Case Study 1: An Evidence-Based Practice Review Report

Theme: Interventions implemented by parents.

Does having a pet dog effectively reduce children and young people's levels of stress or anxiety? A systematic review of the literature.

1. Summary

With NHS Digital (2021) reporting that one in six 5 to 16-year olds have a probable mental health disorder it demonstrates the significant need for professionals and families to find alternative ways to reduce mental health difficulties arising in children and young people (CYP). This systematic literature review explored if having a pet dog is effective at reducing CYP's levels of stress or anxiety. Four databases were searched including Medline, PsycINFO, ERIC and Web of Science and 6 papers were selected for full review. Gough's (2007) Weight of Evidence (WoE) Framework was used to assess the quality and relevance of the studies, together with Gersten et al.'s (2005) and Joanna Briggs Institute's (JBI) (2017) coding protocols. The findings displayed a range of small to large effect sizes, with some also reporting no effects. Although generally the studies indicated a promising reduction in levels of self-reported anxiety symptoms, or biological measures of cortisol levels, there were many weaknesses in the methodology which have been reflected in the in-depth WoE review. Therefore, the evidence should be considered very carefully, and the limitations of the studies and suggested improvements for future research have been deliberated.

2. Introduction

2.1. Stress and anxiety

Stress has been defined as consisting of three elements; a demanding environmental stimulus, threat or challenge causing some pressure or strain, the perception that this stimulus is overwhelming or you have limited resources to meet the challenge, and an automatic response that is measurable. Stress ultimately helps to enable homeostasis and survival by triggering adaptive bodily responses to be able to overcome challenges (Goodnite, 2014). Stress may be triggered from environmental factors such as family conflict, isolation or not being able to meet a work deadline, or physical factors such as illness or being uncomfortably hot, cold or hungry (Bystritsky & Kronemyer, 2014). Everyone will react and respond differently to these stress triggers based on their emotional, cognitive and physiological resources (Franklin et al. 2012).

Anxiety can be viewed as a range of narrower mental or psychological responses compared to stress which can be more widespread. It is based on fear, usually involving a perception of a stimulus as a threat, such as an impending event or something causing uncertainty. This typically causes individuals to have feelings of excessive worry, nervousness or apprehension together with physical bodily responses such as mental tension and an increased heart rate to prepare individuals to either fight, flight or flee the threat. It has been proposed that stress typically involves focusing on past or present threats whereas anxiety involves those in the near or distant future but

with each, the individual feels the affects in the present moment (Bystritsky & Kronemyer, 2014).

There is confusion within the research literature if stress and anxiety are distinct entities or in-fact two overlapping phenomena with intertwined brain processes. It is possible for individuals to have more stress and less anxiety and vice versa but they can affect and exacerbate each other, having a reciprocal relationship (Franklin et al. 2012). Bystritsky & Kronemyer (2014) termed both as counterpart elements within a wider stress/anxiety complex which both occur on a spectrum. From a neurobiological stance, both stress and anxiety produce a habituated 'protective alarm' response stemming from the hypothalamic-pituitary-adrenal (HPA) axis (Lucassen et al. 2014). Cortisol, a steroid hormone, is said to be a central biomarker of the HPA axis (Fries et al. 2009), and if levels of cortisol become too high from anxiety and/or stress, a range of physical and mental health difficulties may emerge or be exacerbated (McEwen, 2008). Within this focused systematic literature review, most outcome measures only included parent and self-reports of stress or anxiety symptoms but two studies also measured levels of cortisol in CYP.

2.2. Autism-Assistant dogs, service dogs and pet dogs.

The studies in this review have either focused on the impacts of Autism-assistant dogs (AAD), service dogs or pet dogs within the family home. Extensive research literature has reported individuals have strong emotional bonds with dogs which are certainly an extremely popular choice of pet across the world. Many individuals consider their dogs to be a family member who can

provide just as much love, protection and companionship as a human relative (Archer, 1997).

Within the literature, an AAD and a service dog seem to be used interchangeably, with the dogs receiving similar training to support CYP with Autism, which two studies in this review include. Typically, the dog receives training to support children with Autism who are at risk of fleeing in public. This occurs by working as a triad, whereby the child is connected via a belt to the dog's vest and the caregiver holds the leash. Additionally, they can be trained to follow commands, remain calm in chaotic environments to aim to improve CYP's social behaviours and perform tasks to increase CYP's independence. The dog is carefully matched to the individual CYP's temperament before being provided to the family, but this is often at a high cost and can involve being on a waiting list for up to five years (Viau et al., 2010; Tseng, 2022). A review by Sprod and Norwood (2017) reported that through participating in AAD programmes CYP's safety and social communication skills can be enhanced which, in turn can increase parental confidence and reduce parenting stress.

2.3 Psychological Theory

Attachment theory (Bowlby, 1988) has been suggested as a convincing psychological basis underpinning the relationship between dogs and changes in CYP's wellbeing. This theory has been applied to many other mammalian species and therefore has been proposed that attachments likely develop not just within species but also across species (Kwong & Bartholomew, 2010). CYP could be said to 'attach' themselves to their pet dog in addition to their

primary caregiver(s), and see them as 'secure base', feeling able to explore their environment and play with others knowing they are nearby, as well as feeling confident they will be comforted by their pet if they feel distressed (Meehan et al., 2017).

Some studies have shown how powerful CYP's relationship can be with dogs, such as children often ranking their pets higher than people in their life to help them to feel calm, raise their self-esteem and keep secrets (McNicholas & Collis, 2001). Kertes et al. (2017) also reported that the presence of a pet dog whilst CYP were undertaking a stressful task significantly buffered their ratings of stress compared to those who were alone or with a parent nearby. Beetz et al. (2015) included the same stressful task and found self-reports levels of stress were conversely not affected by the presence of a dog, caring adult or toy dog, but they did find the dog group had significantly lower levels of cortisol. They also discovered there was a significant negative correlation between the amount the child stroked the dogs and stress levels.

From a physiological stance, it has been proposed that increased interactions with dogs such as stroking can increase oxytocin levels, which in turn can reduce cortisol and consequently feelings of stress and anxiety. It has therefore been proposed that long term exposure with pet dogs compared to single encounters will be associated with more long-lasting impacts on wellbeing (Beetz et al., 2012). These aforementioned studies highlight the value of having a combination of self-report and biological outcome measures, as well as looking at additional factors, such as length of time and attachment with the dog, which may be having a mediating effect. It is important to note

however, that much of the research in this field is collected from solely parent self-reports and based on small homogenous samples with limited validity and reliability to be able to determine causality.

2.4 Rationale and relevance to Educational Psychology (EP) practice

Despite research investigating how dogs can improve the quality of life of children and adults being an emerging field, there are no currently systematic reviews focusing on the effects of dogs who permanently live in a home environment, especially dogs with no specialist training. Instead, reviews have predominantly focused on the impact of children with an Autism diagnosis participating in mostly short-term assistance or therapy programmes with highly trained dogs (Sprod & Norwood, 2017; Nimer & Lundahl, 2007). By focusing on dogs in the home, it means that caregivers can be more closely involved with the intervention, rather than their child visiting an external therapist or dog handler, making it more relevant for Educational Psychologist's (EPs) to possibly advise parents or carers on during consultation work. Moreover, studies which are carried out in natural home environment will have increased ecological validity meaning the results may be more generalisable to situations typical of everyday life compared to interventions that may take place in an unfamiliar or clinical setting.

The majority of studies have measured outcomes on parental stress or improvements in CYP's behaviours and social communication skills, especially in families with a child with Autism. This review therefore aimed to focus on a less researched outcome, of levels of stress or anxiety within any CYP, with or without a diagnosis, to allow findings to be generalisable to a larger range of individuals.

NHS digital (2021) have reported one in six 5 to 16-year olds have a probable mental health disorder, an increase from one in nine, in 2017. A meta-analysis involving over 80,000 CYP found the prevalence of anxiety symptoms in particular have doubled globally since the pandemic struck and impacts are reported to have disproportionately affected girls, older adolescents and those with Special Educational Needs and Disabilities (Racine et al., 2021; Sideropoulos et al., 2022). Research into the long-term impacts of early-onset anxiety has revealed increased risks of educational underachievement and truanting behaviour, diagnoses of anxiety and depression in adulthood and later substance misuse (Chiu et al., 2016; Woodward & Fergusson, 2001). This highlights the need for families and professionals such as EPs to intervene earlier and find alternative ways of helping to reduce stress or anxiety arising in CYP, before escalating into a diagnosed mental health disorder.

2.5 Review Question

Does having a pet dog at home effectively reduce children and young people's levels of stress or anxiety? A systematic review of the literature

3. Critical Review of the Evidence

3.1 Literature Search

A systematic literature search was carried out in December 2022 for journal articles using four databases: PsycINFO, Medline, ERIC and Web of Science. PsycINFO was chosen due to its psychological focus, Medline due to including more biomedical and health journals which were relevant for the outcomes of stress and anxiety, ERIC for its focus on CYP and education and Web of

Science to access a wider range of literature across multiple disciplines. The search terms used to find relevant studies are displayed in Table 1.

Table 1: *Search terms* [1]

1. Intervention type	2. Population	3. Outcome measure	4. Context
(Dog OR Animal therapy OR Pet therapy OR HAI OR Animal-assistance interventions OR AAI)	(Child* OR Teen* OR Adolescen* OR Young people OR ASD OR ASC OR Autism OR Asperger's)	(Stress OR anxiety)	(Parent* OR Carer* OR home OR home-based OR Family)

3.2 Inclusion and Exclusion Criteria

Within the initial search the databases collectively returned 794 studies. These were screened by titles and abstract against the inclusion and exclusion criteria (see Table 2) and a total of 785 were removed, including 7 duplicates. This left 9 articles for full text screening and a further 3 were excluded (See Appendix A for rationales) leaving 6 remaining studies (See Figure 1). The studies included in the final review are listed in Table 3 and more in-depth information about the studies can be found in a 'Mapping the Field' table in Appendix B.

[1] *Note: 'OR' was used to combine various search terms to expand findings. The use of an asterisk as a truncation was included to search words of similar endings e.g. 'Teen' or 'Teen(age)' or 'Teen(ager)' and plurals of words. The four search terms were combined in the databases using 'AND' to find studies including all search terms. HAI is an acronym for 'Human animal interaction.*

Table 2: *Inclusion and Exclusion criteria*

	Inclusion	Exclusion	Rationale(s)
1. Study design	Experimental design Cross sectional studies Cohort studies Studies don't involve a stressor task Comparison group doesn't own a dog	Qualitative data Systematic reviews Studies involve a stressor task Comparison group owns a dog	Due to the nature of this research question not being as feasible or ethical to manipulate variables, study design criterion was less strict, as long as it included quantitative data to discover potential correlations. Reviews of secondary data were excluded due to requiring original empirical research. This review was interested in longer term impacts of stress or anxiety, rather than short term impacts during experimental tasks
2. Settings	Involves the animal living at the home environment	Unfamiliar dog in any other setting outside of the home e.g. lab, school, hospital, dentist etc.	This review aims to look at natural, real-life settings and something parents/carers can more easily put in place to support their children.
3. Participants	0-17 years of any demographic No or any diagnosis	Adults	This review aims to explore potential benefits of any CYP for EPs to possibly advise parents/carers.

4. Intervention	Have a dog living at home (This can include a therapy, AAD or service dog)	Interventions with a dog outside of the home Studies don't involve a dog .	This review aims to look at more natural based interventions that would involve parents/carers. .
5. Outcome measures	The study has at least one outcome measuring stress or anxiety in CYP	The study doesn't include outcomes measuring either stress or anxiety Only measures family or parental stress or anxiety	This review aims to evaluate the effectiveness of a having a pet dog on levels of stress or anxiety in CYP
6. Geographical context and language	Studies can be from any geographical location but are written in English.	Studies not written in English	To ensure researcher understanding

Figure 1: *Diagram of screening selection process in accordance with PRISMA statement recommendations (Page et al., 2021)*

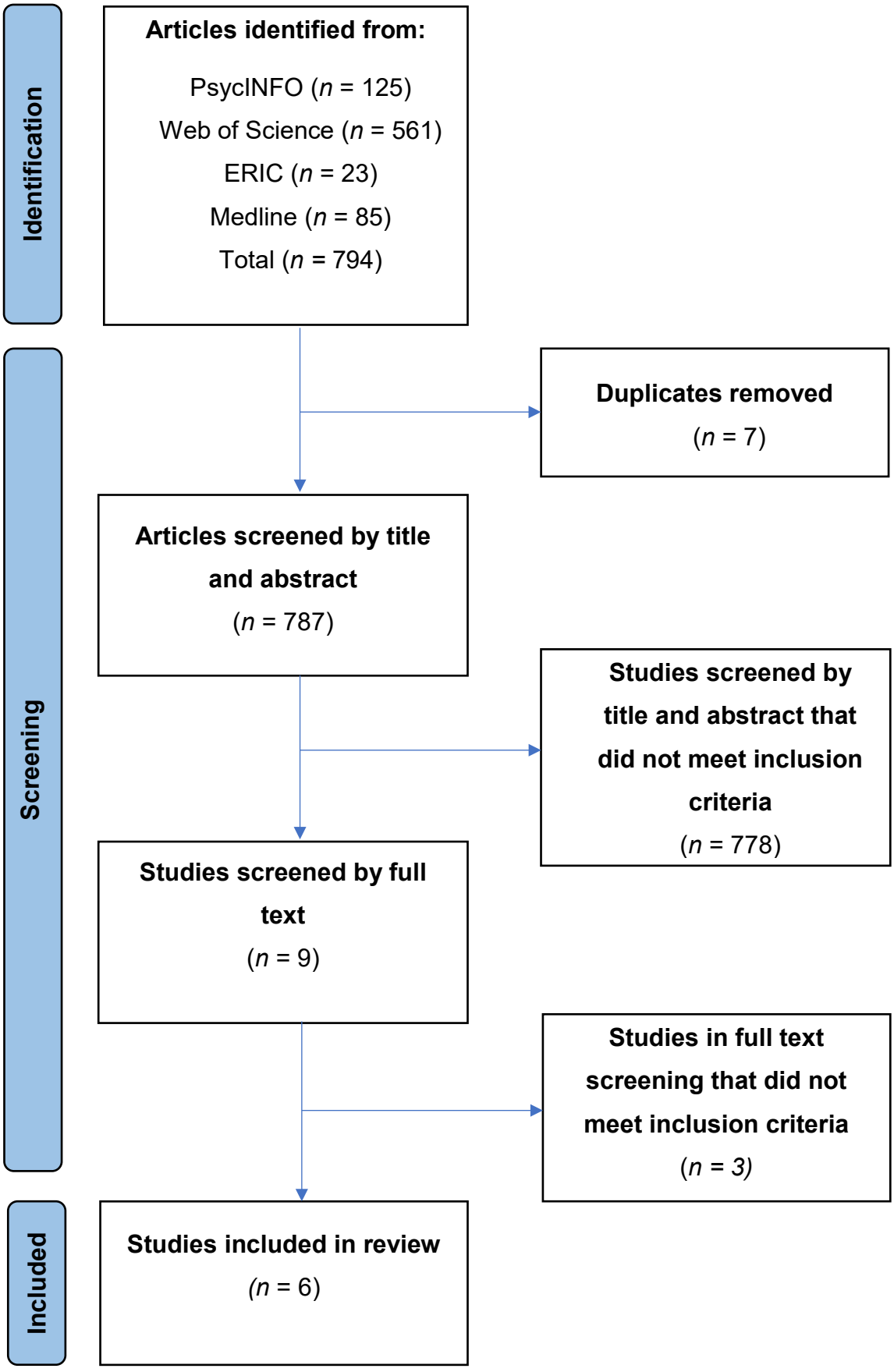

Table 3: *List of included studies*

	Full references of included studies
1	Aggarwal, S., Aggarwal, R., Sodhi, M. K., & Aggarwal, S. (2022). Psycho-Social Effects of Pet Dog Ownership on Mentally Challenged Children. *Cureus Journal of Medical Science, 14*(6), e26389. https://doi.org/10.7759/cureus.26389.
2	Gadomski, A., Scribani, M.B., Krupa, N., Jenkins, P., Nagykaldi, Z., & Olson, A.L. (2015) Pet Dogs and Children's Health: Opportunities for Chronic Disease Prevention? *Preventing Chronic Disease, 12*, e205. https://doi.org/10.5888/pcd12.150204.
3	Gadomski, A., Scribani, M.B, Tallman, N., Krupa, N., Jenkins, P., & Wissow, L. S. (2022) Impact of Pet Dog or Cat Exposure during Childhood on Mental Illness during Adolescence: A Cohort Study. *BMC Pediatrics*, 22(1), 572. https://doi.org/10.1186/s12887-022-03636-0.
4	Tseng, A. (2022). Brief Report: Above and Beyond Safety: Psychosocial and Biobehavioral Impact of Autism-Assistance Dogs on Autistic Children and their Families. *Journal of Autism and Developmental Disorders, 53*(1): 468-483.https://doi.org/10.1007/s10803-021-05410-0.
5	Viau, R., Arsenault-Lapierre, G., Fecteau, S., Champagne, N., Walker, C-D., & Lupien, S. (2010). Effect of Service Dogs on Salivary Cortisol Secretion in Autistic Children. *Psychoneuroendocrinology, 35*(8), 1187-1193.https://doi.org/10.1016/j.psyneuen.2010.02.004.
6	Wright, H., Hall, S., Hames, A. Hardiman, J., Mills, R., PAWS Project Team & Mills, D. (2015). Pet Dogs Improve Family Functioning and Reduce Anxiety in Children with Autism Spectrum Disorder. *Anthrozoos, 28*(4),611–24. https://doi.org/10.1080/08927936.2015.1070003.

3.3 Weight of Evidence

Using Gough's (2007) Weight of Evidence (WoE) framework the six studies included in this systematic review were judged for Methodological quality (WoE A), Methodological Relevance (WoE B) and Topic Relevance (WoE C). For WoE A, Gersten et al.'s (2005) coding protocol was used to assess four studies with a quasi-experimental design with small adaptations for the purpose of this review question (See Appendix C) and the Joanna Briggs Institute (JBI) critical appraisal checklist was used for two cross-sectional and cohort design studies.

Please refer to Appendix D for one example of a quasi-experimental study which was assessed using Gersten et al.'s (2005) coding protocol, Appendix E for one example of a cross-sectional study which was assessed using a JBI protocol and Appendix F for WoE A scores for all studies. For WoE B, Petticrew and Roberts' (2003) typology was used to judge the appropriateness of the research designs for addressing this particular 'effectiveness' review question. See Appendix G for WoE B criteria and ratings. With regards to WoE C, the criterion was decided by the author of this review to judge how well the studies answer the review question which can be found in Appendix H along with the individual scores. The scores for each studies WoE A, B and C were then averaged together to provide an overall weighting (WoE D) with can be seen in Table 4.

Table 4: *Weight of Evidence (WoE) ratings for included studies* [2]

Study	WoE A	WoE B	WoE C	WoE D
Aggarwal et al. (2022)	1	2	1.8	1.6 (Low)
Gadomski et al. (2015)	2	2	2.2	2.1 (Medium)
Gadomski et al. (2022)	3	2	2.7	2.6 (High)
Tseng (2022)	1	2	1.5	1.5 (Low)
Viau et al. (2010)	1	2	1.7	1.6 (Low)
Wright et al. (2015)	2	2	2.3	2.1 (Medium)

[2] *Minimum score of 1 and maximum of 3. Low rating = score of 1.6 or less, medium rating = scores 1.7-2.5, High rating = scores of 2.5 or above.*

3.31 Participants

A total of 969 participants took part in relevant anxiety or stress related measures in the studies. They ranged from 5-11 participants in the smallest study (Tseng, 2022) to 643 in the largest (Gadomski et al., 2015). As part of the inclusion criteria, all ages were included until CYP legally became an adult. Three studies included primary age children (Aggarwal et al., 2022; Gadomski et al., 2015; Tseng, 2022), one included secondary age children (Gadomski et al., 2022) and one study included CYP aged 2-16 (Wright et al., 2015).

When exploring WoE C, two of the criterion were regarding the participants in terms of heterogeneity and the location of where the sample was gathered. Only one study scored the highest rating of 3 for location (Wright et al., 2015) due to taking place in the UK, with three scoring 2 for taking place in western countries such as the USA (Gadomski et al., 2015; Gadomski et al., 2022; Tseng, 2022) or Canada (Viau et al., 2010) and one scoring the lowest rating of 1 due to taking place in India (Aggarwal et al., 2022). This non-western study was least likely to have social, cultural and economic similarities to the UK where the results of this review may be disseminated, and it is significant to note this study used outdated language when referring to children with various intellectual disabilities.

With regards to the heterogeneity of the samples, none of the studies scored the highest rating of 3 with samples generally being quite homogenous. Three studies scored a rating of 2 for having a good balance of ages and gender but not for other criteria including in one study all participants having an intellectual

disability (Aggarwal et al., 2022), and in the two other studies participants being mostly from one ethnicity or all attending the exact same GP clinic (Gadomski et al., 2015; Gadomski et al., 2022). The other three studies scored a rating of 1 due to having very homogenous samples including all participants having a diagnosis of Autism and having many more male than female participants (Tseng, 2022; Viau et al., 2010; Wright et al., 2015). Furthermore, two of the studies did not include a breakdown of participant demographics for the sub-population who completed the relevant stress or anxiety measures following large attrition rates, making it even more difficult to judge how representative their samples were and this was reflected in their low WoE A scores (Tseng 2022; Viau et al., 2010).

3.32 Study design

None of the studies scored the highest rating of 3 for WoE B due to not involving Randomised Control Trials, which are considered to be the 'Gold Standard' design for more rigorously exploring effectiveness type questions, reducing bias and inferring cause and effect (Petticrew & Roberts, 2003). It is important to consider however, that the nature of this particular review question isn't very appropriate both feasibly and ethically to have random assignment of groups e.g. who receives a long-term pet dog or not. All studies were instead Quasi-Experimental designs, whereby they had experimental treatments and outcome measures without random allocation of participants (Barker et al., 2002) and thus all scored a rating of 2 for WoE B. Despite this, the six studies varied considerably in terms of their exact design.

Two studies did not include control group (Tseng, 2022; Viau, 2010) to compare levels of cortisol in participants without a dog. Instead they measured levels within-subjects after introducing a dog, which may have naturally reduced for other unknown reasons and so effect sizes need to be considered with extra caution. Furthermore, some studies included an additional time point, follow up measure or were longitudinal in nature (Viau et al., 2010; Wright et al., 2015; Gadomski et al., 2022) so could be said to be of better methodological design than those that simply measured pre-post effects, to establish if initial effects faded over time. To consider these limitations, studies without a control group or effect measure beyond post-test, naturally scored lower on WoE A and longevity of impact was also included in the WoE C criteria. Two studies could be argued to be of lower quality for being a retrospective cross-sectional study (Gadomski et al., 2015) and a cohort study (Gadomski et al., 2022) and these studies also used some of the same sample of participants seven years apart. An advantage of these two study designs is they can simply ask participants if they have a pet dog or not meaning it is much easier to gain a larger sample size. However, this then means there is no manipulation of the dependant variable e.g. being provided a dog at a controlled baseline. Therefore, cause and effect cannot be inferred and there is greater risk of limitations such as recall bias.

3.33 Intervention

Four studies involved looking at the interaction between levels of stress or anxiety and a ‘typical’ pet dog. However, two studies studied the acquisition of a highly trained service dog or Autism Assistant Dog (Viau et al., 2010; Tseng

et al., 2022) which were rated lower on WoE C criteria due to these dogs being much less accessible and affordable for most caregivers. Three studies looked at additional factors regarding dog ownership which were reflected in higher WoE C scores due to potentially providing more useful information for future research regarding any underlying mediations of the observed relationship. For example, Aggarwal et al. (2022) reported decreases in anxiety symptoms were comparable across different breeds of dogs, Gadomski et al. (2015) stated the amount of years with a dog didn't affect anxiety scores and Gadomski et al. (2022) found that despite there not being a correlation between owning a dog or exposure length, there was a correlation between being highly attached to the dog, with a reduced risk of an anxiety diagnosis. A flaw of four studies was measuring fidelity, which indeed is harder to measure with a pet dog which isn't an intervention with set guidelines per se. However, two studies scored higher for fidelity monitoring by carrying out measures such as parents receiving training on how to effectively engage their child with the dog, asking about the dog's integration into the household and the child's relationship with them, as well as providing strict instructions explaining how to complete outcome measures and asking about factors that may have influenced results (Tseng, 2022; Viau et al., 2010).

3.34 Measures

The studies varied in their methods to measure stress or anxiety in CYP. Only one study used just one measure of overall anxiety symptoms (Aggarwal et al., 2022) compared with five studies which utilised more than one measure or broke down 'overall' anxiety into subgroups such as separation anxiety or OCD

for example, reflected in higher WoE C ratings. Three of the studies only relied on parent or self-report measures of symptoms and thus may have been increasingly subject to limitations such as social desirability bias, as opposed with two studies which included a more objective, biological measure of cortisol (Tseng, 2022; Viau et al. 2010). However, both of these studies had considerably small sample sizes dues to difficulty in cortisol sample collection, as well as no control group so results should be particularly scrutinised. Only one study stated the reliability of the outcome measures (Tseng, 2022) and no studies had blind scorers to the study conditions which could have reduced potential researcher bias and is reflected in lower WoE A ratings.

3.35 Findings and effect sizes

Only one study included Cohen's d (1988) effect sizes (Wright et al., 2015) which meant in order to directly compare findings the remaining effect sizes had to be produced as part of this review, and as such were reflected in lower WoE A scores. These were computed using various methods due to inconsistent, and often poor reporting of results across the studies such as not including Means, Standard deviations or *p*-values for example. Campbells calculator was used to convert two of the studies T-test *p* value's based on unequal sample sizes (Gadomski et al., 2015; Aggarwal et al., 2022) and the Psychometrica calculator was used to convert a reported Spearman's Rho effect size (Gadomski et al., 2022) (See Appendix I). For the two remaining studies with within-subject designs (Tseng, 2022; Viau et al., 2010) the effect sizes were manually calculated through computing the differences between the pre and post means and dividing this by the pre-standard deviation (Cohen,

1988). The results of one study's (Gadomski et al. 2022) outcome measure, which measured if young people developed an anxiety disorder after an 8 year follow up, was not able to be converted into an effect size due to using a proportional hazards regression model.

Effect sizes in all other relevant stress and/or anxiety measures in the included five studies mostly ranged from small to large (using Cohen's 1988 descriptors) suggesting a negative correlation between owning a pet dog and measures of anxiety or stress, with a few however reporting no significant effects. A summary of all six studies outcome measures, key findings and effect sizes are displayed in table 5.

Table 5: *Effect Sizes and Descriptors*

Study	Measure of stress/anxiety	Number of participants (CYP)	Key reported findings	Cohen's d effect size (and *p*-values)	Descriptor of effect size[3]	WoE D
Aggarwal et al. (2022)	Hamilton Anxiety Scale (HAM-A)	**Total:** 92 **Dog group:** 52 **Control:** 40	The HAM-A score was significantly lower for the dog owning group compared to the control group after 3-6 months.	**HAM-A mean score**: 0.72 (*p*-value <0.001)	Medium - Large	1.6
Gadomski et al. (2015)	The Screen for Child Anxiety Related Emotional Disorders (SCARED-5)	**Total:** 643 **Dog group**: 370 **Control:** 273	A dog in the home was associated with a 9% reduced likelihood of a SCARED-5 score of 3 or higher.	**Mean SCARED-5 score:** 0.19 (*p*= .01) **SCARED-5 score 3+:** 0.25 (*p*= .002) **Separation anxiety:** 0.19 (*p*= .02) **Social anxiety:** 0.21 (*p*= .01) **Other domains:** (general anxiety, school phobia and physical symptoms	Small Small Small Small No effects	2.1

[3] *Cohen's d (1988) effect size descriptors - .2 = small, .5 = medium, .8 = large*

Study	Measure of stress/anxiety	No of participants (CYP)	Key reported findings	Effect size (Cohen's d)	Descriptor of effect size	WoE D
Gadomski et al. (2022)	The Screen for Child Anxiety Related Emotional Disorders (SCARED-41) Diagnosis of Anxiety within 8 year follow up	**Total:** 241 **Dog group:** 152 **Control:** 89	No correlation between cumulative dog exposure and SCARED-41 scores. Having a pet dog was not associated with lower risk of an anxiety diagnosis. *Cumulative exposure to the most highly attached dog* was associated with a reduced probability of an anxiety diagnosis.	**SCARED-41 total score:** 0.12 (*p*= .40) **Anxiety diagnosis** Not computed (*p* = .006)	No effect N/A	2.6
Tseng (2022)	Child behaviour checklist (CBCL – anxious subscale) Chronic Cortisol Concentrations (CCC)	**CBCL:** 11 **CCC:** 5 Within-subjects design No control	There were significant pre-post AAD improvements for children on the CBCL (anxious subscale) and a reduction of the objective physiological measure of chronic stress (CCC)	**CBCL mean score:** 0.49 (*p* = .023) **CCC levels:** 1.31 (*p* = .043)	Small - Medium Large	1.5

Study	Measure of stress/anxiety	No of participants (CYP)	Key reported findings	Effect size (Cohen's d)	Descriptor of effect size	WoE D
Viau et al. (2010)	Average basal Cortisol Levels Cortisol Awakening Response (CAR)	**Total:** 34 Within-subjects design No control	Service dogs did not have an effect on the children's average diurnal cortisol levels but did significantly decrease CAR levels, reducing from 58% to 10% when dogs were at home and increasing back to 48% when dogs were removed.	**Average basal cortisol levels**: No effect **CAR:** 0.49 (p = .01)	No effect Medium	1.6
Wright et al. (2015)	Spence Children's Anxiety Scale (SCAS)	**Total:** 40 **Dog group:** 14 **Control:** 26	Anxiety scores in the dog group reduced by a greater amount than the non-dog group, mostly in symptoms of OCD (26% greater decrease), Panic attack and Agoraphobia (24%), Social Phobia (24 %) and separation anxiety (22 %). Total anxiety lessened 13% more in the dog group compared with the control between Baseline (BL) and Follow-up (FU).	**Panic Attack:** 0.4 **Social phobia:** 0.6 **OCD:** 0.5 **Separation anxiety:** 0.7 **Total anxiety:** 0.8 (no p values reported) **Effect size based on BL to FU scores within subjects (Significantly different to control)* **Physical injury fears** (0.9) & **GAD** (0.3) had similar effect sizes to the control group scores.	Small-Medium Medium Medium Medium-Large Large No effect	2.1

4. Conclusions and recommendations

The aim of this review was to explore the effectiveness of having a dog on CYP's level of stress or anxiety, which given the sharp rise in probable mental health disorders in the UK, is a essential research area. Of the six studies reviewed, three studies received a low WoE A and WoE D rating and therefore could be viewed as having the least weight, due to poor quality methodology and relevance. Their findings should thus be viewed with increased caution. Despite this, results appeared to be promising with Aggarwal et al. (2022) reporting HAM-A anxiety scores were significantly lower for the dog owning group compared to the control and this review calculated a medium-large effect size. Tseng (2022) found significant improvements for children on an anxiety subscale of a CBCL checklist, and a reduction in cortisol levels after the acquisition of an Autism-Assistant Dog, with calculated effect sizes approaching medium and high. Viau et al. (2010) described no difference in children's 'average diurnal cortisol levels' but stated a more dynamic measure 'Cortisol Awakening Response', reduced from 58% to 10% when dogs were at home and increased back to 48% when the dogs were removed, with an approaching medium effect size. The latter two studies had small sample sizes and lacked a control group meaning reductions could have occurred naturally regardless of having a pet dog or not.

Two studies received a medium WoE A and D rating. Gadomski et al. (2015) described that having a dog was associated with a 9% decreased probability of a SCARED-5 anxiety score over the clinical threshold of 3+ and this review

calculated small effect sizes across measures. Wright et al. (2015) reported that SCAS anxiety scores in the dog-owning group reduced by a greater percentage than the control group in total anxiety with a high overall effect size, and most noteworthy differences were found in the domains of OCD, panic attack, social phobia and separation anxiety. No differences were found for physical injury fear and general anxiety disorder. Gadomski et al. (2022), which could be argued to hold the greatest weight due to its higher methodical quality and relevance to the research question, found no effect of having a pet dog on SCARED-41 anxiety scores, but reported cumulative exposure with a highly attached pet was associated with a reduced likelihood of an anxiety diagnosis in their 8 year follow up, which this review unfortunately couldn't compute an effect size for. The biggest limitation of this study was it being a cohort design and thus the dependant variable, a pet dog, was not experimentally manipulated and so causality is more difficult to determine even with strict covariates being adjusted for in the analysis. For example, less anxious families may be more likely to buy a dog rather than a dog making CYP less anxious, and there is greater risk of recall bias.

It is recommended for future studies looking into the effectiveness of pet dogs on CYP's wellbeing ensure they have larger, more heterogenous samples as many of the studies in this review had mostly primary age, white, male participants. Three of the studies also just included children with Autism, which although it is highly relevant given anxiety is the most common comorbid diagnosis found in Autism (Zaboski & Storch, 2018), it would be beneficial to expand research to a wider range of CYP to make findings more generalisable.

However, from this review it can be seen that effect sizes were also shown for CYP without Autism, and also not just for trained dogs highlighting perhaps it is presence of the dog itself, and not the training which may help reduce levels of stress and anxiety.

The generally poor WoE A ratings for the studies in this review, highlight the need for improved methodological rigour in future studies. RCT's are understandably not very feasible nor ethical with this type of research, but studies should aim to have a non-dog owning control group, an additional time point or follow up measure, use a combination of stated valid and reliable self-report and biological measures and engage in increased fidelity monitoring. This may include observing, recording or interviewing caregivers on the CYP's interaction with the dog and providing stricter instructions to carers how to effectively collect cortisol levels to ensure data is not lost, reducing sample sizes. Studies should also aim to measure factors within CYP that may be underlying the relationship between dogs and mental health such as amount of exercise and social interaction through dog walking, if the dog seems to help improve CYP's sleep and their levels of interaction e.g. through playing fetch, stroking or grooming.

In conclusion, due to the methodological flaws of most of the included studies and being unable to rule out a myriad of confounding variables, EPs should not confidently recommend acquiring a dog to caregivers who may be considering this to improve their child's mental health but findings do indeed look promising.

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6. Appendices

Appendix A: Excluded studies and rationales

Table 1: *List of excluded studies after full review*

Full References of excluded studies	Exclusion criteria number
Carlisle, G.K., Johnson, R.A., Wang, Z., Bibbo, J., Cheak-Zamora, N., & Lyons, L.A (2021). Exploratory Study of Cat Adoption in Families of Children with Autism: Impact on Children's Social Skills and Anxiety. Journal of Pediatric Nursing, 58, 28-35. https://doi.org/10.1016/j.pedn.2020.11.011.	4 The study involves only cats and no dogs
Kertes, D.A., Liu, L., Hall, N., Hadad, N.A, Wynne, C.D.L., & Bhatt, S.S. (2017). Effect of Pet Dogs on Children's Perceived Stress and Cortisol Stress Response. *Social Development,* 26(2), 382–401. https://doi.org/10.1111/sode.12203.	4 The study involves completing a social stress test and the comparison group owned a dog. .
Kerns, K.A., Stuart-Parrigon, K.L, Coifman, K.G., van Dulmen, M.H.M., & Koehn, A. (2018). Pet Dogs: Does their presence influence preadolescents' emotional responses to a social stressor? *Social Development,* 27(1), 34-44. https://doi.org/10.1111/sode.12246.	4 The study involves completing a social stress test and the comparison group owned a dog.

Appendix B: Mapping the Field

Author & location	Study design	Participant numbers (CYP)	Participant demographics	Intervention type	WoE C criteria and score
Aggarwal et al. (2022) India	Quasi-experimental Pre and Post design (AB) Between subjects Control group	Total: 92 Intervention (dog) group: 52 Control (non-dog) group: 40	Mean age: 7.3 Males: 48 (52.2%) Females: 44 (47.8%) CYP patients at hospital for intellectual disabilities e.g. Cerebral palsy, Tics, Epilepsy	Families either acquired a pet dog (intervention group) or didn't (control group). HAM-A before intervention group acquired dog and 3-6 months later.	A. **Location:** India, use of outdated inappropriate language for western populations (1) B. **Heterogeneity of Sample**: Good balance of ages/gender but restricted to intellectual disabilities/same hospital (2). C. **Relevant outcome measures**: HAM-A (2) D. **Longevity of impact**: Pre and post (1) E. **Type of dog:** Pet dog (3) F. **Measured additional aspects of dog ownership:** Breed (2) **Total WoE C = 1.8**
Gadomski et al. (2015) USA	Cross sectional design Between subjects Control group	Total: 643 Intervention (dog group): 370 Control: 273	Total mean age: 6.72 (Range 4-11) Males: 354 (55%) Females: 289 (45%) Ethnicity: 96% white	Participants were split into whether they already had a pet dog at home or not.	A. **Location:** Western, not UK (2) B. **Heterogeneity of Sample**: Good range of ages/gender/diagnoses but not ethnicity/GP clinic (2) C. **Relevant outcome measures**: SCARED-5 mean and threshold +3 (3). D. **Longevity of impact**: Cross-sectional at one time point (1) E. **Type of dog:** Pet dog (3) F. **Measured additional aspects of dog ownership:** Duration of exposure (2) **Total WoE C = 2.2**

Author & location	Study design	Participant numbers (CYP)	Participant demographics	Intervention type	WoE C criteria and score
Gadomski et al. (2022) USA	Retrospective cohort study design (no manipulation dependant of variable) Between subjects Control group	Total: 216 (who completed SCARED-41) Intervention (dog): 139 (64%) Control (non-dog): 77 (36%)	Mean age: 1 4.1 (range 11-19) Males: 115 (53%) Females: 101 (47%) Ethnicity of parent: White (96%)	Participants were split into whether they already had a pet dog at home or not.	A. **Location:** Western country but not in the UK (2) B. **Heterogeneity of Sample**: Good range of ages/gender not ethnicity (2) C. **Outcome measures:** SCARED-41 score & later anxiety diagnosis (3) D. **Longevity**: 8 year follow up (3) E. **Type of dog:** Pet dog (3) F. **Measured additional aspects of dog ownership:** cumulative exposure and attachment to pet (3) **Total WoE C = 2.7**
Tseng (2022) USA	Quasi – experimental Pre-post design (AB) Within subjects No control group	Total who completed CBCL: 11 Total who completed CCC: 5	All children had ASD, Non-verbal: 5 children (45.5%) Mean age: 9.1 Females: 2 (16.7%) Males: 9 (83.3%) No demographic details provided for smaller sub-group	Families were studied before and after receiving a well-trained Autism Assistant Dog (AAD) using a within-subjects design.	A. **Location:** Western county but not in the UK (2) B. **Heterogeneity of Sample**: All CYP had Autism and most were males (1) C. **Relevant outcome measures**: Parent report & biological measure (3) D. **Longevity**: Just pre-post (1) E. **Type of dog:** AAD (1) F. **Measured additional aspects of dog ownership:** No (1) **Total WoE C = 1.5**

Author & location	Study design	Participant numbers (CYP)	Participant demographics	Intervention type	WoE C criteria and score
Viau et al. (2010) Canada	Quasi – experimental ABA design Within subjects No control group	Total = 34 (from initial 42)	All CYP had a diagnosis of Autism, Asperger's or PDDNOS (Pervasive development disorder not otherwise specified) Initial group: 37 males & 4 females aged 3-14 years (mean age=7). No demographic details for sub-group	Service dogs provided & parents received 3 days training 3 time points Pre = 2 weeks prior to having the dog Dog = 4 weeks with the dog Post = 2 weeks after dog was removed.	A. **Location:** Western county but not in the UK (2) B. **Heterogeneity of Sample**: All CYP had Autism, most were males. Lack of details for sub-group (1) C. **Relevant outcome measures**: 2 measures of cortisol (3) D. **Longevity of impact**: Included 3rd (short term) time point after removal of dog (2) E. **Type of dog:** Service dog (1) F. **Measured additional aspects of dog ownership:** No (1) **Total WoE C = 1.7**
Wright et al. (2015) UK	Quasi-experimental Control group Baseline, intervention, Follow up (ABB)	Total: 40 (from initial 70) Intervention (dog) group: 14 Control (no dog group) 26	All children had ASD Mean age: 9.4 years (2-16) Males: 32 Females: 8 Intervention mean age: 9.4, 3 females, 11 males. Control mean age: 9.1, 5 females, 21 males	Families either acquired a pet dog or didn't Pre = up to 17 weeks before acquiring dog. Post = 3-10 weeks with the dog Follow up = 25-40 weeks with the dog.	A. **Location:** Took place in the UK (3) B. **Heterogeneity of Sample**: All children had Autism, mostly males (1) C. **Relevant outcome measures**: Anxiety measure split into types (3) D. **Longevity of impact**: Follow up (3) E. **Type of dog:** Pet dog (3) F. **Measured additional aspects of dog ownership:** No (1) **Total WoE C = 2.3**

Appendix C: Coding Protocol amendments

Table 1:
Amendments to Gersten et al.'s coding protocol

Overall quality indicator	Specific quality indicator (Original)	Specific quality indicator (modified)	Rationale
Describing participants	Was sufficient information provided to determine/confirm whether the participants demonstrated the disability(ies) or difficulties presented?	Was sufficient information provided about the demographics of the participants?	The review question didn't aim to focus on a specific disability or difficulty so the question was made more general.
Describing participants	Was sufficient information given characterising the interventions or teachers provided? Did it indicate whether they were comparable across conditions?	Was sufficient information given characterising the interventions? Did it indicate whether they were comparable across conditions?	The review question didn't involve any teachers, just CYP and caregivers in the family home
Implementation of the intervention and description of comparison	Was the nature of services provided in comparison conditions described?	Was the comparison condition described?	The review question didn't measure the 'introduction of services' but instead the introduction of a dog (vs no dog in the control group) so was made more general.

Appendix D: Weight of Evidence (WoE) A: Methodological quality for quasi-experimental designs using Gersten et al.'s (2005) coding protocol

Critical appraisal checklist reference:
Gersten, R., Fuchs, L. S., Compton, D., Coyne, M., Greenwood, C, & Innocenti, M. (2005). Quality indicators for group experimental and quasi-experimental research in special education. *Exceptional Children,* 71, 149-164.[4]

Study Reference:
Wright, H., Hall, S., Hames, A. Hardiman, J., Mills, R., PAWS Project Team & Mills, D. (2015). Pet Dogs Improve Family Functioning and Reduce Anxiety in Children with Autism Spectrum Disorder. *Anthrozoos,* 28(4),611–24.

Table 4: *Scoring for WoE A, based on Gersten's et al. (2005) guidelines*

	High Quality	**Acceptable Quality**	**Low quality**	**Overall rating**
Wright et al. (2015)	(Needs to meet all but one of the essential quality Indicators and at least 4 desirable) Rating = 3	(Needs to meet all but one of the Essential Quality Indicators and at least 1 desirable) Rating = 2	(Meets less than 9 of the essential Criteria) Rating = 1	**(1-3)**
Number of essential quality indicators met **9/10**		**X**		**2**
Number of desirable quality indicators met **3/8**				

[4] **To note, this checklist was adapted in areas so the questions were relevant to this particular research question. To display this, the strike-through tool has been used (e.g. ~~like this~~) and then rephrased*

Essential Quality Indicators

A. Quality Indicators for Describing Participants

~~Was sufficient information provided to determine/confirm whether the participants demonstrated the disability(ies) or difficulties presented?~~

1. Was sufficient information provided about the demographics of the participants?

   ☐Yes
   ☐ No
   ☐ Unknown/Unable to Code

   Rationale: Included in-depth tables of participant demographics in full study and the sub-population who completed the anxiety scales.

2. Were appropriate procedures used to increase the likelihood that relevant characteristics of participants in the sample were comparable across conditions?

   ☐Yes
   ☐ No
   ☐ Unknown/Unable to Code

   Rationale: The authors reported if there were significant differences between demographic characteristics between the intervention and the control group. These covariables e.g. differences in baseline anxiety and family functioning scores were then adjusted for in the statistical analysis.

3. Was sufficient information given characterizing the interventions ~~or teachers provided~~? Did it indicate whether they were comparable across conditions?

   ☐Yes
   ☐ No
   ☐ Unknown/Unable to Code

   Rationale: Explained how participants were assigned and provided an in-depth table comparing descriptive characteristics of participants in intervention and control group.

B. Quality Indicators for Implementation of the Intervention and Description of Comparison Conditions

4. Was the intervention clearly described and specified?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: The study enough detail to be able to be replicated.

5. Was the fidelity of implementation described and assessed?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: Fidelity is indeed harder to measure with this type of study but no observations were completed of the child with the pet, no measures of attachment were completed, no parent views were gained about their child's interactions with the dog, no details were provided if outcome measures were gathered effectively and reliably, and no criteria was established to measure cumulative exposure e.g. if the child often stayed at another caregivers hours, only spending only 50% of the time with the dog for example. The authors also mentioned they could have recoded behaviours digitally to increase fidelity (but that the presence of this may likely change typical behaviours and only captures these within the household).

~~Was the nature of services provided in comparison conditions described?~~
6. Was the comparison condition described?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: Due to the nature of this study, the comparison condition is simply not having a pet dog at home which was stated, as well as basic demographic details.

C. Quality Indicators for Outcome Measures

7. Were multiple measures used to provide an appropriate balance between measures closely aligned with the intervention and measures of generalized performance?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: The study also used a validated scale of family strengths and weaknesses (Brief version of the Family Assessment Measure-3) as well as the Spence Children's Anxiety Scale.

8. Were outcomes for capturing the interventions effect measured at the appropriate times?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: The times at which data was collected were up to 17 weeks before acquiring a dog (Baseline) and 3-10 weeks post dog acquisition (post-intervention) and also included a follow up 25-40 weeks post dog acquisition. The authors also detailed there was no significant difference in sampling timescales between groups which may have effected outcome measures.

D. Quality Indicators for Data Analysis

9. Were the data analysis techniques appropriately linked to key research questions and hypotheses? Were they appropriately linked to the unit of analysis in the study?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: Authors stated appropriate and relevant data analysis techniques to measure main pre-post effects linked to the research question. They adjusted for the effects of co-variances which were significantly different at the baseline.

10. Did the research report include not only inferential statistics but also effect size calculations?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: Cohens d effect sizes were included.

Desirable Quality Indicators

1. Was data available on **attrition rates** among intervention samples? Was severe overall attrition documented? If so, is attrition comparable across samples? Is overall attrition less than 30%?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: Original sample size of 70 dropped by 30 participants to a total of 40 who completed the anxiety scales (43% attrition rate)

2. Did the study provide not only internal consistency reliability but also test-retest reliability and interrater reliability (when appropriate) for outcome measures? Were data collectors and/or scorers blind to study conditions and equally unfamiliar to examinees across study conditions?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: Information on reliability of the outcome measures were not specifically provided. The researchers also stated they didn't blind-code the outcome measures which would have helped to reduce bias from the family and experimenter affecting the results.

3. Were outcomes for capturing the intervention's effect measured beyond an immediate post-test?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: A follow up time point was included in the study.

4. Was evidence of the criterion-related validity and construct validity of the measures provided?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: The authors reported using widely used and validated outcome measures.

.

5. Did the research team assess not only surface features of fidelity implementation but also examine quality of implementation?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: Fidelity is indeed harder to measure with this type of study but no observations were completed of the child with the pet, no measures of attachment were completed, no parent views were gained about their child's interactions with the dog, no details were provided if outcome measures were gathered effectively and reliably, and no criteria was established to measure cumulative exposure e.g. if the child often stayed at another caregivers hours, only spending only 50% of the time with the dog for example. The authors also mentioned they could have recoded behaviours digitally to increase fidelity (but that the presence of this may likely change typical behaviours and only captures these within the household).

6. Was any documentation of the nature of instruction or series provided in comparison conditions?

☐Yes
☐ No
☐ Unknown/ Unable to Code

Rationale: No further information or details were provided about the comparison group other than basic demographic details, although it is unclear what would be relevant to include with the nature of this study.

7. Did the research report include actual audio or videotape excerpts that capture the nature of the intervention?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: Audio or video tables were not used to capture the nature of the intervention. These were mentioned as a possibility for future studies in the discussion.

8. Were results presented in a clear, coherent fashion?

☐Yes
☐ No
☐ Unknown/Unable to Code

Rationale: The mean, SEM, % change scores as well as effect size and statistical power scores were across the intervention and control group were clearly displayed in tables.

Overall Rating of Evidence: ☐ 3 ☐ 2 ☐1

Appendix E: Weight of Evidence (WoE) A: Methodological Quality for cross-sectional designs using the JBI protocol

Critical appraisal checklist reference:

Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., Currie, M., Qureshi, R., Mattis, P., Lisy, K., and Mu, P-F. (2017) Chapter 7: Systematic reviews of etiology and risk. *Joanna Briggs Institute Reviewer's Manual.* Adelaide. *https://jbi.global/sites/default/files/202007/Checklist_for_Analytical_Cross_Sectional_Studies.pdf*

Study Reference:

Gadomski, A., Scribani, M.B., Krupa, N., Jenkins, P., Nagykaldi, Z., & Olson, A.L. (2015) Pet Dogs and Children's Health: Opportunities for Chronic Disease Prevention? *Preventing Chronic Disease,* 12, e205.

Table 1: *Scoring for WoE A* [5]

	High Quality	**Acceptable Quality**	**Low quality**
Gadomski et al. (2015)	Score of 8/8 Rating = 3	Score of 7/8 Rating = 2	Scores below 7 Rating = 1
Number of questions met 7/8		**X**	

[5] *The scoring based on the number of criteria met within the coding protocol has been created by the author of this review, due to set guidelines not being provided by the Joanna Briggs Institute.*

JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies

	Yes	No	Unclear	N/A
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐

Rationale: Inclusion details were clearly specified e.g. parents of children aged 4-10 years, one child per family was eligible and ill or developmentally disabled children were excluded etc.

2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐

Rationale: The study included an in-depth table comparing participant demographics across the whole study and between the intervention and control group, to determine if they were statistically different e.g. mean age, poverty level, child history of a mental health diagnosis etc.

3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐

Rationale: The participants were asked specific questions about duration of exposure to the pet dog in the child's lifetime and also time spent being physically active with the dog.

4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐

Rationale: No set criteria was stated for the measurement of the frequency of the exposure to the dog etc.

5. Were confounding factors identified?	☐	☐	☐	☐

Rationale: Multiple potential confounders were included in the method section such as age, sex, SES, family income etc.

6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐

Rationale: In these multivariate models they controlled for covariates that may confound the findings e.g. age, poverty etc.

7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐

Rationale: The authors stated that they used 4 widely used and validated assessment tools for screening (and explained these are not used for formal diagnosis)

8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Rationale: The methods section was detailed enough to determine which analytical technique was used, the authors appropriately completed univariate comparisons of demographics between the intervention and control group e.g. in BMI, history of mental health etc., they tested if any of the data distribution was skewed and then transformed this data in response and explained they carried out multiple linear regression for composite outcomes and logistic regression for dichotomous outcomes. In these multivariate models they controlled for covariates that may confound the findings e.g. age, poverty etc. The authors also completed relevant sub-analyses.

Overall Rating of Evidence: ☐ 3 ☐ 2 ☐1

Appendix F: Weight of Evidence (WoE) A ratings for methodological quality

Table 1: *Summary of WoE A ratings based on the Gersten (2005) and JBI (2017) coding protocols*

Study	Essential indicators	Desirable indicators	Overall WoE A
Aggarwal et al. (2022)	4	2	1
Gadomski et al. (2015)	7	N/A	2
Gadomski et al. (2022)	8	N/A	3
Tseng (2022)	5	4	1
Viau et al. (2010)	5	3	1
Wright et al. (2015)	9	3	2

For WoE A, 3 = High Quality, 2 = Acceptable, Quality, 1 = Poor Quality)

Appendix G: Weight of Evidence B (WoE B) criteria and ratings

WoE B judges the appropriateness of the type of study design in relation to the review question type. Petticrew and Roberts (2003) typology was deemed appropriate to judge WoE B for this review paper. They report Randomised Control Trials (RCT's) as the 'gold standard' study design to measure 'effectiveness' questions due to their high level of experimental control with less risk of bias. Quasi-Experimental, Single-case study, Cross-Sectional and cohort study designs are reported as acceptable but of lower quality design and qualitative research, surveys, case-control studies and non-experimental evaluations are reported as being of poor type design for an effectiveness question (See table 1). Petticrew and Roberts (2003) also report Systematic Reviews as 'Gold Standard' but these were excluded from this review paper due to these studies not providing any original empirical research. WoE B was calculated for each of the 6 studies and the scores are displayed in Table 2.

Table 1: *WoE B Coding criteria*

Weighting	**High - 3**	**Acceptable - 2**	**Poor - 1**
Study design	Randomised Control Trials (RCT)	Quasi-Experimental	Qualitative research
		Single-case study	Surveys
		Cross-sectional	Case-control studies
		Cohort studies	Non-experimental evaluations

Table 2: *WoE B ratings*

Study	**WoE B rating**
Aggarwal et al. (2022)	2
Gadomski et al. (2015)	2
Gadomski et al. (2022)	2
Tseng (2022)	2
Viau et al. (2010)	2
Wright et al. (2015)	2

Appendix H: Weight of Evidence (WoE) C criteria and ratings

Table 1: ***WoE C criteria and rationales***

Criteria	High - 3	Medium - 2	Low – 1	Rationale
A. Location of study	Study carried out in the UK	Study is carried out in the western country that is economically similar to the UK	Study is carried out in a non-western county that isn't economically similar to the UK	For results to be increasingly generalisable to the reviewer's home country of work to disseminate results
B. Heterogeneity of sample	Includes a diverse heterogenous sample e.g. balance of age/gender/any diagnosis/ethnicity etc	Some aspects of the sample population are heterogenous	Appears to be quite a homogenous sample	For results to be increasingly generalisable to a wider range of CYP.
C. Relevant outcome measures	More than 1 relevant outcome measure used or a breakdown in different types of anxiety	1 relevant and widely used/validated tool used as an outcome measure	No relevant or widely used/validated measure of stress of anxiety	This review is looking at the impact on CYP's levels of stress or anxiety

Criteria	High - 3	Medium - 2	Low – 1	Rationale
D. Longevity of impact	Longitudinal study e.g. over several months/years OR Includes more than 2 time points (over a several months) OR Includes a follow up months later	Includes more than 2 time points OR Includes a follow up	Pre-post study design with no additional time points or no follow up.	To assess whether any changes in CYP remain over time.
E. Type of dog	Pet dog permanently in the home	Pet dog (temporarily in the home for the purpose of the study)	A specifically trained dog e.g. a service dog or Autism Assistance dog	To increase generalisability and accessibility for caregivers e.g. its likely most carers wouldn't be able to afford a trained dog
F. Measured additional aspects of dog ownership	Measured more than 1 additional aspect of dog ownership e.g. cumulative exposure, breed, attachment etc.	Measured 1 additional aspect of dog ownership	Just measured dog ownership	To establish further potential underlying mechanisms which may increase outcomes.

Table 2: *Summary of WoE C Ratings*

Study	Criteria A	Criteria B	Criteria C	Criteria D	Criteria E	Criteria F	Overall WoE C
Aggarwal et al. (2022)	1	2	2	1	3	2	1.8
Gadomski et al. (2015)	2	2	3	1	3	1	2
Gadomski et al. (2022)	2	2	3	3	3	3	2.7
Tseng et al. (2022)	2	1	3	1	1	1	1.5
Viau et al. (2010)	2	1	3	2	1	1	1.7
Wright et al. (2015)	3	1	3	3	3	1	2.3

Appendix I: Effect Size Calculators

Psychometrica

This online effect size conversion calculator was used to compute Cohen's d (1988) effect sizes for one study.
This calculator can be found here:
https://www.psychometrica.de/effect_size.html

Campbell Collaboration Calculator

This online effect size calculator, was used to calculate effect sizes for two studies and can be found here:https://campbellcollaboration.org/research-resources/effect-size-calculator.html