

RESEARCH

The benefits and risks of child-dog attachment and child-dog behaviours for child psychological well-being

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Abstract

The importance of secure human attachments in childhood for healthy psychological development is well-established, yet the well-being implications of child-dog symbiotic relationships are less understood. Children form strong emotional bonds with their pet dogs that meet the prerequisites for an attachment relationship. These bonds can be mutually reinforcing and beneficial and could indicate positive child well-being. However, not all child-dog relationships are positive and here we explore whether harmful and unsafe interactions are associated with poorer emotional and behavioural functioning. The aim of this study was to examine whether the type of child-dog behaviour (positive or negative) mediates the relationship between child-dog attachment and well-being indicators. Data from caregiver reports (N = 117) and child self-reports (N = 77) were collected through an online survey. The results revealed that positive child-dog interactions significantly mediated the relationship between high attachment scores and better child outcomes (higher scores for well-being, positive outlook, happiness, quality of life, higher social satisfaction, and lower loneliness), whereas the reverse was found for negative child-dog interactions, predicting lower attachment scores and worse child outcomes (negative outlook, increased loneliness and social dissatisfaction, lower quality of life). This study has identified important mechanisms through which pet dogs may pose both benefits and risks to children's psychological well-being. These findings will aid the development and evaluation of interventions that promote positive and safe child-dog interactions and subsequent child and dog psychological health and welfare.

Keywords: attachment, children, behaviour, dogs, happiness, pets, welfare, well-being

Introduction

The quality of relationships that humans form during their early years can be significant for subsequent functioning and emotional well-being. Early experiences of relationships build internal working models of self (e.g., as valuable, and effective) and others (e.g., as trustworthy) which act as a prototype for, and affect a person's views about the self and future relationships (Bartholomew and Horowitz, 1991). "Attachment" is a universal concept used to describe a lasting psychological connectedness between human beings (Bowlby, 1973), but in more recent years, has been applied to human-animal relationships (Julius *et al.*, 2013; Payne *et al.*, 2015; Jalongo, 2018). Both human and non-human animals have a biological propensity to form an attachment to a primary attachment figure, and there are evolutionary advantages of this, such as increasing chances of survival through psychological and physical protection (Lorenz, 1935; Harlow and Zimmermann, 1958). Secure

attachments can be mutually beneficial, which may explain dog-human coevolution and bonds (Nagasawa *et al.*, 2015). Sensitivity, responsiveness, trust, and safety, from an attachment figure, are important features necessary to form a secure attachment, whereas the reverse is true for the development of an insecure attachment (Brumariu *et al.*, 2018). Such features of secure and insecure attachment orientations have been found to also be present in human-dog dyads (Zilcha-Mano *et al.*, 2011; Solomon *et al.*, 2019). The importance of secure human-human attachments for healthy psychological development is well-established, with secure attachments being an important protective factor against the development of internalizing symptoms (Brumariu and Kerns, 2010), while insecure attachments have been associated with increased risk for psychopathology (Marganska *et al.*, 2013). The developmental implications of child-dog attachments are, however, less understood, although recent findings with adults point to

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insecure attachments as a risk factor for dysfunctional human-dog dyads (Bender *et al.*, 2023). There is a high prevalence of dog ownership within family homes from all socioeconomic backgrounds in Western cultures, and caregivers often acquire a pet dog due to beliefs of a positive impact on child well-being (Westgarth *et al.*, 2010; Jalongo and Ross, 2018; Ballantyne *et al.*, 2022). It is therefore important to investigate the benefits and risks of growing up with pet dogs and to study the attachments that children form with these animals on children's psychological development. This is particularly pertinent during a time of development (middle childhood) where family dog acquisition peaks (Westgarth *et al.*, 2010, 2013). Previous research that aimed to substantiate the social and emotional benefits of dog ownership has been critiqued for only considering dog presence within the home, rather than examining the complexity and individuality of child-dog relationships, and the mechanisms through which children and dogs can mutually promote well-being, such as through attachment, and the types of interactions observed (see Purewal *et al.*, 2017; Barcelos *et al.*, 2021; Giraudet *et al.*, 2022); these mechanisms will therefore be explored in the current study.

CHILD-DOG RELATIONSHIPS AND PSYCHOLOGICAL WELL-BEING

Research has consistently shown that children form strong emotional bonds with their pet dogs, and such bonds may operate through the same physiological pathways as human-human attachments (Julius *et al.*, 2013; Nagasawa *et al.*, 2015). Dogs are often central to a child's social network and are socially situated, creating a shared family identity where they are viewed as important family members (McNicholas and Collis, 2001). Dogs are viewed as natural attachment objects, being readily available, mobile, and affectionate, and offer reciprocal patterns of interaction (Levinson, 1969). Human-dog bonds display features that meet the prerequisites for an attachment relationship: proximity seeking, safe haven, secure base, and separation distress (Zilcha-Mano *et al.*, 2011). Furthermore, dogs are viewed by children as non-judgemental and unconditionally loving attachment figures, providing emotional comfort and support, particularly in times of distress and adversity, which can increase resilience, and decrease stress and anxiety (as observed for both neurotypical and neurodiverse children; Wright *et al.*, 2015; Jalongo, 2018; Kerns *et al.*, 2018, 2023; Ribera *et al.*, 2023). Child-dog relationships are often viewed as mutually reinforcing and beneficial through a child's sense of emotional reciprocity and shared enjoyment of play (Muldoon *et al.*, 2019), as well as through the ability of dogs to synchronize their behaviour to the child (Wanser *et al.*, 2021). Such features of child-dog relationships, along with positive interactions with a dog, such as caregiving behaviour, can help build a strong emotional bond (Hawkins *et al.*, 2022). Although some studies suggest that a secure child-caregiver attachment can saturate the child's need for an attachment relationship with a pet dog (Ribera *et al.*, 2023), other studies suggest that children who are either securely or insecurely attached to their caregiver can derive comfort from their companion dog, and can form an emotional attachment with them (Wauthier *et al.*, 2022a). Moreover, children's internal working models of human attachment relationships do not seem to transfer to their pets (Kurdek, 2008; Julius *et al.*, 2013; Wauthier *et al.*, 2022a), and some studies have suggested that in the absence of a secure child-caregiver attachment, dogs may act as an important attachment "substitute", protecting against the development of psychopathology (Carr and Rockett, 2017; Hawkins *et al.*, 2019).

The child-dog relationship has often been compared to that of a sibling relationship but with more disclosure and less conflict (Cassels *et al.*, 2017), or to that of a child's best friend, offering social companionship, particularly for children who may have difficulties making and maintaining friendships with

other children or report social impairments (Ward *et al.*, 2017; Ballantyne *et al.*, 2022). Companionship and sense of friendship from pet dogs may therefore decrease feelings of social isolation (Purewal *et al.*, 2017). Some studies have found that pet ownership can reduce a child's feelings of loneliness, with the largest effects found for dog owners; however, the overall evidence remains inconclusive (for a review, see Kretzler *et al.*, 2022). Moreover, as identified by Kretzler *et al.* (2022), only four studies have examined pet ownership and loneliness in childhood or adolescence, and these studies did not consider child-dog attachment or types of child-dog interactions observed in such relationships. Children often feel more strongly attached to their pet dog when their dog is responsive to their social communicative cues and thus the child feels a sense of mutual responsiveness, this is enhanced when the child spends quality time with their dog, engaging in positive shared activities (Hall *et al.*, 2016; Jalongo, 2018). A diverse and complex range of behaviour has been observed within child-dog dyads, most of which are influenced by caregiver input. For example, many caregivers encourage their children to take part in caregiving behaviours to aid a sense of responsibility, such as walking, feeding, playing with, and grooming their dog (Muldoon *et al.*, 2015; Kerry-Moran and Barker, 2018). Engaging in such positive behaviours and being responsible for a dog's care, can increase welfare knowledge, aid the development of compassion, and facilitate the child-dog bond (Hall *et al.*, 2016; Jalongo, 2018; Muldoon *et al.*, 2019). Moreover, positive child-dog interactions such as play, can be beneficial for the social and emotional development of children such as building emotion regulation skills and preventing internalizing and externalizing difficulties (Wenden *et al.*, 2021; Hawkins *et al.*, 2022; Giraudet *et al.*, 2022). Dogs have also been found to encourage the development of self-esteem, a sense of autonomy, purpose, capability, and environmental mastery, all of which contribute to an overall sense of positive eudaimonic well-being (Bodsworth and Coleman, 2001; Christian *et al.*, 2022). One activity of particular importance is dog walking, which can be an important part of behaviour activation, encouraging physical activity, while also increasing exposure to and connectedness to nature, thus helping to maintain positive physical and mental health (Christian *et al.*, 2013, 2022). However, children's motivation to walk their pet dogs may depend on the degree of the child-dog attachment, i.e., children who have a stronger attachment, are more likely to spend time walking their dog (Westgarth *et al.*, 2013; Gadomski *et al.*, 2017). Dogs can also offer high-quality play experiences that promote children's well-being (Boisvert and Harrell, 2021) and can promote positive valence-high arousal states such as happiness and excitement, whereas other behaviours (e.g., petting) can promote positive-valence-low arousal states such as feelings of calm and relaxation (Barcelos *et al.*, 2021). Moreover, a large proportion of child-dog behaviours involve tactile interactions such as petting and cuddling that can have psycho-physiological impacts such as decreasing the stress response and reducing sympathetic and hyperarousal (Beetz *et al.*, 2012; Julius *et al.*, 2013), thus decreasing anxious symptomatology (Castro and Lindsey, 2021). Overall, the evidence points to the potential benefits of child-dog attachment and positive interactions for psychological health, yet to our knowledge, the current study is the first to examine such variables together.

CONCERNS ABOUT AND RISKS OF NEGATIVE CHILD-DOG INTERACTIONS

The strength of child-dog attachment can predict the types of child-dog behaviours observed, with more negative behaviours, including animal harm, being observed for those children who are less attached to their pet dog (Hawkins *et al.*, 2022). Although based on research with adults, dog ownership can increase negative feelings (e.g., feeling stressed, annoyed, worried, frustrated, guilt; Barcelos

et al., 2021) and can increase symptoms of anxiety and depression (Merkouri et al., 2022). These negative feelings may arise when there is a perceived lack of compatibility, pet insensitivity or lack of pet responsiveness, unmet ownership expectations, and unwanted dog behaviours (Zilcha-Mano et al., 2011; Applebaum et al., 2020; Merkouri et al., 2022). It is also common for caregivers to have concerns regarding their child's treatment of pets, whether these harmful interactions are intentional (such as in the case of conduct problems or adverse childhood experiences) where targeted intervention is required (Wauthier et al., 2022a, b) or unintentional, where educational prevention programmes can promote positive and safe child-dog interactions (Meints et al., 2018; Hawkins et al., 2020). Negative child-dog interactions including intentional and unintentional animal harm, have been associated with lower attachment to pets, and poorer developmental outcomes including increased internalizing and externalizing problems, and poor emotion regulation (Hawkins et al., 2022; Wauthier et al., 2022a, b). However, the impact of negative interactions with pet dogs and low child-dog attachment has yet to be considered in relation to children's psychological well-being; these relationships will therefore be examined in the current study.

Children show a capacity to understand their dog's inner states and communicative signals (Eretová et al., 2020) although they tend to anthropomorphize (Lane et al., 2010) and give positive appraisal during interpretations even when negative emotions or behaviours are expressed by a dog such as appeasement (Meints et al., 2018; Aldridge and Rose, 2019). This can increase the risk for unsafe interactions that could lead to child injuries (e.g., dog bites) and compromised dog welfare. It is therefore important to consider the full spectrum of child-dog behaviours, and to recognize that not all interactions will be positive. Some caregivers report concerns over the impact of their dog on their child's emotional well-being, such as in cases where a child displays excessive worries about their dog, cases of pet loss, and/or when extreme separation anxiety from a pet is observed (Ballantyne et al., 2022). Caregivers also often report concerns regarding the safety of their child around their pet dog, with many children displaying risky or unsafe behaviours, such as approaching a dog displaying fear or aggression, which can increase the risk for child harm (Arhant et al., 2017; Aldridge and Rose, 2019; Náhlík et al., 2022). The possible risk of negative HAI interactions on developmental outcomes should also therefore be considered.

THE CURRENT STUDY

It is important to investigate the potential mechanisms (attachment and types of interactions, whether positive or negative) that underpin the benefits and risks of child-dog relationships for children's psychological well-being. Understanding such relationships is important for the development and evaluation of interventions that aim to promote positive and safe child-dog interactions, secure pet attachment, and ultimately promote healthy child psychological well-being as well as animal welfare. As such, the current study examines whether positive child-dog behaviour (e.g., caregiving behaviours) and negative child-dog behaviour (intentional and unintentional harm) mediate the relationship between child-dog attachment and children's psychological well-being. This study focuses on primary school-aged children (ages 7–13 years). Middle childhood is when pet ownership peaks, is a time of development when pets are viewed as important sources of attachment and is the average age for the onset of animal harm (Westgarth et al., 2010, 2013; Boat et al., 2011). Based on the previous evidence, it was hypothesized that higher self-reported child-dog attachment scores would predict higher rates of positive child-dog behaviours observed by caregivers and better child outcomes (higher child self-reported scores for subjective happiness, emotional well-being, quality of life, social satisfaction, and lower loneliness). Whereas the reverse would be found for lower attachment and higher rates of negative child-dog behaviours observed.

Methods

DESIGN AND PARTICIPANTS

Participants were part of a wider investigation into the emotional and behavioural basis of the child-dog bond (see Hawkins et al., 2022). The current study focuses on a subset of the data and employs a cross-sectional design using an online survey with caregiver measures (Part 1) and child self-report measures (Part 2). Following data cleaning and the removal of missing data ($n = 77$), the final sample included 117 caregiver reports only and 77 fully completed caregiver reports with child reports. Caregivers were recruited through online advertisements on social media and virtual leaflets shared by schools and universities. Children were recruited through their caregivers. The sample was therefore self-selected and opportunistic. Inclusion criteria were, the child was aged between 7 and 13 years, had at least one pet dog, and were able to give informed consent. Children with more than one dog could take part, but participants were asked to focus their answers on the dog that was either their favourite, they spent the most time with or had owned the longest.

Most caregivers ($n = 91$) identified as the child's mother, 19 identified as the father, and 7 as "other". Most participants were from the United Kingdom ($n = 80$), other locations included the United States ($n = 28$), Canada ($n = 4$), Brazil ($n = 3$), and Australia ($n = 3$). The mean age of the children was 10 years, and age categories included: 7–8 years ($n = 23$), 9–10 years ($n = 45$), 11–12 years ($n = 39$), and 13 years ($n = 10$). A total of 57% of the children were female and 43% were male. Most children had an older sibling ($n = 54$) and/or younger sibling ($n = 40$), some children had a twin sibling ($n = 7$), and some had no siblings ($n = 16$). Most children were White British ($n = 97$), and other nationalities included were: White Traveller ($n = 3$), Other White ($n = 9$), Mixed/Multiple Ethnic Groups/White and Asian ($n = 4$), Other Mixed/Multiple ethnic background ($n = 1$), and Asian/Asian British–Chinese ($n = 1$).

Most children ($n = 82$) considered their dog to be "their own", and most children helped to choose their dog ($n = 90$). The mean length of dog ownership was 31 months ($SD = 34.53$ months). Most children ($n = 88$) had one dog, and some children had 2–3 dogs ($n = 27$) or 4–5 dogs ($n = 2$). Dog sex included male/male castrated ($n = 60$) and female/female spayed ($n = 57$). Dog breeds were diverse, with the most popular breeds being Cocker Spaniel crossbreeds such as Cavapoos and Cockapoos ($n = 18$), Labradors ($n = 12$), Golden Retrievers ($n = 10$), mixed/unknown breeds ($n = 9$), Husky/Malamutes ($n = 8$), and Border collies/other collie breeds ($n = 8$).

PROCEDURE

The study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the institutional ethics committee of the university (approval number: 13308: 11985). The study involved an online survey, hosted on QuestionPro, which comprised of a series of questions and validated psychological measures relating to family and child demographics, dog ownership, pet care practices, child-dog attachment, and child well-being outcomes. At the start of the survey, caregivers viewed an information sheet that fully informed them about the purpose and aims of the research, before deciding whether to participate, and then provided informed consent through an online consent form, before being directed to the caregiver-report survey questions (Part 1). At the end of the caregiver section, a digital debrief form was provided and there was an option for the caregiver to save their response and return to the survey later or to continue to Part 2 which was the child-report section. The debrief form reminded caregivers of the purpose and aims of the study and provided information on the child report section of the survey (Part 2). Part 2 began with a child-friendly information sheet that explained the aims and purpose of the study in child appropriate language. Caregivers were responsible for ensuring that their child had fully understood and consented to the study. Children were then

directed to complete the digital informed consent form presented on the next page. Following informed consent, children completed the child-report section of the survey. During this time, caregivers could observe and help their child understand a question if needed but were asked not to influence any answer provided by their child. A child-friendly debrief form was then provided at the end of the survey that reminded them of the aims and purpose of the research. All documents and measures were designed to accommodate a basic level of reading comprehension and were suitable for the age range in our sample.

MEASURES

Caregiver-report measures

Demographics

Caregiver-reported demographic questions included: child's age, gender, religion, ethnicity, location, whether the child had siblings, whether the caregiver was the child's mother/father/other, the number of pet dogs in the household, the pet dog's sex, age, breed, whether the child helped to choose the dog, and whether the child considered the dog to be their own (see Section "Design and participants").

Child behaviour towards the pet dog

Caregivers were asked "please click the option for how frequently you observe your child to..." with 29 items relating to children's behaviour towards their pet dog. Each item is rated from 1 ("Never") to 6 ("Very often"). This measure is comprised of two sub-scales, positive/benign child-dog behaviours which have 13 items ($\alpha = 0.99$), and negative child-dog behaviours which has 16 items ($\alpha = 0.99$) (Arhant *et al.*, 2017; Hawkins *et al.*, 2022). Example items for positive/benign items include, "speak to the dog", "kiss the dog", "pet the dog on its body", "pet the dog on its head", and "leave the dog alone when it is resting". Example items for negative child-dog behaviours include "verbally scold the dog", "yell or scream during interaction", "restrain the dog by its collar", "throw objects on the dog", and "pull-on body parts of the dog". The negative behaviour subscale includes items for both intentional harms (e.g., "inflict pain deliberately on the dog"), and unintentional harm (e.g., "inflict pain accidentally on the dog, e.g., stepping on"). The average frequency of behaviours for each subscale was calculated (range 1–6). The average frequency of positive child-dog behaviours in this sample was $M = 4.52$ ($SD = 0.68$) and the average frequency of negative behaviours in this sample was $M = 2.06$ ($SD = 0.92$).

Child self-report measures

Attachment to pets

The CENSHARE Pet Attachment Survey (CENSHARE-PAS; Holcomb *et al.*, 1985) contains 27 items rated on a 4-point Likert scale from 1 "almost always" to 4 "almost never". The word "pet" was changed to "dog" throughout for clarity for those children with multiple pets. This measure taps into key elements of pet attachment, relationship maintenance, and intimacy. Example items include: "you are too busy to spend time with your dog", "you talk to your dog as a friend", "you consider your dog to be a member of your family", "when you feel bad, you seek your dog for comfort", and "you have your dog near you when you study, read, or watch TV". Additional items were added to capture fundamental aspects of pet attachment not measured by the original measure, pets as a safe haven and pets as a safe base. These additional items included "your dog helps you enjoy exploring new places", "you feel safer when you are with your dog" and "you feel more confident when you are with your dog". Negatively worded items are reverse coded and then a total attachment score is calculated (min/max range = 30–120) with higher scores indicating higher attachment. This is a widely used measure for pet attachment that is suitable and reliable for the age range tested (Cassels *et al.*, 2017; Bures *et al.*, 2019). This measure demonstrated strong psychometric properties and validity as well as high internal

consistency reliability in our sample; adding the three additional items increased internal consistency and reliability ($\alpha = 0.85$). The average attachment score (with the additional three items) in this sample was $M = 95.55$ ($SD = 10.89$, min/max range = 30–120).

Psychological well-being

The Stirling Children's Well-being Scale (SCWBS; Liddle and Carter, 2015) measures subjective psychological well-being and contains 12 items scored on a scale from 1 "never" to 5 "all of the time". The scale covers multiple areas of well-being including optimism, cheerfulness, and relaxation; satisfying interpersonal relationships; clear thinking and competence. The measure is comprised of two well-being subscales: (1) "Positive Emotional State" with six items (e.g., "I've been feeling calm", "I've been in a good mood", and "I've been getting on well with people"), and (2) "Positive Outlook" with six items (e.g., "I think good things will happen in my life", "I think lots of people care for me", and "I've been able to make choices easily"). Total scores for each scale are calculated (min/max range = 6–30) with lower scores indicating poorer mental well-being. Each subscale demonstrated good internal consistency and reliability within our sample, Positive Emotional State ($\alpha = 0.83$) and Positive Outlook ($\alpha = 0.80$). The average well-being score in our sample for Positive Emotional State was $M = 22.62$, $SD = 3.55$ (range = 13–30), and for Positive Outlook it was $M = 23.64$, $SD = 3.55$ (range = 13–30).

Happiness

The Subjective Happiness Scale (SHS; original, Lyubomirsky and Lepper, 1999, we used an adapted version, see O'Rourke and Cooper, 2010; Holder *et al.*, 2012) contains four items. Children are asked to select the number on the scale (between 1 and 7) that they feel describes them best. For item 1, children rated themselves from "I am not a very happy person" (1) to "I am a very happy person" (7), "most of the time". For the next three items ("some people are always happy – does this describe you?", "some people enjoy life whatever is going on. Does this describe you?", "some people are never as happy as they could be. Does this describe you?") children rated each item from 1 "not at all" to 7 "a great deal". Total happiness scores are calculated (min/max range = 4–28) with higher scores indicating higher reported happiness. This scale demonstrated adequate internal consistency and reliability in our sample ($\alpha = 0.63$). The average happiness score in our sample was $M = 20.53$ ($SD = 4.11$, range = 11–28).

Loneliness and social dissatisfaction

The Children's Loneliness and Social Dissatisfaction Scale (Asher *et al.*, 1984) measures children's subjective feelings of loneliness and social acceptance and contains 16 primary items that tap into feelings of loneliness, social inadequacy, and subjective estimations of peer state. Each item is scored from 1 "not at all true" to 5 "always true". Negatively worded items are first reverse coded and then a total score is calculated (min/max range = 16–80) whereby high scores indicate lower loneliness and higher social satisfaction. The scale demonstrated high internal consistency and reliability in our sample ($\alpha = 0.92$). The average score for this scale in our sample was $M = 64.95$, $SD = 10.44$ (min/max range = 37–80) and so all children either fell in the "marginal category" or the "pass" category i.e., displayed low loneliness and few social acceptance issues.

Health-related quality of life

The KIDSCREEN-10 Index (Ravens-Sieberer *et al.*, 2010) measures children's self-reported health-related quality of life (HRQoL) and contains ten items rated on a 5-point scale from 1 "not at all" to 5 "extremely". Example items include, "Have you felt fit and well?", "Have you felt full of energy?", "Have you had enough time for yourself?", and "Have you been able to pay attention?". Average scores are calculated, and high scores indicate higher HRQoL. This scale demonstrated good internal consistency and

reliability in our sample ($\alpha = 0.81$). The average HRQoL in our sample was $M = 3.83$, $SD = 0.59$ (min/max range = 2–4.9).

ANALYSIS

A G^* power analysis indicated that our sample was sufficient to detect medium effect sizes (based on 80% power and alpha of 0.05). Prior assumption testing confirmed that all basic assumptions for mediation analysis were met. All analyses were carried out using SPSS 25 (IBM SPSS Statistics for Windows, IBM Corp., Armonk, N.Y., USA) and Hayes' 2013 PROCESS macro for SPSS (V3.5). Intercorrelations were first carried out followed by parallel mediation analyses. Completely standardized beta for ab pathways (i.e., indirect effect of X on Y through M) (abcs) are utilized to determine the effect size of each indirect effect (Preacher and Kelley, 2011) and Cohen's effect size standards are squared in mediation analysis (Cohen, 1992; Kenny, 2021). Effect sizes are therefore $abcs = 0.01$ (small effect), $abcs = 0.09$ (medium effect), and $abcs = 0.25$ (large effect). Preliminary analyses found no effect of child or caregiver demographics on the variables of interest.

Results

INTERCORRELATIONS

Intercorrelations between the variables of interest are displayed in Table 1. Correlations revealed that child-dog attachment significantly positively correlated with positive child-dog behaviours,

positive emotional state, positive outlook, happiness, quality of life, and correlated with lower loneliness and social dissatisfaction. Positive child-dog behaviours significantly positively correlated with scores for positive emotional state, positive outlook, happiness, quality of life, and less loneliness and social dissatisfaction. Therefore, children with greater attachment to their dog were more likely to display more positive behaviours towards their dog, and subsequently scored higher on well-being outcomes.

Correlations also revealed that child-dog attachment significantly negatively correlated with negative child-dog behaviours, and that negative child-dog behaviours significantly negatively correlated with positive outlook, quality of life, and correlated with higher loneliness and more social dissatisfaction. Therefore, children who displayed lower attachment to their pet dog, were more likely to display more negative behaviours towards their dog, and subsequently scored lower on well-being outcomes.

MEDIATION ANALYSES

Parallel mediation analyses (Tables 2 and 3) were carried out to examine the mediating effect of positive child-dog behaviours (M1) and negative child-dog behaviours (M2) on the relationship between child-dog attachment (X) and children's psychological well-being outcomes (Y).

Direct effects in mediation analysis are the effect of X on Y in the absence of the mediator (M). The indirect pathway is the effect of X

Table 1. Intercorrelations among the main study variables.

	1	2	3	4	5	6	7	8
1 Child-dog attachment	1	0.559**	-0.329**	0.344**	0.393**	0.396**	0.299**	0.334**
2 Positive child-dog behaviours		1	0.090	0.323**	0.386**	0.413**	0.415**	0.344**
3 Negative child-dog behaviours			1	-0.109	-0.245*	-0.152	-0.364**	-0.318**
4 Positive emotional state				1	0.690**	0.524**	0.444**	0.600**
5 Positive outlook					1	0.570**	0.638**	0.757**
6 Happiness						1	0.536**	0.468**
7 Low loneliness and social satisfaction							1	0.655**
8 Quality of life								1

Note: Effect sizes are: small, $r = 0.1$; medium, $r = 0.3$; large, $r = 0.5$ (Cohen, 1992). **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

Table 2. Parallel mediation analysis examining indirect effects of child-dog attachment (X) on child self-reported psychological well-being (Y), via caregiver-reported positive child-dog behaviours (M1), and negative child-dog behaviours (M2).

	Psychological well-being (SCWBS total)			Positive emotional state (subscale)			Positive outlook (subscale)		
	β	SE	95% CI	β	SE	95% CI	β	SE	95% CI
Completely standardised indirect effect beta values of X on Y (ab_{cs}) (total)	0.20*	0.09	0.04, 0.39	0.13	0.09	-0.03, 0.32	0.23*	0.10	0.04, 0.45
Direct effect of M1 on Y	2.77*	1.27	0.23, 5.31	1.12	0.72	-0.33, 2.56	1.65*	0.69	0.02, 0.28
Direct effect of M2 on Y	-0.96	0.76	-2.47, 0.56	-0.19	0.43	-1.05, 0.67	-0.76	0.41	-1.58, 0.05
Direct effect of X on Y	0.12	0.08	-0.04, 0.29	0.07	0.05	-0.02, 0.16	0.05	0.04	-0.04, 0.14
Indirect effect of X on Y via M1	0.09*	0.05	0.02, 0.20	0.04	0.03	-0.01, 0.09	0.06*	0.03	0.01, 0.12
Indirect effect of X on Y via M2	0.03	0.02	-0.01, 0.08	0.01	0.01	-0.02, 0.03	0.02*	0.01	0.00, 0.05
Unstandardised total indirect effect of X on Y via M1 and M2	0.12*	0.06	0.02, 0.25	0.04	0.03	-0.01, 0.11	0.08*	0.03	0.01, 0.15

Note: Effect sizes: $abcs = 0.01$ (small effect), $abcs = 0.09$ (medium effect), and $abcs = 0.25$ (large effect). M1 = positive child-dog behaviours, and M2 = negative child-dog behaviours. *Significant pathway ($p < 0.05$).

Table 3. Parallel mediation analysis examining indirect effects of child-dog attachment (X) on child outcomes (Y), via caregiver-reported positive child-dog behaviours (M1) and negative child-dog behaviours (M2).

	Happiness			Low loneliness and social satisfaction			Quality of life		
	β	SE	95% CI	β	SE	95% CI	β	SE	95% CI
Completely Standardised indirect effect beta values of X on Y (ab_{cs}) (total)	0.20*	0.09	0.04, 0.41	0.42*	0.12	0.22, 0.68	0.28*	0.09	0.13, 0.47
Direct effect of M1 on Y	1.89*	0.08	0.29, 3.49	7.92*	1.95	4.03, 11.81	0.29*	0.12	0.06, 0.51
Direct effect of M2 on Y	-0.39	0.48	-1.34, 0.56	-4.52*	1.14	-6.80, -2.24	-0.19*	0.07	-0.32, -0.05
Direct effect of X on Y	0.07	0.05	-0.03, 0.17	-0.12	0.13	-0.38, 0.13	0.00	0.01	-0.01, 0.02
Indirect effect of X on Y via M1	0.17*	0.08	0.04, 0.35	0.29*	0.09	0.12, 0.49	0.01*	0.00	0.00, 0.02
Indirect effect of X on Y via M2	0.03	0.03	-0.02, 0.11	0.01*	0.01	0.00, 0.03	0.01*	0.00	0.00, 0.01
Unstandardised total indirect effect of X on Y via M1 and M2	0.20*	0.09	0.04, 0.41	0.42*	0.12	0.21, 0.69	0.02*	0.01	0.01, 0.03

Note: Effect sizes: $abcs = 0.01$ (small effect), $abcs = 0.09$ (medium effect), and $abcs = 0.25$ (large effect). M1 = positive child-dog behaviours, and M2 = negative child-dog behaviours. *Significant pathway ($p < 0.05$).

on Y that works through the mediator (M). We, therefore, report on the indirect pathways for each analysis as these explain the impact of child-dog behaviours on the relationship between child-dog attachment and child well-being outcomes. Complete mediation suggests that X no longer affects Y when the M has been introduced in the analysis. Partial mediation suggests that X still affects Y, but the effect has been reduced when M has been introduced.

Psychological well-being

Child-dog attachment (X) had a significant indirect effect on total scores for child reported well-being (SCWBS) (Y) through parent-reported positive child-dog behaviours (M1) and negative child-dog behaviours (M2) ($ab_{cs} = 0.20$, medium effect) (Fig. 1); this was a complete mediation as the direct effect of X on Y was no longer significant when accounting for M1 and M2. In this model, only positive child-dog behaviour was a significant mediator of psychological well-being ($\beta = 0.09$).

Child-dog attachment (X) did not have a significant indirect effect on the subscale child reported positive emotional state (Y) through parent-reported positive child-dog behaviours (M1) and negative child-dog behaviours (M2). However, child-dog attachment (X) did have a significant indirect effect on the subscale child reported positive outlook (Y) through parent-reported positive child-dog behaviours (M1) and negative child-dog behaviours (M2) ($ab_{cs} = 0.23$, medium effect) (Fig. 2); this was a complete mediation as the direct effect of X on Y was no longer significant when accounting for M1 and M2. In this model, both positive child-dog behaviours ($\beta = 0.06$) and negative child-dog behaviours ($\beta = 0.02$) were significant mediators. While positive child-dog behaviour was a marginally stronger mediator, the contrast between positive and negative child-dog behaviours was not significant ($\beta = 0.04$, SE = 0.03, CI's: -0.01, 0.09).

Happiness

Child-dog attachment (X) had a significant indirect effect on child reported happiness (SHS) (Y) through parent-reported positive child-dog behaviours (M1) and negative child-dog behaviours (M2) ($ab_{cs} = 0.20$, medium effect) (Fig. 3); this was a complete mediation as the direct effect of X on Y was no longer significant when accounting for M1 and M2. In this model, only positive child-dog behaviour was a significant mediator ($\beta = 0.17$).

Loneliness and social dissatisfaction

Child-dog attachment (X) had a significant indirect effect on child reported low loneliness and high social satisfaction (Y) through

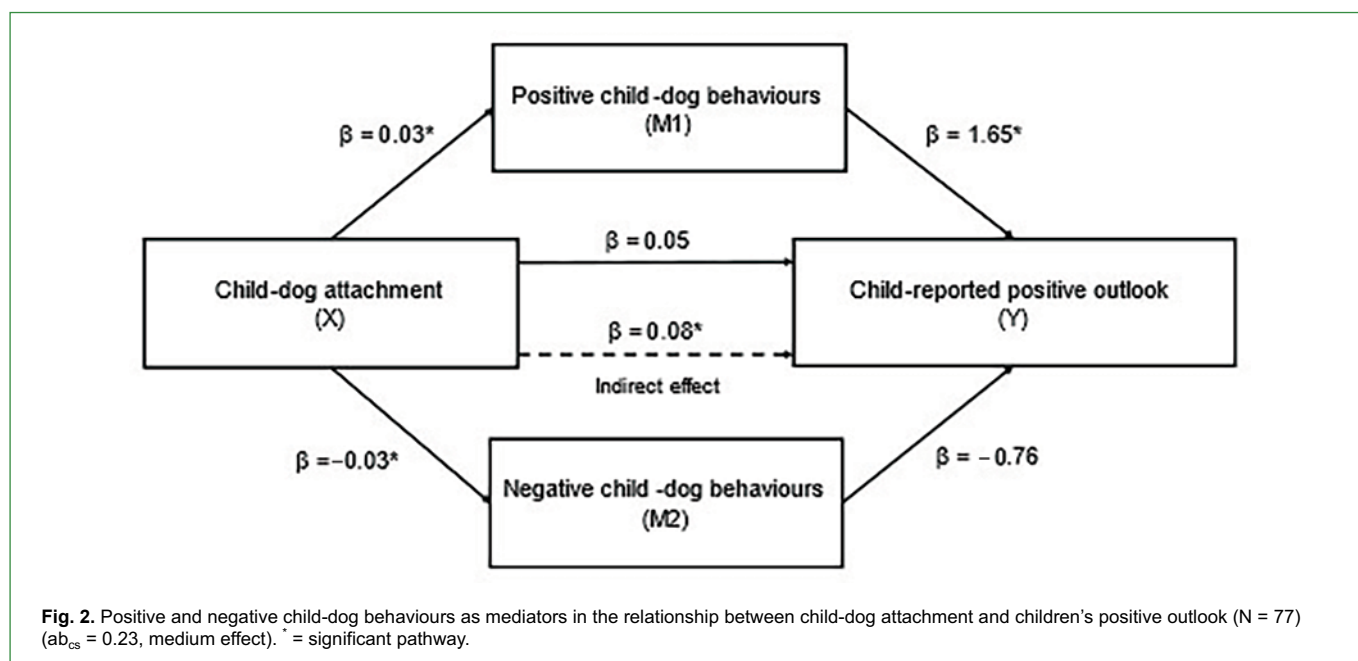
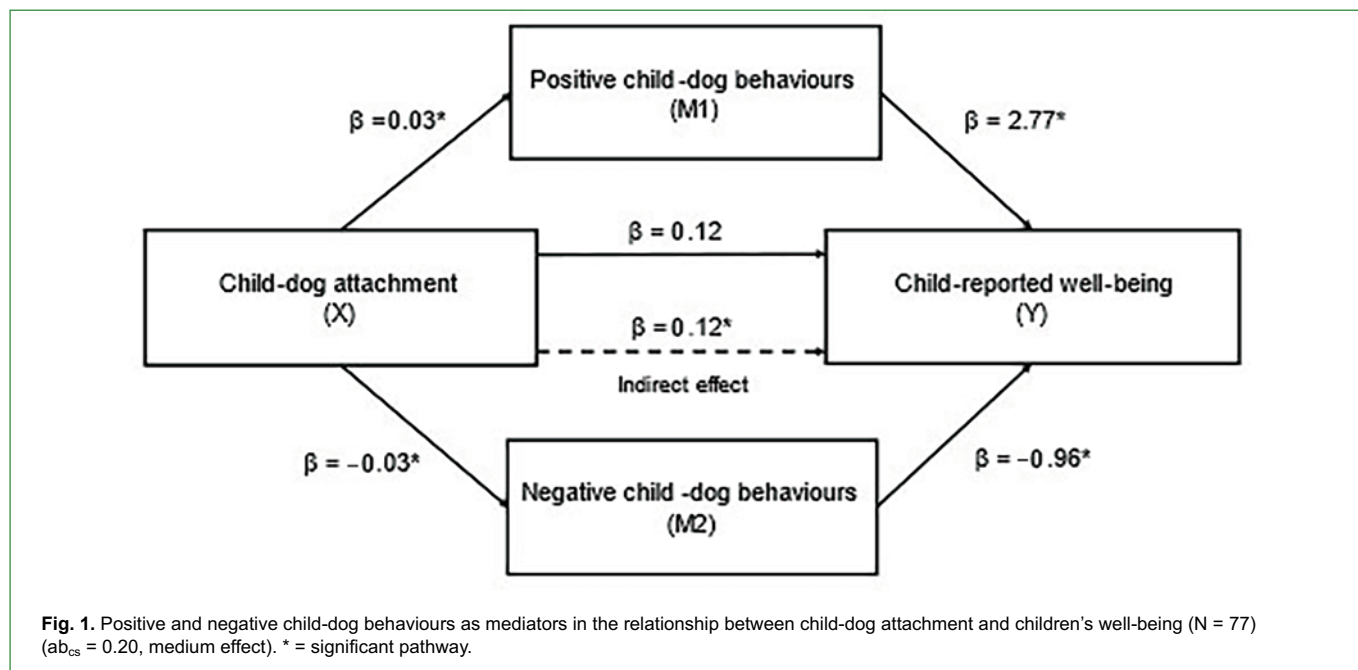
parent-reported positive child-dog behaviours (M1) and negative child-dog behaviours (M2) ($ab_{cs} = 0.42$, large effect) (Fig. 4); this was a complete mediation as the direct effect of X on Y was no longer significant when accounting for M1 and M2. In this model, both positive child-dog behaviours ($\beta = 0.29$) and negative child-dog behaviours ($\beta = 0.01$) were significant mediators. While positive child-dog behaviour was a marginally stronger mediator, the contrast between positive and negative child-dog behaviours was not significant ($\beta = 0.16$, SE = 0.11, CI's = -0.05, 0.37).

Quality of life

Child-dog attachment (X) had a significant indirect effect on child reported quality of life (Y) through parent-reported positive child-dog behaviours (M1) and negative child-dog behaviours (M2) ($ab_{cs} = 0.28$, large effect) (Fig. 5); this was a complete mediation as the direct effect of X on Y was no longer significant when accounting for M1 and M2. In this model, both positive child-dog behaviours ($\beta = 0.01$) and negative child-dog behaviours ($\beta = 0.005$) were significant mediators. While positive child-dog behaviour was a marginally stronger mediator, the contrast between positive and negative child-dog behaviours was not significant ($\beta = 0.004$, SE = 0.004, CI's: -0.004, 0.013).

Discussion

The aim of this study was to examine whether positive child-dog behaviour (such as caring behaviour) and negative child-dog behaviour (intentional and unintentional animal harm) mediate the relationship between child-dog attachment and children's psychological well-being. As predicted, child-dog attachment influenced types of child-dog interactions observed, and child-dog interaction type influenced children's self-reported well-being outcomes. The frequency of positive child-dog interactions significantly mediated the relationship between attachment scores and child outcomes (higher scores for well-being, positive outlook, happiness, quality of life, higher social satisfaction, and lower loneliness). The reverse was found for negative child-dog interactions, mediating the relationship between attachment scores and child outcomes (lower well-being, increased negative outlook, higher loneliness and social dissatisfaction, and lower quality of life). Effect sizes were either medium or large, and these were complete mediation effects, suggesting that types of child-dog interactions explained the relationship between child-dog attachment and well-being outcomes. No significant mediation effect was found for positive emotional state (well-being subscale).



Although based on associations and so causation cannot be determined, these findings advance our understanding of the complex relationship that children have with their pet dogs and highlight the possible benefits and risks of child-dog attachment and the varied types of behaviours observed within child-dog dyads for children's psychological well-being.

The findings from this study are in line with previous research that has demonstrated the well-being benefits of dog ownership for children and young people (Rhoades *et al.*, 2015; Endo *et al.*, 2020). These findings are noteworthy given that childhood well-being can predict well-being in adulthood (Richards and Huppert, 2011). In our study, such identified well-being benefits were only found for children who were highly attached to their dog and engaged in a high frequency of positive child-dog behaviours, and there was only a significant mediation effect of child-dog behaviour for total well-being scores and the subscale positive outlook. These findings may explain previous inconclusive evidence surrounding the mental health benefits of pets in studies that only examined pet

presence (Fraser *et al.*, 2020; Rodriguez *et al.*, 2021; Scoresby *et al.*, 2021). These findings also further support the importance of considering human-dog attachment for well-being outcomes (Wanser *et al.*, 2019; Wells, 2019), and that types of human-dog activities may impact different well-being dimensions (Barcelos *et al.*, 2021).

Our study found higher scores for happiness, an important component of well-being, and positive outlook (but not emotional state), for children who were highly attached to their dog and displayed positive child-dog behaviours compared to those who were less attached. Based on previous evidence, it is hypothesized that the happiness scores found in our study could be explained through the mechanisms of play, and through laughter and humour, thus negative feelings may be reduced through "comic relief" within families who are highly attached to their family dogs (Gonot-Schoupinsky *et al.*, 2020; Christian *et al.*, 2022). Such benefits may be further enhanced by happiness indicators found in children and young people with dogs, such as higher quality

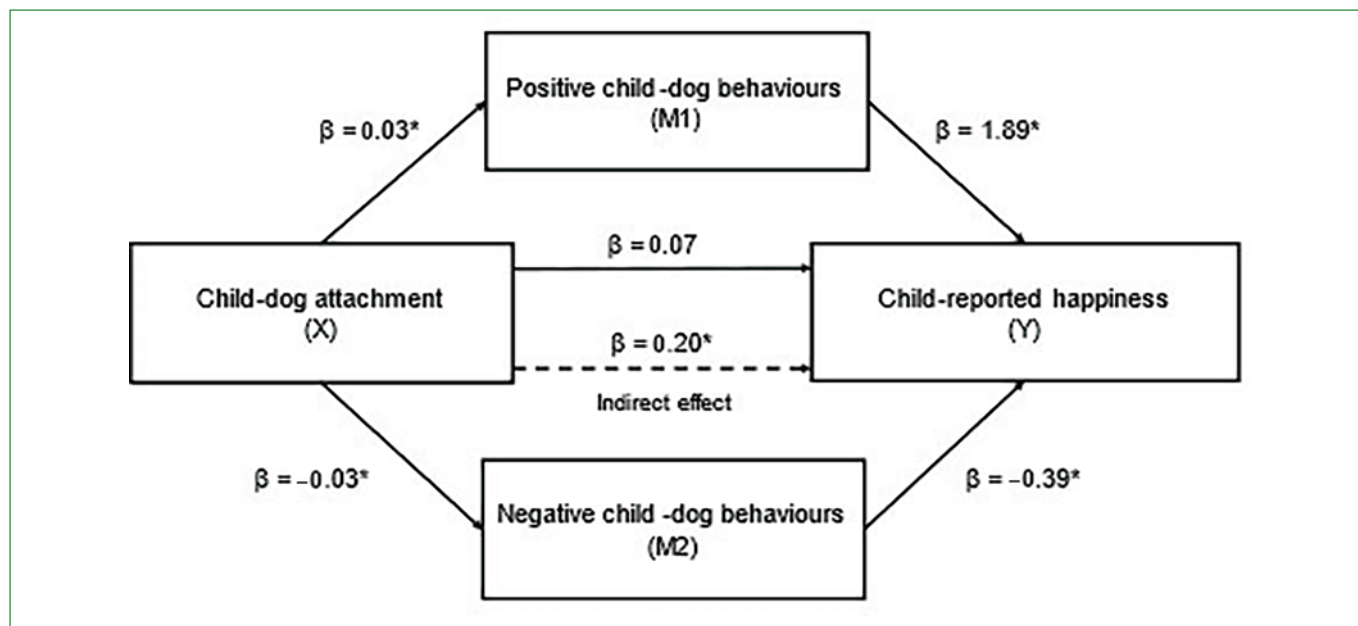


Fig. 3. Positive and negative child-dog behaviours as mediators in the relationship between child-dog attachment and children’s happiness (N = 77) ($ab_{cs} = 0.20$, medium effect). * = significant pathway.

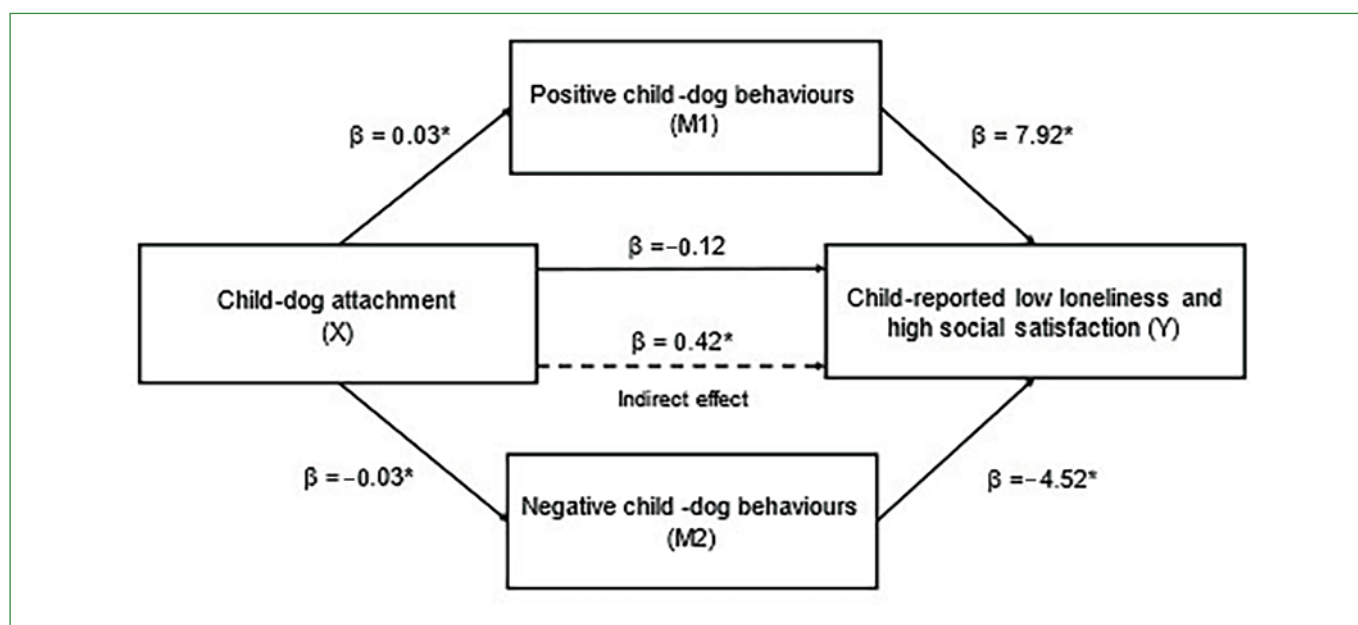
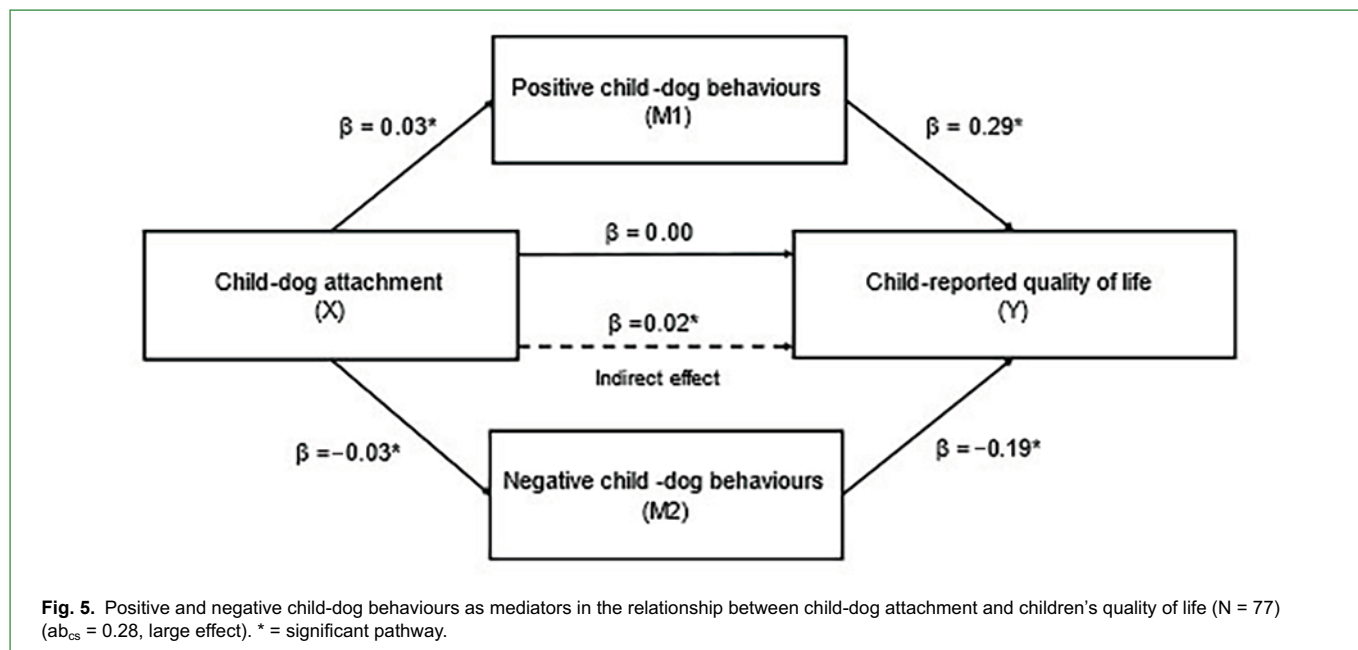


Fig. 4. Positive and negative child-dog behaviours as mediators in the relationship between child-dog attachment and children’s loneliness and social dissatisfaction (N = 77) ($ab_{cs} = 0.42$, large effect). * = significant pathway.

sleep, heightened sense of social support and companionship, feeling safe and secure, feeling calm and relaxed, and increased self-esteem (Kurdek, 2008; Purewal *et al.*, 2017; Castro and Lindsey, 2021; Ballantyne *et al.*, 2022). We cannot determine the causal effects of these mechanisms from our current findings so future studies could examine whether such effects exist. We also know from previous evidence that engagement in positive interactions such as caregiving behaviour and physical affection (e.g., petting), could prevent or interrupt rumination and negative thinking patterns as these positive activities increase mindfulness, helping children to focus on the present moment and to modify their attention away from worries (Jackson-Grossblat *et al.*, 2016). Research supports the importance of mindfulness and disruption of rumination for psychological well-being in childhood (Kallapiran *et al.*, 2015), and so mindfulness could be explored as a possible mechanism explaining the impact of pets for child development in future research. Our findings indicate potential beneficial impacts

of attachment to dogs and positive engagement with dogs for both mood (happiness) and state of mind (positivity). The non-significant finding for emotional state, an indicator of hedonic well-being, was unexpected, given the higher scores found for happiness and total well-being. Nevertheless, positivity can significantly predict positive affectivity across time as well as psychological well-being across the course of development, and positivity is important for resilience in times of adversity and stress (Caprara *et al.*, 2009, 2017).

The World Health Organization (WHO) advocates for a more holistic definition of well-being and resilience, and not just the absence of mental illness (World Health Organization, 1948). Well-being comprises a spectrum of positive feelings and subjective life assessments, thus comprising both cognitive and affective components (Andrews and McKennell, 1980). Subjective quality of life, although arguably based upon different theoretical concepts to subjective well-being, is often used as an important indicator



of well-being (Currie *et al.*, 2012; Skevington and Böhnke, 2018). Our study found higher self-report scores for quality of life for children who displayed high attachment and high engagement in positive behaviours with their dogs. This finding is in line with our hypothesis and supports previous research with adolescents who also report a higher quality of life when attached to their pet dogs (Marsa-Sambola *et al.*, 2017). However, previous studies have mostly focused on owner attachment and perceived quality of life of the dog (e.g., White *et al.*, 2017) or on how child-dog interactions impact upon the dog's quality of life (e.g., Hall *et al.*, 2019), few studies have examined the quality of life outcomes for the child. Future research could usefully measure animal welfare in the context of relationships with children.

As mentioned, although we cannot determine mechanisms that explain the associations we found in our study, one determinant of quality of life and subjective well-being is perceived social support and social satisfaction, along with positive affect and optimism (Karademas, 2006; Siedlecki *et al.*, 2014). Quality of social relationships and perceived social support can predict subjective well-being, with those feeling satisfied with their relationships, and having expectations that they can rely on someone (or in our study, a pet dog), feeling a sense of comfort and support, which increases happiness and life satisfaction (Siedlecki *et al.*, 2014). Moreover, attachment can predict quality of life, life satisfaction, and perceived social support (Nickerson and Nagle, 2004; Chen *et al.*, 2017). Such research may explain our finding that children who were more attached to their dog reported more satisfaction with their social relationships. Perceived social support and relationship satisfaction could therefore be explored in future research in relation to human-dog attachments. Our findings may be further explained through research demonstrating that families with dogs tend to report more fun and humorous conversations between family members, less family conflict, and lower parental stress (Tannen, 2004; Hall *et al.*, 2016; Cassels *et al.*, 2017), which may increase the quality and nature of family relationships. Having a dog that a child feels attached to, and feel they can rely on for social support, may therefore also facilitate positive relationships and foster attachment between a child and their other family members, improving family functioning, and increasing social satisfaction (Wright *et al.*, 2015; Carr and Rockett, 2017). Such possible mechanisms should be explored in future HAI research.

Overall, our findings demonstrated that most children in our sample displayed high scores on emotional attachment to their

pets, engaged in positive interactions with them, and subsequently demonstrated positive developmental outcomes. Attachment is therefore not only a protective factor for psychological wellbeing within human-human relationships but may also extend to HAI contexts. Further research should expand upon these findings to capture groups where there is a higher risk for attachment insecurities (e.g., childhood externalizing problems; Hawkins *et al.*, 2022) for a wider representation of child-dog relationships.

LIMITATIONS, IMPLICATIONS, AND DIRECTIONS FOR FUTURE RESEARCH

A limitation of our study was that we did not examine pre-existing child or caregiver mental health difficulties. We did, however, collect data on children's diagnosis of developmental disabilities, but this data was not considered in the formal analyses due to too few numbers within each diagnosis group. Based on previous research (e.g., caregivers with autistic children, Ballantyne *et al.*, 2022), caregivers may be more motivated to acquire pet dogs if they believe that dog would be beneficial for their child's well-being, in perhaps a similar way that adults with mental health difficulties acquire a pet to help manage their own symptoms (Hawkins *et al.*, 2021; Merkouri *et al.*, 2022). For example, during the COVID-19 pandemic, families commonly reported that they acquired a puppy for companionship for their child and to improve their family's mental health (Packer *et al.*, 2021). However, our study demonstrated that child-dog interactions will not always be positive, and not all children will form a strong bond with their family dogs. Often children engage in harmful child-dog interactions, increasing the risk for animal harm and child injury (Giraudet *et al.*, 2022), and caregivers tend to overestimate the beneficial effects of pet dogs (Wright *et al.*, 2015). Pet dogs can exacerbate existing psychological difficulties, or bring about new challenges and concerns, such as for families with neurodiverse children (Wright *et al.*, 2015). Future studies could consider including measures that tap into both child and caregiver perceived pet responsiveness and sensitivity, ownership expectations and satisfaction, and unwanted dog behaviour, given the increased risk of such variables for increased stress and caregiver burden (Zilcha-Mano *et al.*, 2011; Applebaum *et al.*, 2020; Merkouri *et al.*, 2022). These additional confounding variables outlined could also explain the effects we observe among attachment, types of behaviours, and child outcomes. Careful consideration should be given to decisions around dog acquisition for families, considering individual family

circumstances, current challenges faced, and individual child and caregiver characteristics and diagnoses. Specifically, future research could explore the outcomes for children whose families adopt a dog as a reward for good behaviour versus children from families who adopt a dog to improve pre-existing behaviour problems.

The measure of attachment in the current study only tapped into strength of emotional attachment and did not capture attachment “type” or “orientation”. Attachment types are important, and anxious and avoidant attachment types have been observed in human-pet relationship studies with adults (Zilcha-Mano *et al.*, 2011). Pathological attachment strategies may be linked to a higher risk of animal harm and accepting attitudes towards harmful behaviours, and children with insecure attachment types may display less mentalization about pets, and fewer caregiving behaviours (Wauthier *et al.*, 2022a, b). Examining child-pet attachment type (secure pet attachment compared to anxious/avoidant/dismissive pet attachment) rather than strength of emotional attachment alone, will therefore be important in future studies that aim to substantiate the impact of pets on psychological well-being. Another potential confounding variable that should be considered in future research is child-caregiver attachment. This is due to recent findings demonstrating that more secure child-caregiver attachments may predict less attachment to a dog through decreased psychological need (Ribera *et al.*, 2023). Moreover, it is worth mentioning that we explored children’s relationships to companion dogs, where time and exposure and feeling that the dog is the child’s “own”, is important for attachment development. This attachment is likely to be different to the relationship between a child and their therapy or service dog where a child may be more dependent on the dog for daily functioning and the dog has more of a functional role (Kwong and Bartholomew, 2011). Such potential differences in attachment relationships could also be considered in future studies.

A strength of our study is that we collected self-report data directly from children. However, to assess child-dog interactions, we also collected caregiver’s reports which raises concern over reliability and validity. Caregivers reported upon their child’s behaviour towards their family dogs, and so some behaviours may have been missed or caregivers may have been reluctant to report harmful behaviours. Moreover, children often seek comfort from their pets in private, such as cuddling them and telling them secrets (Bryant, 1990), but also engage in harmful behaviours in private, and so caregivers are not always aware of such interactions. However, child and parental reports of animal cruelty have been found to correlate in previous research (Dadds *et al.*, 2004). Nevertheless, future research could examine child-dog behaviour through behavioural observations in natural settings, through child self-reports of such behaviours through diaries or interviews and could explore possible discrepancies between child and caregiver report HAI measures. Finally, we collected data on the number of all pets present within a household as well as types of pet present. However, analysing these variables was out of the scope of the current study, and we only assessed attachment to a single pet dog within the home (the one the child had owned the longest, spent the most time with, or was their favourite). Although children form the strongest attachments to pet dogs, children also form emotional attachments to other house-dwelling pets such as cats and small mammals, and pets that do not live within the home such as horses and goats (Hawkins *et al.*, 2017; Muldoon *et al.*, 2019). Future studies could therefore consider assessing the well-being outcomes of attachment to different pet types, breeds, and mixed pet households, and could consider the impact of having multiple or differing pet attachment types to individual pets. Behaviours with other types of pets may be limited (e.g., a fish, reptile, or hamster) which could therefore limit attachment and well-being opportunities given the role of shared behaviours for psychological health.

CONCLUSION

This study has identified important mechanisms through which pet dogs could pose both benefits and risks to children’s well-being. Our study has shown that child-dog relationships may promote positive well-being through engagement in positive behaviours. In contrast, well-being benefits may not be observed for children who are less attached to their dog and display negative child-dog interactions. Our findings are based on associations and so caution should be taken when interpreting the findings. Nevertheless, our study highlights the potential importance of identifying risk factors for negative interactions and for the development and evaluation of prevention strategies that will be mutually beneficial for both children and dogs. Interventions that aim to promote secure child-dog attachments, along with the development of a child-dog attachment type measurement tool (that taps into both secure and insecure attachment types), may be important, as no such intervention or measurement tool currently exists. Many parent-child attachment interventions exist, and so a worthwhile endeavour may be to examine whether similar interventions focused on HAI could be successfully implemented and evaluated for potential improvements in child-dog relationships, particularly in the context of negative or problematic child-dog interactions. Our study also highlights the need for interventions that focus on the promotion of safe and positive child-dog interactions, such as the encouragement of caregiving behaviour and the prevention of harmful or risky behaviours whether intentional or not. Existing interventions that focus on child-dog behaviours have been delivered in educational settings, by animal welfare organizations, or by university research teams and are usually short-term or one-off sessions, therefore, leading to short-term benefits (such as cognitive change but not affective or behavioural change, e.g., Hawkins *et al.*, 2020). Universal at-home strategies where long-term monitoring and intervention is possible, may also be impactful and caregivers could play important roles in such strategies. Developing and evaluating user-friendly, research-informed guidance, and educational materials designed for caregivers could be a useful future avenue for both researchers and practitioners.

CONFLICTS OF INTEREST

This study was funded by Nestlé Purina PetCare Company. The sponsors had no role in the design, execution, interpretation, or writing of the study. The authors declare no other conflicts of interest.

ETHICS STATEMENT

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the institutional ethics committee (approval number: 13308: 11985). Informed consent was gained from all participants.

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AUTHOR CONTRIBUTIONS

R.D.H conceptualized the study; C.R. and R.D.H. carried out final design; C.R. and R.D.H. investigated the study; R.D.H. carried out formal analysis; R.D.H. carried out writing – original draft preparation; C.R. and N.M. carried out writing – review and editing; R.D.H. supervised the study; C.R. and R.D.H. administrated the project; R.D.H. and N.M. carried out funding acquisition. All authors have read and agreed to the published version of the manuscript.

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DATA AVAILABILITY

Data is available on request.

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