Costs, benefits and mechanisms of animal-assisted therapy: adopting a change in perspective

Vanessa A. D. Wilson

Abstract

Animal-assisted therapy has progressed in recent years, helping a broad spectrum of people to tackle stress, loneliness and health problems, including those with life-long disabilities. For children with autism spectrum disorder (ASD), animal-assisted therapy helps with social functioning and communication. Whilst numerous articles document the human benefits, far fewer studies have addressed the benefits, or costs, to the therapists themselves —– the animals. Whilst some studies indicate that humans and animals may mutually benefit from positive social interactions, we are yet to fully understand the mechanisms that regulate the social and behavioural outcomes of human-animal interactions under animal-assisted therapy, or its effects on the therapy animal. In this article, I discuss the benefits of examining the physiological and endocrinological mechanisms that underlie such interactions, and why it is important to understand the effects on both nonhumans and humans alike, focusing on animal-assisted therapy for children with ASD. I address species suitability and animal handling experience, and discuss an individualised approach that suits both child and animal, by considering patient needs and animal temperament. Together, these points allow us to reduce the potential of stress in therapy animals, improve the impact of animal-assisted therapy on recipients, and move towards a human-animal interaction that is mutually beneficial.

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Corresponding author:

Vanessa Wilson, wilsonvad@gmail.com

Benefits of animal-assisted therapy in autism spectrum disorder

Records of pets used in human therapy date back over 200 years, with pet therapy and research into its benefits developing in earnest since the 1960s (Hooker, Freeman, & Stewart, 2002). Animal-assisted therapy helps people tackle stress, loneliness and health problems (Bert, Gualano, Camussi, Pieve, Voglino, & Siliquini, 2016; Souter & Miller, 2007), and the associated literature now spans a broad medical array, from people facing mental health problems and the elderly to those living with life-long disorders such as autism spectrum disorder (ASD) (Hoagwood, Acri, Morrissey, & Peth-Pierce, 2017; Nimer & Lundahl, 2007; Perkins, Bartlett, Travers, & Rand, 2008). In the following discussion, I will focus specifically on the role of animal-assisted therapy for children with autism spectrum disorder (ASD). Specifically, I will discuss the mechanisms that underlie human-animal interactions, and will consider how understanding more about these interactions could be beneficial to both parties.

Autism spectrum disorder is a challenging condition in which people struggle with social interactions, communication and restrictive or repetitive behaviour (American Psychiatric Association, 2013). The symptoms associated with ASD are diverse in nature, but may include difficulties such as lack of eye contact, verbal deficits, inability to process social information such as facial expressions or gestures, strong sensitivity to sensory stimuli, strict adherence to routines and potential cognitive deficits.

Animal-assisted therapy is demonstrated to help children with ASD with social functioning and communication. A meta-analysis, which found a positive role of animal-assisted therapy across four domains, found the strongest effect sizes[1] in studies assisting people with ASD, suggesting that animal-assisted therapy in these cases produced beneficial outcomes (Nimer & Lundahl, 2007). The studies assessing ASD reviewed by Nimer and Lundahl (2007) all used dogs as their therapy animal. More recent research supports the role of dogs as beneficial in

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[1] Effect size: defined as the quantitative measure of a relationship, for example, the extent to which two variables correlate. For more information see Lalongo (2016).

therapy for children with autism, such as reducing distraction and helping to engage them socially (Berry, Borgi, Francia, Alleva, & Cirulli, 2013; Solomon, 2010). Other research suggests that equine therapy may also benefit children with autism. A review paper revealed that of nine studies examining animal-assisted therapy in ASD, five studies indicated positive outcomes in social functioning, motor skills or communication; four of these five studies used horses as the therapy animal (Hoagwood et al., 2017).

Animal-assisted therapy sessions can take place in a variety of settings, from individual sessions to the classroom. Recently, the role of animals in the home has also been considered a form of therapy: amongst families living with ASD, the presence of a pet dog was associated with decreased family difficulties, in comparison to families without a dog (Hall, Wright, Hames, & Mills, 2016; Wright, Hall, Hames, Hardiman, Mills, & Mills, 2015). These findings however are criticised for their limited methodology, such as excluding from analyses participants who rehomed their dog, and relying on participant choice in taking on a pet rather than random assignment (Crossman & Kazdin, 2016). Given that the emotional and health benefits of pets have been well-documented (Amiot & Bastian, 2014; Friedmann, 1995; Julius, Beetz, Kotrschal, Turner, & Uvnäs-Moberg, 2013), it is highly probable that pets may provide an important role in families dealing with the difficulties of ASD. A family pet is not however a fix-all solution and acquiring one for the sole purpose of being a support-animal raises several ethical considerations. Whilst a growing literature continues to address the benefits of nonhuman animals (from here on referred to as simply animals) to people, we continue to neglect to address the other side of the coin: the benefits (or lack of) to the assisting animals. In the following section I address the effects of animal-assisted therapy on the therapy animal.

Animal benefits or costs of animal-assisted therapy

There are a number of possible concerns regarding the treatment and welfare of animals that assist in human therapy. Iannuzzi and Rowan (1991) are amongst the earliest authors to address the issue of animal ethics in animal-assisted therapy. Welfare concerns range from health problems that may develop from a lack of appropriate diet or exercise, as occurred in some cases where rescue

dogs were housed with elderly people; to fatigue in residentially housed therapy-animals, who do not get enough time to rest; to stress and exhaustion as a result of visitation programmes. Whilst many animal-assisted therapy programmes use domesticated animals, captive undomesticated animals such as dolphins and monkeys have also been used, which raises additional questions about appropriate species selection for use in human interactions (Iannuzzi & Rowan, 1991; Nathanson, De Castro, Friend, & McMahon, 1997).

Appropriateness can be considered in two ways. Firstly, when examining animal type in the effectiveness of the therapy, species matters. Nimer et al (2007) found that when comparing the effectiveness of studies, the use of dogs generally resulted in high effect sizes, whereas the use of horses and aquatic animals did not. Secondly, we must consider whether using non-domesticated or only recently domesticated species is a form of exploitation (Zamir, 2006). Pets such as dogs and cats have been domesticated over thousands of years, a process that has shaped both the behaviour and physiology of these species (Clutton-Brock, 1995; Driscoll, Menotti-Raymond, Roca, Hupe, Johnson, Geffen et al., 2007). If an animal seeks out the company of a person, it may not be considered exploitative to use them for human benefits (Zamir, 2006). Captive animals on the other hand (i.e. animals taken from the wild or bred from their descendants) do not have this history of human interaction and by extension, did not 'choose' their living environment. They are also more prone to stress than their domesticated counterparts (Hemmer, 1990). Thus we must consider that whilst a human interaction with, for example, a dolphin may benefit us, it might prove stressful for the animal involved if they have no choice over the situation (Frohoff & Packard, 1995).

The same could also be said for domesticated animals in particular contexts. A survey addressing teacher attitudes to the use of animal-assisted therapy in classrooms with children with ASD revealed animal welfare concerns: a dog becoming overwhelmed by children unresponsive to its needs, or practical issues such as who will care for the dog outside of school hours, or what happens when the dog is ill or ready to retire (Smith & Dale, 2016). Concerns about welfare are thus valid to all animals used in therapy; however, the direct effects of animal-assisted therapy on animal stress have not been widely studied.

Haubenhofer and Kirchengast (2006) found that dogs tended to experience physiological arousal as a result of therapy sessions, as indicated by increased cortisol levels following these sessions. The results were particularly pronounced in shorter, more intense sessions where the dogs were unlikely to get a break. Cortisol is a glucocorticoid hormone produced by the adrenal cortex as part of the hypothalamic-pituitary-adrenal axis, a negative feedback cycle which regulates a number of mechanisms, including response to stress. In response to a stressful event, cortisol increases, which regulates the cardiovascular, metabolic and central nervous systems (Dedovic, Duchesne, Andrews, Engert, & Pruessner, 2009). However, continued exposure to high cortisol levels can have high physical costs such as negatively affecting brain development and the immune system (Elenkov, Webster, Torpy, & Chrousos, 1999; Lupien, McEwen, Gunnar, & Heim, 2009).

Whilst Haubenhofer and Kirchengast (2006) note that arousal does not necessarily indicate a negative effect of therapy sessions on the dogs, prolonged arousal can lead to chronic stress, suggesting that rest time between sessions is important for the dogs' wellbeing (Haubenhofer & Kirchengast, 2006). Serpell et al (2010) note that if a therapy animal is unduly stressed during an interaction, then the interaction should be suspended — an important observation, but one that requires a handler who knows the signs of stress in the animal and will intervene accordingly. One study in therapy dogs indicated an increase in cortisol levels during therapy sessions compared with baseline (King, Watters, & Mungre, 2011) but behavioural signs of stress varied with age and experience. It is thus unclear in this case if changes in cortisol were due to 'positive' stress, posed by a stimulating environment, or 'negative' stress, where an individual may experience negative emotions as a result of becoming overwhelmed. In contrast to these findings, a study of animal-assisted activity (in contrast to animal-assisted therapy, this provides people with the chance to interact with animals outside a regulated therapeutic setting.) in dogs found neither cortisol levels nor stress-related behaviours showed any significant difference between an activity session and at-home baseline level (Zenithson, Pierce, Otto, Buechner-Maxwell, Siracusa, & Werre, 2014). Similarly, Palestrini et al. (2017) found no changes to heart rate in a canine subject used in post-operative

therapy. They did observe the most frequent behaviour to be panting, a potential sign of stress, although this could also have been due to room temperature.

Taken together, these studies do not give a strong indication of particularly negative effects of animal-assisted therapy on the participating animals. But it is noteworthy to add that positive or negative effects to the animal depend largely on the circumstances in which they are required to work. For example, a dog that visits a hospital for a few hours a week experiences a completely different environment than one that works as a live-in therapy dog at someone's home. Serpell et al (2010) note for example that an animal-assisted therapy animal housed in a residential setting is likely most at risk of becoming fatigued through lack of rest.

There are a number of additional things to consider here. Firstly, the studies reviewed above all considered dogs as therapy animals. Secondly, these studies all address stress of animals in therapy sessions, and do not account for animals that have more permanent roles in therapy, such as household pets (Hall et al., 2016). Thirdly, the findings present mixed evidence of negative or null effects of therapy sessions on the animals. All of these points highlight the need for further study of the stressful effects of animal-assisted therapy, both in varying contexts (considering not only environment but also considering patient type, number of people in a session, session length) and across a broader array of species.

Mutual benefits and underlying mechanisms of human-animal interactions

Whilst the benefit to working animals who provide human therapy may be under question, there is evidence that some human-animal interactions may benefit both parties. Here, I draw on the literature examining the neurochemical and physiological mechanisms underlying social interactions. In shelter dogs, positive contact with humans after arrival at a shelter was associated with decreased cortisol levels the following day, compared with dogs that did not receive positive contact (Coppola, Grandin, & Enns, 2006). Human contact has also been demonstrated to alleviate the effects of stress in the laboratory. When dogs were

exposed to a conditioned tone-shock sequence, their heart rate in response to the tone was lower when the tone was accompanied by petting from a person (Lynch & McCarthy, 1967). Given the potentially negative effects of cortisol produced by prolonged stress (Elenkov et al., 1999; Lupien et al., 2009), these findings suggest possible beneficial effects of human-dog interactions on the dog. It is suggested, at least amongst primates (including humans), that social bonds provide a buffer against stress, which could be mediated by oxytocin, a neuropeptide that is released upon social contact with a bond partner (Crockford, Deschner, & Wittig, 2017; Doom, Doyle, & Gunnar, 2017; Dunbar, 2010). In turn, oxytocin stimulates social interactions such as increasing eye contact (Beetz, Uvnaes-Moberg, Julius, & Kotrschal, 2012). It is thought that oxytocin down regulates hypothalamic-pituitary-adrenal activity, thus reducing cortisol levels and associated feelings of stress (Beetz et al., 2012; Crockford et al., 2017). Associated benefits of oxytocin release can even include wound healing, as has been found in socially-housed hamsters, and when oxytocin is administered to socially isolated hamsters (Detillion, Craft, Glasper, Prendergast, & DeVries, 2004).

The majority of research examining the relationship between oxytocin and social interactions has focused on studies within-species, such as in groups of chimpanzees or macaques (Crockford et al., 2013; Young, Majolo, Heistermann, Schülke, & Ostner, 2014), however, there is also evidence that inter-species bonds can have similar effects. Dog owners were found to have an increase in urinary oxytocin levels after 30-minute interactions in which they made eye contact with their dogs (Nagasawa, Kikusui, Onaka, & Ohta, 2009). Moreover, dogs' oxytocin levels increase following long-gaze-based interactions with their owners, indicating mutual attachment between bonded dogs and humans (Nagasawa, Mitsui, En, Ohtani, Ohta, Sakuma et al., 2015). Similarly, Odendaal (2000) found increases in, amongst other neurotransmitters, oxytocin and dopamine, in both dogs and humans following positive social interaction. Odendaal also found a significant decrease in cortisol levels in people following the interaction, but not in dogs. Lower morning cortisol levels have been found in dogs whose owners perceive them as social partners (Schöberl, Wedl, Bauer, Day, Möstl, & Kotrschal, 2012). Reduced cortisol awakening response was also

found in children with ASD in the presence of a service dog, and was associated with decreased behavioural problems after the dog was introduced (Viau, Arsenault-Lapierre, Fecteau, Champagne, Walker, & Lupien, 2010).

Interspecific interactions may also depend on prior attitudes: in a study assessing stroking of horses, heart rate of people with negative attitudes towards horses was initially higher than those with positive attitudes or prior experience with horses, but heart rate of all participants decreased over a 40 second period (Hama, Yogo, & Matsuyama, 1996). Notably, the heart rate of horses being stroked by people with negative attitudes was also initially higher than when stroked by people without negative attitudes; these findings suggest that there may be a process such as emotional contagion (whereby emotion in one individual invokes that emotion in another) taking place between horse and human (Hama et al., 1996; Hatfield, Cacioppo, & Rapson, 1993). Similar to dogs, this could invoke feedback between underlying physiological mechanisms (Nagasawa et al., 2015).

To date, there are only a few studies examining the mutually beneficial effects of human-animal interactions, especially with regard to the underlying mechanism of these interactions. However, it is evident from the human literature that pets generally have a positive effect on humans, such as reduced heart rate, blood pressure and anxiety (Beetz et al., 2012; Julius et al., 2013) (although, not all studies find positive health effects of owning pets; see for example Amiot & Bastian, 2014). Given that measures of these physiological responses increase under stressful situations, it is feasible that human-pet interactions reduce effects of stress in humans through changes in cortisol and oxytocin levels (Beetz et al., 2012). It would therefore be worth addressing in more detail whether similar physiological outcomes are apparent in pets receiving positive contact from people.

Suitability of animals for animal-assisted therapy

The findings discussed above suggest the possibility that animals, like people, can benefit from positive human-animal interactions. It is unclear however as to what extent a social bond is required for such positive effects to take place. One

should also be wary in extrapolating across species. Earlier I touched upon the issue of species suitability to animal-assisted therapy, noting that domesticated species may be more suitable to this role than non-domesticated species. However, suitability can vary also between domesticated species and even within species. Dogs for example are not only domesticated but tend to form strong bonds with their human owners; in contrast, horses, a prey animal who typically form their own within-species social groups, may not benefit from human interaction to the same extent as dogs (Payne, DeAraugo, Bennett, & McGreevy, 2016). An animal's response to a human may depend a lot on their prior experience with social interactions, and their familiarity with the person involved. For example, the early handling of rabbit pups leads to reduced fear of humans in adulthood, and is accompanied by bolder behaviour, increased weight gain and reduced mortality rate, compared to rabbits that do not receive regular handling (Jezierski & Konecka, 1996). Thus early-life experience with people can have a lasting impact on both behavioural and physiological outcomes, and should also be an important consideration when involving animals of all kinds in animal-assisted therapy. A rabbit with no handling experience that is put into a room full of children will likely experience more stress than a well-handled rabbit. However, given that rabbits are prey animals, they are still more likely to experience stress when placed in a new or overwhelming environment compared to a well-handled dog.

There are two additional considerations to handling suitability. Within historically domesticated species, breed plays an important role in behaviour (Serpell, McCune, Gee & Griffin, 2017; Svartberg, 2006). Dogs and horses especially are bred for a variety of roles — to run fast, pull heavy equipment, defend property, herd sheep — which of course dictate the temperament of that breed. A highly-strung horse or dog that is bred for aggressive purposes may not be the most suitable animal for therapy. It is additionally important to consider that temperament, which varies with breed, can also vary with an individual. A family that adopts a dog in the hope that it helps them to communicate with their child may find themselves struggling if the dog is easily scared or not well trained. Indeed, research on dog temperament, also referred to as personality (Jones & Gosling, 2005), has revealed certain traits to be more suitable for particular

behavioural roles. In guide dog puppy training, eight-month old puppies have a higher probability of qualifying as guide dogs if they exhibit traits of low distraction, low anxiety and low reactivity (Harvey, Craigon, Sommerville, McMillan, Green, England, & Asher, 2016). Temperament in young dogs has also been linked to maternal care, with puppies that experience less maternal care more likely to succeed on tests assessing suitability to becoming guide dogs (Bray, Sammel, Cheney, Serpell, & Seyfarth, 2017). This compounds an earlier point that early-life environment is important to predicting behavioural outcomes. Temperament should also be included as a variable of consideration in future research assessing the effects of stress on therapy animals.

In sum, species, breed, handling experience and temperament are all important considerations in addressing which animals are most suited to use in animal-assisted therapy. In turn, addressing suitability of therapy animals can help to not only reduce negative effects on the animal but also increase the positive effects for the human recipient. Increasing the suitability of an animal in animal-assisted therapy should therefore improve the chances that the therapy can provide mutual benefits to human and animal alike.

Animal-assisted therapy for children with ASD: taking an individualised approach

Earlier evidence indicates that animal-assisted therapy can help children with autism to engage socially (Berry et al., 2013; Hoagwood et al., 2017; Solomon, 2010). Implementation of animal-assisted therapy in a care setting could provide a relational approach, encouraging children to form bonds with animals and giving them the chance to feel valued and nurtured (Garfat, 2003). Given what we know about the endocrinological feedback mechanisms of social interaction, forming a bond with an animal may act as a buffer against stress (Beetz et al., 2012; Crockford et al., 2017; Julius et al., 2013). It could also form a feedback mechanism to stimulate further social engagement, such as eye contact, self-worth, and healthy attachment (Beetz et al., 2012; Fahlberg, 1991; Nagasawa et al., 2015). Thus, social interactions with animals could help to provide a 'bridging experience' to positive interactions with people (Anglin, 2004).

What additional considerations would be beneficial for children with ASD to get the most out of animal-assisted therapy? Animal-assisted therapy may not be suited to everyone (Smith & Dale, 2016). Whilst for example having a pet or classroom dog may help some children with ASD engage and interact, others may be fearful which can exacerbate problems. The goal of animal-assisted therapy in the case of children with ASD should be to find a good person-animal match, where it is both needed and wanted. For example, if one is unsure what type of therapy would be best for a child, a first step would be to let them try a riding or dog-petting session to gage how they respond. It might also be useful to consider which type of animal would be most suited to the child — a dog can provide social comfort and interaction; a horse can provide stimulation and engagement through motion; it is important to think also of how the animal would respond if a child has challenging behaviour — will they be calm, will they be scared, will they avoid or engage in the situation? If one wishes to use animal-assisted therapy on a more day-to-day basis, it might be worth considering what benefits a pet could bring. For a child with ASD, a well-adjusted pet dog may provide a more mutually beneficial relationship than attending intermittent therapy sessions where child and animal are strangers. However, this also brings with it the burden of ethical responsibility to the pet.

The relationship between child and pet can have a lasting impact on their social-cognitive abilities (Daly & Morton, 2009; Poresky, 1996). Given the potential importance of strong bond formation between child and pet, especially for a child with ASD, it is worth considering what variables may influence bond strength. For example, affection towards pets is related to personality traits; people who are more conscientious (constrained and organised) and more neurotic (anxious, tense) report higher affection for pets (Reevy & Delgado, 2015). Attachment to a pet is stronger in six to ten year-old children when the pet is more closely phylogenetically related, for example having a dog or cat over a pet fish or insect; in eleven to fourteen year old children, girls were also found to have higher attachment to pets than boys (Hirschenhauser, Meichel, Schmalzer, & Beetz, 2017). Thus, just as different animals may be differentially suited to work in therapy, different people will also likely respond varyingly to interaction with animals, depending on their age, sex, personality and prior experience with

other species. These questions and considerations bring into play a number of the issues discussed earlier, and should be considered by carers and therapists alike in regard of getting the most out of animal-assisted therapy.

Can animal-assisted therapy be mutually beneficial?

It is clear that the relationship between patient and animal-therapist is not straight forward and that the effectiveness of animal-assisted therapy depends upon a number of factors. What is still not clear is to what extent being a therapy animal may affect the wellbeing of the animal in question, or how this in turn affects the effectiveness of animal-assisted therapy as a treatment. To understand this better the field needs to address the mechanisms underlying the behaviour of human-animal interactions during therapy sessions, through examining indicators of arousal, stress and positive emotional effects, such as changes to cortisol, oxytocin, heart rate and blood pressure in both animal therapists and human recipients. Of particular interest would be to assess the occurrence of emotional contagion, and determine if there are any positive or negative feedback processes occurring that mediate the interaction between person and animal. Such research would also benefit from further assessment of individual variables, such as personality, prior experience, age and sex of both parties, and motivation of the patient to interact with the therapy animal.

In particular, further research in residential settings is required. Many children with ASD receive residential care. If animal-assisted therapy can be implemented as a routine aspect of care systems, numerous children could benefit, as demonstrated by a recent report of equine-assisted therapy at Camphill school and care home (McArdle, 2016). As cautioned earlier however, a system first needs to be established to assess how the animals could be appropriately cared for, receive rest days, and avoid becoming overwhelmed. Care would equally have to be taken to ensure that the children involved could benefit. A potential starting point would be to introduce the animals to children in short one-on-one settings, thereby gauging potential risks and allowing relationships to develop.

It is no longer enough to note that an animal is not stressed or negatively affected by a human encounter. The best-case scenario should be that the animal can benefit from it, too. This is especially so for live-in animals, who have a constant relationship with one or several individuals. Regarding choice of animal, some key considerations in finding a suitable animal for therapy are: (1) is the species suitable for human handling, in other words, is this a domesticated species which is adapted to human interaction? (2) Does the animal have handling experience from an early age? (3) Does the animal have a suitable temperament for the job? The question as to whether animal-assisted therapy can be mutually beneficial depends a lot on these factors. If the animal is well suited to the task, then it already has a good chance to benefit from the human interaction, especially when it has a bond with that person. If the animal can benefit, there is a good chance that this improves the benefits for the human recipient, too.

The benefits of animal-assisted therapy to children living with ASD have been widely reported. ASD is a challenging condition, for both the people that live with it and for their families and carers. Animal-assisted therapy provides an approach that seems to help improve the lives of people living with ASD and in reducing the daily challenges that they face. It is therefore time that research began to address how we can improve the use of animal-assisted therapy for people with ASD by assessing simultaneous effects on both human and animal alike.

About the author

Vanessa Wilson received her PhD in Psychology in 2016 from The University of Edinburgh. She has ten years of research experience with a variety of different species, from cats to monkeys to humans, and currently works as a Postdoctoral researcher at the German Primate Centre, Goettingen. Her research interests include the study of personality, wellbeing, social interactions and communication, emotional expression and perception, social cognition and animal welfare.

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