

Use of Assistance and Therapy Dogs for Children with Autism Spectrum Disorders: A Critical Review of the Current Evidence

Alessandra Berry, PhD, Marta Borgi, MS, Nadia Francia, PhD,
Enrico Allewa, PhD, and Francesca Cirulli, PhD

Abstract

Background: Autism spectrum disorders (ASD) are characterized by deficits in social reciprocity and communication, and by unusually restricted, repetitive behaviors. Intervention strategies based on the exploitation of the emotional aspects of human–dog relationships hold the potential to overcome the difficulty of subjects with ASD to relate and interact effectively with others, targeting core symptoms of this disorder.

Methods: This review summarizes the results of six published studies on the effects of brief interactions with dogs and the effects of introducing dogs in families with a child diagnosed with ASD, with an emphasis on social behaviors and language use. Furthermore, the possible mechanisms responsible for the beneficial effects observed are discussed.

Conclusions: Although the studies described here are encouraging, further research with better designs and using larger samples is needed to strengthen translation of such interventions to the clinic. In addition, potential applications of analyzing child–dog interactions are highlighted to screen for early signs of the disorder.

Introduction

IN 1943, LEO KANNER FIRST DESCRIBED children who lacked interest in other people, using the term “early infantile autism.” One (1) year later, Hans Asperger independently reported of a group of children characterized by similar behavioral features but with milder severity and higher intellectual abilities.¹

Autism is the prototypical form of a spectrum of related, complex, neurodevelopmental disorders referred to as autistic spectrum disorders (ASDs), also known as pervasive developmental disorders (PDDs). These include autism, Asperger syndrome, and atypical autism,² and it has been estimated that they affect 1 child in about 150 children,³ although several factors may lead to an underestimation of the prevalence.⁴ ASDs are strongly biased toward males (with a male/female ratio of 4:1 for classic autism), suggesting a potential involvement of perturbations in the typical trajectory and maturation of the sexually dimorphic brain in the etiology of this disease.^{3,5,6} Impairments in reciprocal social interaction and deficits in age-specific play patterns and symbolic behavior are key features indicative of autism in infants and preschoolers. In particular, a diagnosis of autism, based on the Diagnostic and Statistical Manual of Mental

Disorders (DSM IV) and on the International Statistical Classification of Diseases and Related Health Problems,^{2,7} implies impairments in three behavioral domains: (1) social interaction; (2) language, communication, and imaginative play; and (3) restricted range of interests and activities. The onset of the disease must be before the age of 3 years.

Autism is recognized as a neurobiological condition involving central nervous system dysfunctions with a strong genetic basis, involving multiple, interacting genes, as confirmed from twin and family studies.^{8–11} However, the precise etiology of ASD still remains unknown because of the complex behavioral phenotypes and multigenic factors characterizing this disorder. In addition, exposure to environmental modifiers might contribute to variable expression of autism-related traits.¹² Indeed, recent studies suggest that programming effects on the developing offspring, resulting from stressful experiences, maternal diet and infections, advanced parental age, prematurity, and low birth weight—just to mention a few—might act through epigenetic mechanisms resulting in critical determinants of disease “predisposition,” including autism.^{6,12–15} By contrast, intensive behavioral interventions carried out during early childhood have been shown to decrease symptom severity.^{16,17}

A growing number of therapeutic approaches exist for the management of infantile autism.^{16,18} Some of these involve developmental/behavioral strategies; others are based on sensory-integration or social skills training, whereas pharmacologic therapies are not specifically meant to target the core symptoms of ASD, but rather to act on some psychiatric aspects associated with this pathology (hyperactivity, inattention, aggression, irritability, and self-injurious behaviors).^{16,19–24} Intervention programs based on behavioral strategies, such as the Lovaas program,²⁵ have shown to successfully improve communication, social skills, and management of “problematic” behaviors, and currently represent the most effective methods for ASD management.²⁶ However, despite the large number of therapeutic approaches, at present, neither proven therapies nor preventive measures exist for the universal treatment of infantile autism. Therefore, further research and the development of individualized therapies for the ASD population appear imperative.

It is possible to hypothesize that intervention strategies based on exploiting the emotional aspects of the relationship with a dog might represent an effective tool to dampen withdrawal of children with ASD by targeting some of the core symptoms of this disorder. The simple and interpretable pattern of movements that characterizes dogs might facilitate the engagement of children with ASD in structurally simple social actions that do not require the interpretation of verbal cues and are highly repeatable and predictable (e.g., throw, fetch and retrieve play, walking the dog on a leash, giving a hand command).^{27–29} Sams and colleagues suggest that acquiring the ability to interpret and respond to the social and behavioral cues of dogs may provide a bridge toward learning to interpret the more subtle behavior of human beings.²⁸ It has also been suggested that dogs, representing a powerful multisensory stimulus—strong and clear sounds, a vivid visual impression, a special smell, and a stimulation to touch—might target the low sensory and affective arousal levels characterizing children with ASD.²⁹ In this context, it is worth noticing that the Denver Model, a therapeutic intervention that integrates applied behavior analysis with developmental and relationship-based approaches,^{30,31} involves the use of “sensory social routines” (i.e., repeated dyadic interactions, based on pleasurable activities, that have strong sensory, movement, and social foundations).¹⁹ Thus, dogs appear to be good candidates to assist therapists in building such pleasurable dyadic interactions.

Generally, dogs are receiving increasing attention because of their potential use in various therapeutic/activity programs (*therapy dogs*), also known as Animal-Assisted Interventions (AAI), aimed at targeting a large number of health-related problems in different clinical populations.^{32,33}

Different reports have also shown the overall ability of *assistance dogs* (which are owned by individuals with different disabilities) to act as social catalysts, enhancing social interactions and increasing social networks, especially for those with severe disabilities, who very often suffer social discrimination.^{34–38}

Despite the growing body of evidence showing the potential of interaction with dogs to benefit people, including those with disabilities, only a limited amount of studies have specifically focused on the role of child–dog relationships in the ASD population. In addition, most of these studies are

lacking a standard methodology, making it difficult to evaluate the efficacy of the intervention.

The aim of this review is to provide a critical and systematic reading of the literature assessing the effects of therapy and assistance dogs on children with ASD and the possible overall reflection on the welfare of their families.

Targeting Autism Through the Interaction with Dogs: A Review of the Literature

Although the first reports on the beneficial effects of dogs with severely withdrawn children date back to the 1960s with the experience of Boris Levinson,³⁹ successive studies aimed at evaluating the efficacy of systematic interactions of children affected by ASD with dogs are scarce. In the late 1980s, Redeker and Goodman²⁹ were pioneers in the scientific approach of the effects of interaction with dogs on children with autism, although a systematic review of the literature revealed that it was only from 2000 that this field of research has been receiving growing attention, as reflected in the increasing amount of studies published.

For the purpose of this review, only experimental studies, semistructured interviews, and case studies, published in the English language in peer-reviewed journals, have been taken into account. Qualitative (anecdotal) studies were excluded, as well as published PhD theses and conference proceedings. The literature search included the following databases: PubMed, Google Scholar, ScienceDirect, and ERIC. Reference lists in studies and review articles about this intervention were also consulted to identify potentially relevant studies. Participants were children (age range: 3–15) diagnosed with a PDD, according to DSM-IV. Research that did not entirely focus on autistic disorders (i.e., large range of clinical syndromes, small number of people with autism) was excluded. Interventions involving therapy were distinguished from those involving assistance dogs. As for *therapy dogs*, interactions occurred in the presence of the therapist, who followed a predetermined research protocol that included structured one-to-one activities designed to stimulate social behaviors and language use. *Assistance dogs* were introduced into the families with the primary function to ensure child safety, at home and in public, by inhibiting children from bolting or moving dangerously (e.g., walking off the sidewalk).⁴⁰

Results of this literature search revealed that only six articles met the inclusion criteria: two of them describe the effects of assistance dogs (Table 1) and four interventions involve the effects of therapy dogs (Table 2) on children with PDD, including ASD.

Effects of Interventions

Assistance dogs

When studying the effects of the introduction of assistance dogs on the general welfare of families with children affected by ASD, Burrows and colleagues⁴¹ observed that the contribution of these animals extended beyond children’s physical safety to therapeutic and communicative domains. In fact, the integration of assistance dogs resulted in beneficial effects on children’s behavior with decreased anxiety and anger, increased calmness, reduction in the number of emotional outbursts (tantrums), and more manageable bedtime routines. These authors also report an additional sense

TABLE 1. STUDIES INVOLVING ASSISTANCE DOGS ON ASD POPULATION

Authors	Participants	Design	Animal-related situations	Outcomes	Main results
Burrows et al. ⁴¹	Diagnosis: ASD N = 10 Age: range 4.5–14 Sex: 7M, 3F Setting: home	Semistructured interview for children's parents; ethological observations	Placement of an assistance dog with the families of autistic children	Perceived safety and well-being for families	Participants reported improved child's safety (at home and in public), motor function, calmness, and compliance with the parents' directives. Participants also reported an improvement in the daily routines, and increased positive social acknowledgments
Viau et al. ⁴²	Diagnosis: ASD N = 42 Age: range 3.6–14.8 Sex: 37M, 5F Setting: home	Longitudinal, repeated-measures (pre- and post-test) design	Placement of an assistance dog with the families of autistic children	Basal salivary cortisol; problematic behaviors (e.g., self-stimulation, repetitive, disruptive behaviors, tantrums)	Number of problematic behaviors reported by parents decreased after the introduction of the dog. Cortisol levels prior and after the introduction of the dog were the same; CAR (cortisol awakening response) was found to be considerably reduced when dogs were present and rose again when dogs were removed from the families.

ASD, autism spectrum disorder.

of security for the parents, especially at night, which improved their quality and quantity of sleep and their sense of independence. In addition, all the members of the family experienced an increase in the social acknowledgment perceived, thanks to the presence of the assistance dog. In fact, the dog became the focus of attention, alleviating some of the embarrassment and stress felt by the parents and the siblings of the autistic child and helping the whole family to integrate into the community.⁴¹

A different study focused on the specific effect of assistance dogs in regulating a physiologic response to stress in autistic children. Viau and colleagues⁴² measured physiologic variables (i.e., cortisol levels) before, during the staying of the dogs, as well as after they were removed from the families. Authors found that the cortisol awakening response (CAR) was decreased upon the introduction of dogs (acute effect), whereas it rose again when the animals were removed from the families (long-term effects). Indeed, these results show that, in children with ASD, CAR is sensitive to the presence of assistance dogs, suggesting that this measure might represent a reliable physiologic marker of a positive/negative psychological state. Interestingly, parents also reported a decrease in the number of problematic behaviors (such as self-stimulation, repetitive behaviors, and tantrums) when the dogs were living in the families, which lends support to the potential behavioral benefits of assistance dogs for children with ASD.⁴²

It is important to stress that, in both of these studies, the effect of an assistance dog on children with problematic behaviors was assessed by means of semistructured interviews and a questionnaire distributed to parents, possibly reflecting the parents' satisfaction more than an actual modification in their child's behavior. The analysis of behavioral changes based on systematic observations might represent a more useful and comprehensive approach.

Therapy dogs

Interventions with therapy dogs rely upon brief interactions with these animals (AAI). All the interventions reviewed here occurred in the presence of the therapist, who followed a predetermined research protocol that included structured one-to-one (individual) activities designed to stimulate social behaviors and language use. In all cases, results were encouraging since interaction with dogs was able to dampen social isolation and withdrawal in children.

Redefer and Goodman²⁹ observed that, following the introduction of a friendly dog into a therapeutic session, seriously withdrawn children with ASD showed a sharp increase in the frequency of both verbal and nonverbal social behaviors; this increase was directed toward the dog and the therapist and was paralleled by a decrease in children's withdrawal. This general improvement could still be observed 1 month after dog exposure (follow-up), although in a smaller proportion. Limitations of this study are the lack of information about the diagnostic criteria used and the absence of a control condition, which permit singling out whether the positive effects observed during AAI are simply due to the introduction of a novel and exciting stimulus (e.g., a visiting dog).

Martin and Farnum⁴³ observed children's social behavior when they were interacting with a live dog and when

TABLE 2. STUDIES INVOLVING THERAPY DOGS ON PDD/ASD POPULATION

<i>Authors</i>	<i>Participants</i>	<i>Design</i>	<i>Animal-related situations</i>	<i>Outcomes</i>	<i>Main results</i>
Redefer and Goodman ²⁹	Diagnosis: ASD N=12 Age: 5-10 Sex: 9 M, 3 F Setting: not specified	Longitudinal, repeated-measures (pre- and post-test) design	Twenty minutes of interaction with a therapist in the presence of a therapy dog	Changes in isolation (play or self-stimulatory activities directed to self) and social interaction (any instance of verbal or nonverbal behavior directed toward the therapist and the dog)	Increase in social interaction and decrease in isolation when the dog was introduced in therapy sessions. By follow-up (1 month after the treatment), social interaction declined but was still above baseline and isolation increased but was still below baseline.
Martin and Farnum ⁴³	Diagnosis: PDD ^a N=10 Age: range 3-13 Sex: 8 M, 2 F Setting: school	Crossover, repeated-measures design (all participants experienced all three conditions)	Fifteen minutes of interaction with a therapist in the presence of a therapy dog, a stuffed dog, or a ball	Language use and social behaviors directed toward the therapist and the dog; nonsocial behavior (i.e., hand flapping)	In the presence of the therapy dog, children showed a more playful mood, were more likely to keep their gaze focused on the dog, to talk to the dog and engage the therapist in discussion regarding the dog. Children touched the dog less often than the ball or stuffed dog. Children exhibited more hand flapping in the presence of the dog.
Sams et al. ²⁸	Diagnosis: ASD ^b N=22 Age: range 7-13 Sex: not specified Setting: school	Crossover, repeated measures design (all participants experienced all two conditions)	Between 20 and 30 minutes of occupational therapy sessions incorporating animals (i.e., llamas, dogs, rabbits) or standard occupational therapy sessions	Language use; spontaneous or prompted social interaction with humans or animals	Children showed greater use of language and greater social interactions (number per minute) in the occupational therapy sessions incorporating animals
Silva et al. ⁴⁴	Diagnosis: ASD N=1 Age: 12 Sex: M Setting: outpatient therapy center	Case study	Forty-five minutes of structured sessions of one-to one activities with the therapist in the presence of a therapy dog or without the presence of the therapy dog	Negative behaviors (e.g., physical and verbal aggressive behaviors, repetitive behaviors, self-absorption) and positive behaviors (e.g., play, visual contact, smiling) toward the therapist and inanimate objects	Aggressiveness and self-absorption less frequent in the sessions that included the therapy dog; visual contact, smiling and affectionate behaviors more frequent in the sessions that included the therapy dog

^aN=7 PDD not otherwise specified, N=2 Asperger's disorder, N=1 autistic disorder.

^bTwo of the participants carried a secondary diagnosis of cerebral palsy. ASD, autism spectrum disorder; PDD, pervasive developmental disorders.

playing either with a nonsocial toy (i.e., a ball) or a stuffed dog. These authors found that children were less distracted, exhibited a more playful mood, and were more aware of their social environment when in the presence of the therapy dog.⁴³ Furthermore, verbal interactions were stimulated by the presence of the animal: Children were more likely to talk to the dog, engaging the therapist in discussions regarding the animal, and speaking less about topics unrelated to the therapeutic protocol during the dog condition. An increase in hand flapping was also reported in children exposed to the therapy dog. Although such a behavior is usually considered as a stereotypy and therefore viewed as undesirable, the authors believe that this "was a mode of expressing excitement and exhilaration."⁴³ It is worth noticing that this study represents a first important attempt to perform a thorough analysis of the effects of AAI with a dog through the comparison with behavioral changes resulting from the exposure to different stimuli (ball/stuffed dog).

Similar results were obtained by Sams and colleagues,²⁸ who found that the incorporation of animals (i.e., llamas, dogs, and rabbits) in a school-based occupational therapy program was able to encourage language use and social interaction in children with ASD, particularly in comparison to occupational therapy using standard techniques.

The efficacy of the dogs' presence in increasing the engagement and decreasing negative behavioral patterns (such as aggressive and obsessive manifestations) was also confirmed in a very recent case-study by Silva and colleagues.⁴⁴ In particular, physical and verbal aggressiveness, as well as self-absorption, were significantly reduced while smiles, visual contacts, and affectionate behaviors were increased.⁴⁴

Discussion

By being able to respond affectionately to human attention, to elicit prosocial behavior and positive feelings, animals seem to possess a unique capacity to serve as an emotional bridge in specific therapeutic contexts and to act as social catalysts.^{39,45} The forms and manifestations of human bonds with companion animals, particularly with dogs, have led to their extensive inclusion in different educational and therapeutic interventions.^{32,33} In this context, attitude toward animals is thought to be sufficient to explain some of the beneficial effects observed, since things that tend to absorb people's attention in nonthreatening ways are also known to exert a calming and de-arousing influence.⁴⁶⁻⁴⁸ A more relaxing environment might, in turn, increase people's responsiveness and willingness to communicate. In fact, different studies reported that, when a dog was present, children appeared more prone to engage with peers and adults.⁴⁹⁻⁵¹

Taken together, the studies reviewed here are encouraging, since the interaction of children affected by ASD with therapy dogs was able to promote verbal and nonverbal behaviors, directed both towards the dog and the therapist.^{28,43,44} Some authors have suggested that being able to gain access to pets, or to talk about them, might represent a strong drive for children with ASD to increase social interactions with the therapist.²⁸ In this context, it is important to stress that language impairment is one of the most pervasive symptoms characterizing children with ASD early during postnatal life, and thus being able to act upon such a domain

is a main challenge of current behavioral therapies. However, it is also important to take into account that the observed effects on verbal and social skills might in some cases be related to symptom severity; however, none of the studies reviewed considered this variable.

The introduction of assistance dogs into the families of children with ASD allows investigation of the long-term effects of interactions with dogs. In particular, Viau and colleagues⁴² found a decrease in problematic behaviors in addition to a specific reduction in a stress-related hormonal parameter (CAR) only during the time the dog was housed with the family. By contrast, when the dog was moved away, the CAR rose again, suggesting that this measure of neuroendocrine activation is very sensitive to the presence of the dog. These data are in line with a substantial body of evidence showing the overall "de-arousing effect" of human-animal interactions on human physiology.⁵²⁻⁵⁸

The study by Burrows and colleagues found that the introduction of assistance dogs resulted in beneficial effects not only on children's behaviors but also on the overall welfare of the family. Family members reported a sense of security and independence, a result particularly important when considering that the impulsivity, hyperactivity, irritability, and aggressiveness of children with ASD profoundly influence parents' everyday activities, which eventually result in extremely stressful and unsafe experiences for the whole family.^{41,59,60} Moreover, an increase in the social acknowledgment helped the whole family to feel integrated into the community. This is indeed a desirable result, considering that these families have to deal with social isolation and often experience elevated levels of pessimism and of depressive symptoms.⁶⁰⁻⁶⁴ Overall, these findings are not surprising and are in agreement with reports showing the ability of dogs to act as social catalysts, enhancing social interaction between people and increasing social networks, especially for those who have severe disabilities and who very often suffer social discrimination.³⁴⁻³⁸

Despite these positive and encouraging results, a note of caution must be placed here. In particular, it has been reported that the presence of a dog might elicit an increase in undesirable stereotyped behaviors (such as the hand-flapping⁴³), which are thought to attenuate or intensify the arousal levels of children with ASD, depending upon the environmental circumstances.^{65,66} Almost all individuals affected by autism are characterized by hyper- or hyporesponsiveness to sensory inputs^{65,67,68}; therefore, stimuli that are experienced as neutral by typically developing children might result either in highly rewarding or aversive responses for children with ASD.⁶⁹ Thus, in the case of assisted interventions with dogs, these might involve individualized programs tailored to each child's profile, taking into special account sensory difficulties and arousal levels.^{16,67}

In conclusion, intervention strategies, based on exploiting the emotional aspects of the relationship with a dog, can overcome the inability of children affected by ASD to relate and interact with others by targeting some of the core symptoms of this disorder. However, it is important to take into account that overall most of the AAI programs lack a standard methodology, and there is a need for basic research aimed at including larger sample sizes to assess their effectiveness, using randomized controlled trial designs. In addition, studies specifically aimed to examine whether the

effects of contact with dogs are enduring or are strictly related to a continuous exposure to the animal are still lacking. The use of systematic, detailed studies of behavior should be encouraged since they can better clarify the effectiveness of dog-oriented programs on children's behavior and overall quality of family life.

Future Perspectives: Child–Dog Interaction as a New Screening Tool for Early ASD Diagnosis

A diagnosis of autism is achieved early during childhood, with symptoms becoming manifest within the first 3 years of life. However, parents often recall having had developmental concerns between the first and the second birthdays of their children. This delay in the diagnosis prevents the possible benefits of an early intervention during a time window characterized by higher brain and behavioral plasticity.^{16,70–73} A promising study reports that characteristic interaction patterns exist during child–dog encounters, and this may be effective to diagnose psychiatric disorders including autism. Patients demonstrated significant diagnosis-specific behavioral differences; in particular, autism patients looked at the dog for a considerably shorter time, showed longer phases of distancing behavior from the dog, and stroked it less than other diagnostic groups did (i.e., anxiety disorder, anorexia, bulimia).⁷⁴ In this scenario, it is possible to hypothesize that the identification of specific behavioral patterns displayed during child–dog interactions might provide a novel additional tool for the early diagnosis of some ASD signs, such as deviation from typical attentive and social behaviors (gazes, smiles, directed vocalizations) and changes in posture and movements towards the dog.

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Address correspondence to:

Francesca Cirulli, PhD

Section of Behavioural Neurosciences

Department of Cell Biology and Neurosciences

Istituto Superiore di Sanità

Viale Regina Elena 299

Rome I-00161

Italy

E-mail: francesca.cirulli@iss.it