparison of two groups experiences in relation to particular variables.

To answer research question 1 the Brief Family Functioning Questionnaire will be administered to all participants. The dog group responses will be compared to those of the control group. T-Tests and ANOVAS will be completed. Post-hoc analysis will be completed if appropriate.

To answer research question 2 the LAPS and SAPS will be administered to the parents and children in the dog group. The parents will also complete the LAPDIS. Their responses will be compared using t-tests and ANOVAS. Post-hoc analysis will be completed if appropriate.

To answer research question 3 the SCQ will be completed by the parents in both groups. Their responses will be compared using t-tests and ANOVAS. Post hoc analysis will be completed if appropriate.

To answer research question 4 the parents in both groups will complete the APSI. Their responses will be compared using t-tests and ANOVAS. Post hoc analysis will be completed if appropriate.

To answer research question 5 the ECR-R and ECR-CR will be administered to all participants. The dog group responses will be compared to those of the control group. T-Tests and ANOVAS will be completed. Post-hoc analysis will be completed if appropriate.

Qualitative data will be analysed using thematic analysis (Braun & Clarke, 2006). The anticipated themes may include the impact of dogs within the family, the quality of the relationship the parent and child have with the dog and the benefits/burdens of having a dog in the family (as highlighted above these may include companionship, safety and comfort).

During the data analysis period, the researcher may liaise with a statistician regarding the analysis procedure so that the project can benefit from their expertise.

8 DATA MANAGEMENT

8 1.1 Personal Data

The following personal data will be collected as part of the research:

Name and name of your child, NHS/CHI number and that of your child, address, phone number, Personal data will be stored securely by the research team at NHS Tayside psychological therapies department. The principle researcher and their supervisors will have access to this information. All responses to research questionnaires/interviews will be ammonised and kept separately from personal data.

Personal data will be stored for 3 years.

8 1.2 Transfer of Data

Data collected or generated by the study (including personal data) will not be transferred to any external individuals or organisations outside of the Sponsoring organisation.

8 1.3 Data Controller

A data controller is an organisation that determines the purposes for which, and the manner in which, any personal data are processed.

The University of Edinburgh is the data controllers along with any other entities involved in delivering the study that may be a data controller in accordance with applicable laws (e.g. the site)

8 1.4 Data Breaches

Any data breaches will be reported to the University of Edinburgh Data Protection Officer who will onward report to the relevant authority according to the appropriate timelines if required.

9 OVERSIGHT ARRANGEMENTS

9.1 INSPECTION OF RECORDS

Investigators and institutions involved in the study will permit trial related monitoring and audits on behalf of the sponsor, REC review, and regulatory inspection(s). In the event of audit or monitoring, the Investigator agrees to allow the representatives of the sponsor direct access to all study records and source documentation. In the event of regulatory inspection, the Investigator agrees to allow inspectors direct access to all study records and source documentation.

9.2RISKS

Risk	Likelihood	Impact	Owner	Response
Application for ethical approval is rejected, delaying recruitment and data collection, leading to insufficient sample size	Low	Delay to recruitment and data collection. This may lead to an insufficient sample size	Researcher	Submit ethics application as early as possible in order to allow time for resubmission if required. Close work with supervisors and wider research resources available to ensure ethics application is as comprehensive a possible prior to submission.
Supervisors may become unavailable	Low	Delay to feedback and guidance on project.	Researcher	NHS have identified two field supervisors in order to reduce the risk of a lack of supervision becoming an issue. Efforts would be made to secure an appropriate alternative academic and/or field supervisor should this be required.
Insufficient sample size due to recruitment difficulties	Medium	Underpowered study	Researcher	Participants will be initially recruited from local tertiary organisations however if required recruitment could expand to similar Scotland wide organisations. The researcher will also work closely with staff within these organisations to clarify the purpose of the study and

				emphasise the families who would be appropriate for recruitment.
Loss or corruption of data	Low	Set-back for study, potential breach of confidentiality	Researcher	All paper documents (e.g. consent forms; completed questionnaires) will be held in a secure location and retained for the duration of the study. Data from documents will be entered into a spreadsheet after each data collection session and backed up regularly - The anonymised master data will be held on the NHS trainee laptop which is highly secure due to fingerprint identification.
Participants may experience psychological distress	Low	Heightened distress for participants, ethical considerations	Researcher	Questionnaires and interview questions are not in direct relation to mental health or psychological issues. Selected measures are tried and tested for an ASD population and are age appropriate. There is a small chance that psychological distress may occur due to stress engaging in the research process. Every effort will be made to reassure the individuals as all stages of the study. Participants will also be signposted to local support services or directed to their current service provider should support be required. Participants will also be made aware that they can withdraw from the study at any time.

9.2STUDY MONITORING AND AUDIT

The ACCORD Sponsor Representative will assess the study to determine if an independent risk assessment is required. If required, the independent risk assessment will be carried out by the ACCORD Quality Assurance Group to determine if an audit should be performed before/during/after the study and, if so, at what frequency.

Risk assessment, if required, will determine if audit by the ACCORD QA group is required. Should audit be required, details will be captured in an audit plan. Audit of Investigator sites, study management activities and study collaborative units, facilities and 3rd parties may be performed.

10 GOOD CLINICAL PRACTICE

10.1 ETHICAL CONDUCT

The study will be conducted in accordance with the principles of the International Conference on Harmonisation Tripartite Guideline for Good Clinical Practice (ICH GCP).

Before the study can commence, all required approvals will be obtained and any conditions of approvals will be met.

10.2 INVESTIGATOR RESPONSIBILITIES

The Investigator is responsible for the overall conduct of the study at the site and compliance with the protocol and any protocol amendments. In accordance with the principles of ICH GCP, the following areas listed in this section are also the responsibility of the Investigator. Responsibilities may be delegated to an appropriate member of study site staff.

10.2.1 Informed Consent

The Investigator is responsible for ensuring informed consent is obtained before any protocol specific procedures are carried out. The decision of a participant to participate in clinical research is voluntary and should be based on a clear understanding of what is involved.

Participants must receive adequate oral and written information – appropriate Participant Information and Informed Consent Forms will be provided. The oral explanation to the participant will be performed by the Investigator or qualified delegated person, and must cover all the elements specified in the Participant Information Sheet and Consent Form.

The participant must be given every opportunity to clarify any points they do not understand and, if necessary, ask for more information. The participant must be given sufficient time to consider the information provided. It should be emphasised that the participant may withdraw their consent to participate at any time without loss of benefits to which they otherwise would be entitled.

The participant will be informed and agree to their medical records being inspected by regulatory authorities and representatives of the sponsor(s).

The Investigator or delegated member of the trial team and the participant will sign and date the Informed Consent Form(s) to confirm that consent has been obtained. The participant will receive a copy of this document and a copy filed in the Investigator Site File (ISF) and participant's medical notes (if applicable)

10 2.2 Study Site Staff

The Investigator must be familiar with the protocol and the study requirements. It is the Investigator's responsibility to ensure that all staff assisting with the study are adequately informed about the protocol and their trial related duties.

10 2.3 Data Recording

The Principal Investigator is responsible for the quality of the data recorded in the CRF at each Investigator Site.

10 2.4 Investigator Documentation

- The Principal Investigator will ensure that the required documentation is available in local Investigator Site files ISFs.

10 2.5 GCP Training

For non-CTIMP (i.e. non-drug) studies all researchers are encouraged to undertake GCP training in order to understand the principles of GCP. However, this is not a mandatory requirement unless deemed so by the sponsor. GCP training status for all investigators should be indicated in their respective CVs.

10 2.6 Confidentiality

All evaluation forms, reports, and other records must be identified in a manner designed to maintain participant confidentiality. All records must be kept in a secure storage area with limited access. Clinical information will not be released without the written permission of the participant. The Investigator and study site staff involved with this study may not disclose or use for any purpose other than performance of the study, any data, record, or other unpublished, confidential information disclosed to those individuals for the purpose of the study. Prior written agreement from the sponsor or its designee must be obtained for the disclosure of any said confidential information to other parties. The only exception to this will be in the case of disclosures of risk/abuse. In this instance the relevant information will be shared with authorities including social work, SSPCA etc. Participants will be made aware of this information prior to consenting to participate in the study.

10 2.7 Data Protection

All Investigators and study site staff involved with this study must comply with the requirements of he appropriate data protection legislation (including the General Data Protection Regulation and Data Protection Act) with regard to the collection, storage, processing and disclosure of personal information.

Computers used to collate the data will have limited access measures via user names and passwords.

Published results will not contain any personal data and be of a form where individuals are not identified and re-identification is not likely to take place

11 STUDY CONDUCT RESPONSIBILITIES

11.1 PROTOCOL AMENDMENTS

Any changes in research activity, except those necessary to remove an apparent, immediate hazard to the participant in the case of an urgent safety measure, must be reviewed and approved by the Chief Investigator.

Amendments will be submitted to a sponsor representative for review and authorisation before being submitted in writing to the appropriate REC, and local R&D for approval prior to participants being enrolled into an amended protocol.

11.2 MANAGEMENT OF PROTOCOL NON COMPLIANCE

Prospective protocol deviations, i.e. protocol waivers, will not be approved by the sponsors and therefore will not be implemented, except where necessary to eliminate an immediate hazard to study participants. If this necessitates a subsequent protocol amendment, this should be submitted to the REC, and local R&D for review and approval if appropriate.

Protocol deviations will be recorded in a protocol deviation log and logs will be submitted to the sponsors every 3 months. Each protocol violation will be reported to the sponsor within 3 days of becoming aware of the violation. All protocol deviation logs and violation forms should be emailed to QA@accord.scot

Deviations and violations are non-compliance events discovered after the event has occurred. Deviation logs will be maintained for each site in multi-centre studies. An alternative frequency of deviation log submission to the sponsors may be agreed in writing with the sponsors.

11.3 SERIOUS BREACH REQUIREMENTS

A serious breach is a breach which is likely to effect to a significant degree:

(a) the safety or physical or mental integrity of the participants of the trial; or

(b) the scientific value of the trial.

If a potential serious breach is identified by the Chief investigator, Principal Investigator or delegates, the co-sponsors (seriousbreach@accord.scot) must be notified within 24 hours. It is the responsibility of the co-sponsors to assess the impact of the breach on the scientific value of the trial, to determine whether the incident constitutes a serious breach and report to research ethics committees as necessary.

11.4 STUDY RECORD RETENTION

All study documentation will be kept for a minimum of 1 year from the protocol defined end of study point. When the minimum retention period has elapsed, study documentation will not be destroyed without permission from the sponsor.

11.5 END OF STUDY

The end of study is defined as the last participant's last visit.

The Investigators or the co-sponsor(s) have the right at any time to terminate the study for clinical or administrative reasons.

The end of the study will be reported to the REC, and R+D Office(s) and co-sponsors within 90 days, or 15 days if the study is terminated prematurely. The Investigators will inform participants of the premature study closure and ensure that the appropriate follow up is arranged for all participants involved. End of study notification will be reported to the co-sponsors via email to resgov@accord.scot.

A summary report of the study will be provided to the REC within 1 year of the end of the study.

11.6 INSURANCE AND INDEMNITY

The co-sponsors are responsible for ensuring proper provision has been made for insurance or indemnity to cover their liability and the liability of the Chief Investigator and staff.

The following arrangements are in place to fulfil the co-sponsors' responsibilities:

- The Protocol has been designed by the Chief Investigator and researchers employed by the University and collaborators. The University has insurance in place (which includes no-fault compensation) for negligent harm caused by poor protocol design by the Chief Investigator and researchers employed by the University.
- Sites participating in the study will be liable for clinical negligence and other negligent harm to individuals taking part in the study and covered by the duty of care owed to them by the sites concerned. The co-sponsors require individual sites participating in the study to arrange for their own insurance or indemnity in respect of these liabilities.
- Sites which are part of the United Kingdom's National Health Service will have the benefit of NHS Indemnity.
- Sites out with the United Kingdom will be responsible for arranging their own indemnity or insurance for their participation in the study, as well as for compliance with local law applicable to their participation in the study.

12 REPORTING, PUBLICATIONS AND NOTIFICATION OF RESULTS

12.1 AUTHORSHIP POLICY

Ownership of the data arising from this study resides with the study team.

13 REFERENCES

Albuquerque, N., Guo, K., Wilkinson, A., Savalli, C., Otta, E., & Mills, D. (2016). Dogs recognize dog and human emotions. *Biology Letters*, *12*(1), 20150883. https://doi.org/10.1098/rsbl.2015.0883

Allen, Karen ; Blascovich, Jim PhD, and; Mendes, W. B. M. (n.d.). Cardiovascular Reactivity and the Presence of Pets, Friends,... : Psychosomatic Medicine. Retrieved May 31, 2018, from https://journals.lww.com/psychosomaticmedicine/Abstract/2002/09000/Cardiovascular_Reactivity_and_the_Presence_of.5.aspx

Baumeister, R. F., Campbell, J. D., Krueger, J. I., & Vohs, K. D. (2003). ROSENBERG SELF-ESTEEM SCALE. Retrieved from http://fetzer.org/sites/default/files/images/stories/pdf/selfmeasures/Self_Measures_for_Self-Esteem_ROSENBERG_SELF-ESTEEM.pdf

Braun, V., & Clarke, V. (2006). Braun, V. and Clarke, V. (2006) Using thematic analysis in psychol- ogy. Qualitative Research in Psychology, 3 (2). pp. 77-101. ISSN 1478-0887 Available from: http://eprints.uwe.ac.uk/11735. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Carlisle, G. K. (2014). Pet Dog Ownership Decisions for Parents of Children With Autism Spectrum Disorder. *Journal of Pediatric Nursing*, *29*(2), 114–123. https://doi.org/10.1016/j.pedn.2013.09.005

Chandler, S., Charman, T., Baird, G., Simonoff, E., Loucas, T., Meldrum, D., … Pickles, A. (2007). Validation of the social communication questionnaire in a population cohort of children with autism spectrum disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *46*(10), 1324–1332.

https://doi.org/10.1097/chi.0b013e31812f7d8d
Daly, B., & Morton, L. L. (2006). An investigation of human-animal interactions and empathy as related to pet preference, ownership, attachment, and attitudes in children. *Anthrozoös*, *19*(2), 113–127. https://doi.org/10.2752/089279306785593801
Hall, S. S., Wright, H. F., Mills, D. S., & Schmitz, C. (2016). What Factors Are Associated with Positive Effects of Dog Ownership in Families with Children with Autism Spectrum Disorder? The Development of the Lincoln Autism Pet Dog Impact Scale. https://doi.org/10.1371/journal.pone.0149736
Haskett, M. E., Ahern, L. S., Ward, C. S., & Allaire, J. C. (2006). Factor Structure and Validity of the Parenting Stress Index-Short Form. *Journal of Clinical Child & Adolescent Psychology*, *35*(2), 302–312. https://doi.org/10.1207/s15374424jccp3502_14
Kazdin, A. E. (2015). Methodological Standards and Strategies for Establishing the Evidence Base of Animal-Assisted Therapies. In *Handbook on Animal-Assisted Therapy* (pp. 377–390). Elsevier. https://doi.org/10.1016/B978-0-12-801292-5.00027-4
Leaf, J. B. (n.d.). *Handbook of social skills and autism spectrum disorder : assessment, curricula, and intervention*.
Lionetti, F., Mastrotheodoros, S., & Palladino, B. E. (2018). Experiences in Close Relationships Revised Child version (ECR-RC): Psychometric evidence in support of a Security factor. *European Journal of Developmental Psychology*, *15*(4), 452–463. https://doi.org/10.1080/17405629.2017.1297228
Marsa-Sambola, F., Williams, J., Muldoon, J., Lawrence, A., Connor, M., Roberts, C., … Currie, C. (2016). Sociodemographics of Pet Ownership among Adolescents in Great Britain: Findings from the HBSC Study in England, Scotland, and Wales. *Anthrozoös*, *29*(4), 559–580. https://doi.org/10.1080/08927936.2016.1228756
Mansfield A. K., Keitner, G. I. & Sheeran K, (2018). The Brief Assessment of Family Functioning Scale (BAFFS): a three-item version of the General Functioning Scale of the Family Assessment Device. Psychotherapy Research Vol 29, 8, 824-831.
Melson, G. F. (1990). Studying Children's Attachment to their Pets: A Conceptual and Methodological Review. *Anthrozoös*, *4*(2), 91–99. https://doi.org/10.2752/089279391787057297
Muldoon, J.C., Williams, J.M., Lawrence A. & Currie C.E. (2019). Differences in boys' and girls' attachment to pets in early-mid adolescence. *Journal of Applied Developmental Psychology*, 62, 5-58.
Muldoon, J.C., Williams, J.M., & Lawrence A. (2019). The nature and psychological impact of child/adolescent attachment to dogs compared with other companion animals. *Animals and Society,* 27, 55-74.
Nancy R. Gee, WALTHAM Centre for Pet Nutrition, James A. Griffin, Eunice Kennedy Shriver National Institute of Child Health and Human Development, Peggy McCardle, & Haskins Laboratories. (n.d.). Human–Animal Interaction Research in School Settings: Current Knowledge and Future Directions. *AERA Open*, *3*(3), 1–9. https://doi.org/10.1177/2332858417724346
Nimer, J., & Lundahl, B. (2007). Animal-Assisted Therapy: A Meta-Analysis, *203*, 225–238. https://doi.org/10.2752/089279307X224773doi.org/10.2752/089279307X224773
O'Haire, M. E. (2013). Animal-Assisted Intervention for Autism Spectrum Disorder: A Systematic Literature Review. *Journal of Autism and Developmental Disorders*, *43*(7), 1606–1622. https://doi.org/10.1007/s10803-012-1707-5
Ozsivadjian, A., Knott, F., & Magiati, I. (n.d.). Parent and child perspectives on the nature of anxiety in children and young people with autism spectrum disorders: a focus group study. *Autism*, *16*(2), 107–121. https://doi.org/10.1177/1362361311431703
People, Y. (2004). KIDSCREEN instruments, 2000–2751. Retrieved from www.kidscreen.org
Purewal, R., Christley, R., Kordas, K., Joinson, C., Meints, K., Gee, N., & Westgarth, C. (2017). Companion Animals and Child/Adolescent Development: A Systematic Review of the Evidence. *International Journal of Environmental Research and Public Health*, *14*(3), 234. https://doi.org/10.3390/ijerph14030234
Sedgewick, F., Hill, V., Yates, R., Pickering, L., & Pellicano, E. (2016). Gender Differences in the Social Motivation and Friendship Experiences of Autistic and Non-autistic Adolescents. *Journal of Autism and Developmental Disorders*, *46*(4), 1297–1306. https://doi.org/10.1007/s10803-015-2669-1
Silva, L. M. T., & Schalock, M. (2012). Autism parenting stress index: Initial psychometric evidence. Journal of Autism and Developmental Disorders, 42, 566-574.
Wright, H. F., Hall, S., Hames, A., Hardiman, J., Mills, R., Mills, D. S., & Mills, D. S. (2015). Acquiring a Pet Dog Significantly Reduces Stress of Primary Carers for Children with Autism Spectrum Disorder: A Prospective Case Control Study. *Journal of Autism and Developmental Disorders*, *45*(8), 2531–2540. https://doi.org/10.1007/s10803-015-2418-5

Appendix D Consent Forms and Information Sheets

PARENT CONSENT FORM
ASD and Dogs

Participant ID: ☐

[Insert contact details of person taking consent]

Please initial box

1. I confirm that I have read and understand the information sheet (version 1, 01 March 2019) and data protection information sheet (version 1 01 March 2019) for the above study. I have had the opportunity to consider the information and ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐

3. I understand that relevant sections of data collected during the study may be looked at by individuals from the regulatory authorities and from the Sponsor (the University of Edinburgh), or from the NHS organisation, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records. ☐

4. I agree to take part in a focus group discussion and for this discussion to be audio recorded (OPTIONAL) ☐

5. *I agree to my data being used for future ethically approved studies.* ☐

6. I agree to my GP being informed about my and my child's involvement in the study ☐

7. I agree to take part in the above study. ☐

8. I agree to my child taking part in the study ☐

Name of Participant	Date	Signature

Relationship to child

Name of Person taking consent	Date	Signature

1x original – into Site File; 1x copy – to Participant;

Participant Information Sheet
Man's Best Friend

The impact of having a dog present in families with children with ASD

You are being invited to take part in a research study. Before you decide whether or not to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish. Contact us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

.

What is the purpose of the study?
The study aims to investigate the difference between families who have a dog present and families who do not have a dog present. We are specifically recruiting families who have a child/children with Autism Spectrum Disorder (ASD).

Why have I been asked to take part?
You have been asked to take part as your child has been diagnosed with ASD.

Do I have to take part?
No, it is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. Deciding not to take part or withdrawing from the study will not affect the healthcare that you receive, or your legal rights.

What will happen if I take part?
You will be asked review this information sheet and be given an opportunity to ask any questions you have about the study. You will then be asked to complete a consent form indicating your consent to take part in the study. You will also be asked to consent on behalf of your child and if appropriate your child will be asked to consent to participation themselves also. Your child will be provided with ASD friendly information regarding the study and given the opportunity to ask questions before giving consent.

You will be asked to complete a questionnaire/interview about you and your family including questions about your child's social communication and relationships which will take around 15 minutes. Where possible data will be collected in a location which is familiar to you and/or your child.

Your child will also be asked to complete questionnaires about relationships and social communication which will up to 20 minutes. You may be present to support your child with this if you wish.

If you have a dog you may also be asked take part in a small focus group (up to 5 parents) where open ended questions will guide discussion about your experience of having a dog in your family. This will take approximately 30 minutes. These discussions will be audio recorded. This will take place on a later

date this will take approximately 40 minutes. You can choose to opt out of this part of the study and still take part in the questionnaires.

What are the possible benefits of taking part?
You may not get a direct benefit from taking part in this study but taking part in this study may help improve understanding of the impact that dogs have on children with ASD and their families. This information may contribute towards ASD interventions and care in the future.

What are the possible disadvantages and risks of taking part?
It is not thought that there are many disadvantages; however, it is possible that the research process may be considered an additional stressor to both parents and children with ASD alike. As this study is surplus to routine assessment additional travel and time taken to participate (approximately 1 hour) may also be considered a disadvantage. Children's engagement will be monitored on an ongoing basis. You and you child can withdraw from the study at any time. If you choose to withdraw no further information will gathered however the information you have provided will continued to be used for the purposes of the study. Should you experience any distress as a result of the research process please speak to the researcher and you can be signposted to support services or directed to your current service providers.

What happens when the study is finished?
At the end of the research we will store your anonymised data securely for up to 3 years to allow write up of the study and further statistical analysis in support of submission of the study for publication to scientific journals. Following this period the data will be deleted. There will be no follow-up or intervention as part of this study. You will be offered a copy of completed study once it is finished.

Will my taking part in the study be kept confidential?
The answers and information you provide will be processed and stored in accordance with Data Protection Law. All the information we collect during the course of the research will be kept strictly confidential and there are strict laws which safeguard your privacy at every stage. For more information about how we will use your information please see the Data Protection Information Sheet
Child and animal welfare issues are an important consideration for the study. If the researcher becomes aware of or is concerned about any risk of harm/abuse of children then appropriate procedures will be followed such as passing this information to other agencies. The researcher will speak to you about this before they pass on this information. If there are concerns regarding animal welfare you and your child can also be referred to the new Scottish SPCA Animal Guardians programme for further support.

To ensure that the study is being run correctly, we will ask your consent for responsible representatives from the Sponsor and NHS Institution to access your data collected during the study, where it is relevant to you taking part in this research. The Sponsor is responsible for overall management of the study and providing insurance and indemnity.

What will happen to the results of the study?
The study will be written up as an academic dissertation and may be submitted for publication to relevant journals. It may also be presented at conferences and

disseminated to relevant professionals. You will not be identifiable in any published results. You will have the opportunity to review the study prior to its publication. You can also be provided with a copy of the study if you wish, this can be sent to you by post.

Who is organising the research and why?
The research is in partial fulfilment of the University of Edinburgh Doctorate in Clinical Psychology course.

Who has reviewed the study?
All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee. A favourable ethical opinion has been obtained from NHS Tayside REC. NHS management approval has also been obtained.
If you have any further questions about the study please contact Lianne White on: 01382 204004 or email: l.white10@nhs.net **or Prof Jo Williams on: 0131 651 6339 or email: jo.williams@ed.ac.uk**

If you would like to speak to someone independent of the study please contact Prof Matthias Schwannauer, Head of the School of Health in Social Sciences, University of Edinburgh

If you wish to make a complaint about the study please contact NHS Tayside:

The NHS Tayside Complaints and Feedback Team is based at:

Complaints and Feedback Team
Ninewells Hospital
Dundee
DD1 9SY
Telephone: 0800 027 5507
Email: feedback.tayside@nhs.net

Thank you for taking the time to read this information sheet.

THE UNIVERSITY of EDINBURGH

NHS Tayside

Child Consent Form

We are from the University of Edinburgh and we are asking you to be in a research study. We do research studies to learn more about how the world works and why people act the

way they do. In this study, we want to learn about Autism, your family and your dog, if you

have one.

What we are asking you to do:
We would like to ask you to answer some questions on paper about you and your family which will take around 20 minutes. You can skip any question if it makes you uncomfortable.

Do I have to be in this study?
You do not have to take part in this study. It is up to you. You can say no now or you can even change your mind later. No one will be upset with you if you decide not to be in this study. You will not miss out by deciding not to take part.

Will being in this study hurt or help me in any way?
Being in this study will bring you no harm. There are no direct benefits to you for participating in this study. It will help us learn more about autism, families and dogs.

What will you do with the information about me?
We will be very careful to keep your answers to the questions private. Before and after the study we will keep all information we collect about you locked up and password protected.

If you want to stop doing the study, contact Lianne White at 01382 204004 or l.white10@nhs.net . If you choose to stop before we are finished, any answers you already gave will be destroyed. If you decide that you don't want your answers in the study but you already completed them, just let Lianne White know.

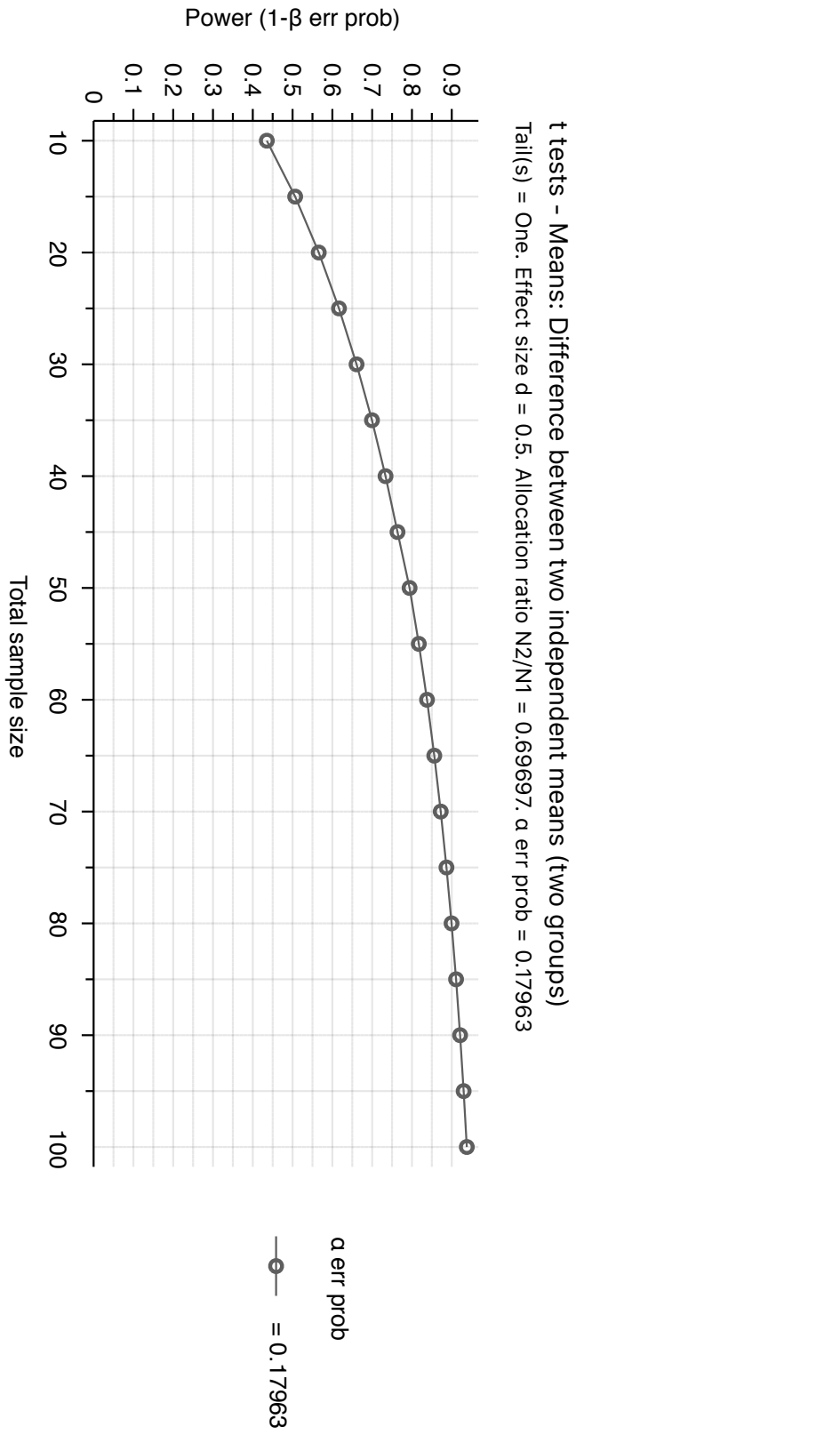
If you have questions about the study, contact:
Lianne White on: 01382 204004 or email: l.white10@nhs.net
Prof Jo Williams on 0131 651 339 or email: jo.williams@ed.ac.uk

I understand the information on this form ☐

I have asked any questions I wanted to about the study ☐

I want to take part in the study ☐

Appendix E: G-Power Plot



Appendix F: Measures

Child Measures

*Only to be given to child with pet.

SAPS

Choose the number that fits with your relationship with your pet.

Strongly Agree=1 Agree=2 Disagree=3 Strongly Disagree=4

	Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**
I don't really like animals	**1**	**2**	**3**	**4**
I spend time every day playing with my pet	**1**	**2**	**3**	**4**
I have sometimes talked to my pet and understood what it was trying to tell me	**1**	**2**	**3**	**4**
I love pets	**1**	**2**	**3**	**4**
I talk to my pet quite a lot	**1**	**2**	**3**	**4**
My pet makes me feel happy	**1**	**2**	**3**	**4**
I consider my pet to be a friend	**1**	**2**	**3**	**4**
My pet knows when I'm upset and tries to comfort me	**1**	**2**	**3**	**4**
There are times I'd be lonely without my pet	**1**	**2**	**3**	**4**

Kids-Screen 10

***How are you? How do you feel? This is what we would like you to tell us.**

Please read every question carefully. What answer comes to your mind first? Choose the box that fits your answer best and cross it.

Remember: This is not a test so there are no wrong answers. It is important that you answer all the questions and also that we can see your marks clearly. When you think of your answer please try to remember the last week.

Have you felt fit and well?	Not at all	Slightly	Moderately	Very	Extremely
Have you felt full of energy	Never	Seldom	Often	Very Often	Always
Have you felt sad?	Never	Seldom	Often	Very Often	Always
Have you felt lonely?	Never	Seldom	Often	Very Often	Always
Have you had enough time for yourself?	Never	Seldom	Often	Very Often	Always
Have you been able to do the things that you want to do in your free time?	Never	Seldom	Often	Very Often	Always
Have your parent(s) treated you fairly?	Never	Seldom	Often	Very Often	Always
Have you had fun with your friends?	Never	Seldom	Often	Very Often	Always

Have you got on well at school?	Not at all	Slightly	Moderately	Very	Extremely
Have you been able to pay attention?	Never	Seldom	Often	Very Often	Always

Rosenberg Scale:

Instructions

Below is a list of statements dealing with your general feelings about yourself. Please indicate how strongly you agree or disagree with each statement.

1. On the whole, I am satisfied with myself.	Strongly Agree	Agree	Disagree	Strongly Disagree
2. At times I think I am no good at all.	Strongly Agree	Agree	Disagree	Strongly Disagree
3. I feel that I have a number of good qualities.	Strongly Agree	Agree	Disagree	Strongly Disagree
4. I am able to do things as well as most other people.	Strongly Agree	Agree	Disagree	Strongly Disagree
5. I feel I do not have much to be proud of.	Strongly Agree	Agree	Disagree	Strongly Disagree

6. I certainly feel useless at times.	Strongly Agree	Agree	Disagree	Strongly Disagree
7. I feel that I'm a person of worth, at least on an equal plane with others.	Strongly Agree	Agree	Disagree	Strongly Disagree
8. I wish I could have more respect for myself.	Strongly Agree	Agree	Disagree	Strongly Disagree
9. All in all, I am inclined to feel that I am a failure.	Strongly Agree	Agree	Disagree	Strongly Disagree
10. I take a positive attitude toward myself.	Strongly Agree	Agree	Disagree	Strongly Disagree

Brief Family functioning Questionnaire

Circle the response that reflects your experience of family life. Try not to spend too much time thinking about each statement but respond as quickly and as honestly as you can.

We can express feelings to each other	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
We don't get along with each other	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
We confide in each other	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**

Parent Measures

Demographic Information
Parents Age
Parents Gender
Level of Education: Primary, Secondary, University
Parents Occupation
Number of Children within family with a diagnosis of ASD
Your Child
Child's Age
Childs Gender
Age Diagnosis was given
Support Services involved (if any)
If you do not have a dog please ignore remaining questions and proceed to parents questionnaires section.

Your Dog: Dog Breed
How long has the family had the dog
How would you describe your dogs temperament: Placid, Playful, Energetic, Irritable
Why did you choose to get the dog

*Only to be given to participant with pet

Lincoln Autism Pet Dog Impact Scale (LAPDIS)

The following scale assesses the impact your pet dog has on your child. Please respond with to the questions below using the numbers indicated for how much you agree or disagree with the statements.

1 = Strongly Agree, 2 = Agree, 3 = Strongly Disagree, 4 = Strongly Disagree

Adaptability

1 My child is more likely to tolerate changes in his/her normal routine if he/she is with the dog

2 My child shows more independence in his/her self-care behaviours if he/she is with the dog (e.g., is better at washing, or dressing when the dog is there)

3 My child seems happier in him/herself when he/she is with the dog

4 My child is more affectionate towards human family members when he/she is with the dog

5 My child is less afraid of other dogs when he/she is with our dog

6 My child is less likely to have tantrums or meltdowns when he/she is with the dog

7 My child is able to pay attention on an imposed task (i.e., something you have asked them to do) when he/she is with the dog

8 My child is less likely to engage in repetitive behaviours (e.g., hand flapping, pacing) when he/she is with the dog

9 My child is more willing to engage in new activities or experiences if he/she is with the dog

10 My child is more likely to show empathy for another family member (e.g., instinctively feel sad for them, rather than being prompted or instructed by another) when he/she is with the dog

11 My child shows more use of imagination when engaging in play with other people when he/she is with the dog (e.g., will follow the lead of others and engage in the 'spirit' of the game)

12 My child is more willing to go out for a walk with other family member when he/she is with the dog

13 My child shows more independence within the home if he/she is with dog (e.g., would be more likely to off into another room away from family member if the dog is with him/her)

14 As a parent I feel I am more able to have time to myself when my child is with the dog

15 Family activities are more enjoyable when the child is with the dog

16 My child recovers from tantrums or meltdowns more quickly when the dog is there

17 My child is more likely to show imagination in his/her play (e.g., it's not always the same pattern of play or game) when he/she is with the dog

Social Skills

18 My child is less likely to engage in an appropriate social interaction with a new or unfamiliar person if he she is with the dog

19 My child is less likely to communicate his/her immediate needs to a family member (either verbally or non-verbally) when he/she is with the dog

20 We have less flexibility in our routines when the child is with the dog

21 My child is less likely to engage in a social interaction with another family member when he/she is with the dog

22 My child is more hesitant to interact with other dogs when he/she is out with our dog

23 My child is less likely to communicate his/her feelings to another family member when he/she is with the dog

24 My child is less likely to co-operate with another family member if he/she is with the dog

Conflict Management

25 My child is more likely to get into conflict with his/her siblings when he/she is with the dog

26 We are less able to get out of the house to complete routine tasks when the child is with the dog

27 We have more family arguments and disagreements when the child is with the dog

28 My child shows more running off or bolting behaviour when he/she is with the dog

*Only give to participants with pets.

The Lexington Attachment to Pets Scale (LAPS)

Instructions: Please take a few minutes to fill in this questionnaire based on the animal you have lived with the longest.

Answer using the follow criteria: Strongly disagree = 0; Somewhat disagree = 1; Somewhat agree = 2; Strongly agree = 3.

1. My pet means more to me than any of my friends

2. Quite often I confide in my pet

3.I believe that pets should have the same rights and privileges as family members

4. I believe my pet is my best friend

5. Quite often, my feelings towards people are affected by how they react to my pet

6. I love my pet because he/she is more loyal to me than most of the people in my life

7. I enjoy showing other people pictures of my pet

8. I think my pet is just a pet

9. I love my pet because it never judges me

10. My pet knows when I'm feeling bad

11. I often talk to other people about my pet

12. My pet understands me

13. I believe that loving my pet helps me stay healthy

14. Pets deserve as much respect as humans do

15. My pet and I have a very close relationship

16. I would do almost anything to take care of my pet

17. I play with my pet quite often

18. I consider my pet to be a great companion

19. My pet makes me feel happy

20. I feel that my pet is a part of my family

21. I am not very attached to my pet

22. Owning a pet adds to my happiness

23. I consider my pet to be a friend

Kidscreen 10-Parent Version

Please answer the following questions to the best of your knowledge, ensuring that the answers you give reflect the perspective of your child. Please try to remember your child's experiences over the last week.

Not at all=1 Slightly=2 Moderately=3 Very=4 Extremely=5

1. Has your child felt fit and well?

2. Has your child felt full of energy?

3. Has your child felt sad?

4. Has your child felt lonely?

5. Has your child had enough time for him/herself?

6. Has your child been able to do the things that he/she wants to do in

his/her free time?

7. Has your child felt that his/her parent(s) treated him/her fairly?

8. Has your child had fun with his/her friends?

9. Has your child got on well at school?

10. Has your child been able to pay attention?

Finally, In general how would your child rate their health?

Excellent ____ Very Good ___ Good ____ Fair _____ Poor _____

SCQ
Name of Child …….. Date of Birth …….

Name of Person Completing Form …….

Date of Completing Form ……

Thank you for taking a few minutes to complete this questionnaire. A few questions ask about several related types of behaviour; please tick yes if **any** one of these were present. Although you may be uncertain about whether some behaviours were present or not, please do answer 'yes' or 'no' to every question on the basis of what you think.

		YES	NO
1.	Is he/she now able to talk using short phrases or sentences?	☐	☐
	If NO, please proceed to Question 9		
2.	Does he/she ever talk with you just to be friendly (rather than to get something)?	☐	☐
3.	Can you now have a to and fro "conversation" with him/her that involves taking turns or building on what you have said?	☐	☐
4.	Has he/she ever used odd phrases or said the same thing over and over in almost exactly the same way? That is, does he/she repeat either phrases he/she has heard other people use or ones that he/she has made up?	☐	☐
5.	Has he/she ever used socially inappropriate questions or statements? For example, has he/she ever regularly asked personal questions or made personal comments at awkward times?	☐	☐
6.	Does he/she ever get her pronouns the wrong way round: for instance saying you or he/she instead of I?	☐	☐
7.	Has he/she ever used words that he/she seems to have invented or made up; or ever put things in odd, indirect or metaphorical ways (for example, saying "hot rain" for steam")?	☐	☐
8.	Has he/she ever said the same thing over and over in exactly the same way, or insisted on you saying the same things over and over again?	☐	☐

		YES	NO
9.	Has he/she ever had things that he/she seemed to have to do in a very particular way or order, or things that he/she insisted that you do in a particular way?	☐	☐
		☐	☐

10. Does his/her facial expression usually seem appropriate to the particular situation, as far as you can tell?

11. Has he/she ever used your hand like a tool, or as if it were part of his/her own body (e.g. pointing with your finger, putting your hand on a doorknob to get you to open the door)? ☐ ☐

12. Has he/she ever had any interests that preoccupy him/her and might seem odd to other people (e.g. traffic lights, drainpipes or timetables)? ☐ ☐

13. Has he/she ever seemed to be more interested in part of a toy or an object as it was intended? ☐ ☐

14. Has he/she ever had any special interests that were **unusual** in their intensity but otherwise appropriate for his/her age and peer group (e.g. trains, dinosaurs)? ☐ ☐

15. Has he/she ever seemed to be **unusually** interested in the sight, feel, sound, taste or smell of things or people? ☐ ☐

16. Has he/she ever had any mannerisms or odd ways of moving his/her hands or fingers, such as flapping or moving his/her fingers in front of his/her eyes? ☐ ☐

17. Has he/she ever had any complicated movements of his/her Whole body, such as spinning or repeatedly bouncing up and down? ☐ ☐

18. Does he/she ever injure himself/herself deliberately, such as by biting his/her arm or banging his/her head? ☐ ☐

19. Are there any objects (**other** then a soft toy or comfort blanket) that he/she **has** to carry around with her? ☐ ☐

20. Does he/she have any particular friends or a best friend? ☐ ☐

For some behaviours, it is most helpful to focus on the time period between the 4th birthday and 5th birthday. You may find it easier to remember how things were at that time by fixing it in your mind in relation to key happenings such as starting school, moving house, Christmas time, or any events that are particularly memorable for you as a family.

13 **YES** **NO**

21. When he/she was 4 to 5 did he/she ever **spontaneously** copy you (or other people) or what you were doing (such as hoovering, gardening, mending things)? ☐ ☐

22. When he/she was 4 to 5 did he/she ever spontaneously point ☐ ☐

at things around him/her just to show you things (not because he/she wanted them)?

23. When he/she was 4 to 5 did he/she ever use gestures, other than pointing or pulling your hand, to let you know what he/she wanted? ☐ ☐

24. When he/she was 4 to 5 did he/she nod his/her head to mean "yes"? ☐ ☐

25. When he/she was 4 to 5 did he/she shake his/her head to mean "no"? ☐ ☐

26. When he/she was 4 to 5 did he/she usually look at you directly in the face when doing things with you or talking with you? ☐ ☐

27. When he/she was 4 to 5 did he/she smile back if someone smiled at him/her? ☐ ☐

28. When he/she was 4 to 5 did he/she ever show you things that interested him/her to engage your attention? ☐ ☐

29. When he/she was 4 to 5 did he/she ever offer to share things other than food with you? ☐ ☐

30. When he/she was 4 to 5 did he/she ever seem to want you to Join in his/her enjoyment of something? ☐ ☐

31. When he/she was 4 to 5 did he/she ever try to comfort you if You were sad or hurt? ☐ ☐

32. Between the ages of 4 to 5 when he/she wanted something or wanted help, did he/she look at you and use gestures with sounds or words to get your attention? ☐ ☐

YES **NO**

33. Between the ages of 4 to 5 did he/she show a normal range of facial expression? ☐ ☐

34. When he/she was 4 to 5 did he/she ever spontaneously join in and try to copy actions in social games – such as the Mulberry bush or The Farmer's in his Den? ☐ ☐

35. When he/she was 4 to 5 did he/she play any pretend or make believe games? ☐ ☐

36. When he/she was 4 to 5 did he/she seem interested in other children of approximately the same age whom he/she did no know? ☐ ☐

37. When he/she was 4 to 5 did he/she respond positively when another child approached him/her? ☐ ☐

38. When he/she was 4 to 5 if you came into a room and started talking to him/her without calling his/her name, did he/she usually look up and pay attention to you? ☐ ☐

39. When he/she was 4 to 5 did he/she ever play imaginative games with another child in such a way that you could tell they understood what each other was pretending? ☐ ☐

40. When he/she was 4 to 5 did he/she play co-operatively in games that need some form of joining in with a group of other children, such as hide and seek or ball games? ☐ ☐

Parental Stress Scale

The following statements describe feelings and perceptions about the experience of being a parent. Think of each of the items in terms of how your relationship with your child or children typically is. Please indicate the degree to which you agree or disagree with the following items by placing the appropriate number in the space provided.

1 = Strongly disagree 2 = Disagree 3 = Undecided 4 = Agree 5 = Strongly agree

1	I am happy in my role as a parent	
2	There is little or nothing I wouldn't do for my child(ren) if it was necessary.	
3	Caring for my child(ren) sometimes takes more time and energy than I have to give.	
4	I sometimes worry whether I am doing enough for my child(ren).	
5	I feel close to my child(ren).	
6	I enjoy spending time with my child(ren).	
7	My child(ren) is an important source of affection for me.	
8	Having child(ren) gives me a more certain and optimistic view for the future.	
9	The major source of stress in my life is my child(ren).	

10	Having child(ren) leaves little time and flexibility in my life.	
11	Having child(ren) has been a financial burden.	
12	It is difficult to balance different responsibilities because of my child(ren).	
13	The behaviour of my child(ren) is often embarrassing or stressful to me.	
14	If I had it to do over again, I might decide not to have child(ren).	
15	I feel overwhelmed by the responsibility of being a parent.	
16	Having child(ren) has meant having too few choices and too little control over my life.	
17	I am satisfied as a parent	
18	I find my child(ren) enjoyable	

Brief Family functioning Questionnaire

Circle the response that reflects your experience of family life. Try not to spend too much time thinking about each statement but respond as quickly and as honestly as you can.

We can express feelings to each other	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
We don't get along with each other	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
We confide in each other	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**