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Examining the Effects of Human-Animal Interaction on Individuals with Developmental Disabilities

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EXAMINING THE EFFECTS OF HUMAN-ANIMAL INTERACTION ON INDIVIDUALS WITH DEVELOPMENTAL DISABILITIES

A dissertation submitted in fulfillment of the requirements for the degree of Doctor of Philosophy in Health Related Sciences at Virginia Commonwealth University

by

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Abstract

Title of Dissertation: EXAMINING THE EFFECTS OF HUMAN-ANIMAL INTERACTIONS ON INDIVIDUALS WITH DEVELOPMENTAL DISABILITIES

By Jennie Dapice Feinstein, Ph.D., OTR/L

A dissertation proposal submitted in fulfillment of the requirements for the degree of Doctor of Philosophy in Health Related Sciences at Virginia Commonwealth University.

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Dissertation Committee Chair: Shelly J. Lane, Ph.D., OTR/L, FAOTA,
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Companion animals play a pivotal role in typical human development. It remains unknown how animals affect individuals with developmental disabilities. Based on the knowledge that companion animals help typically developing individuals, this research examined the effects of human-animal interactions on individuals with developmental disabilities.

Human-animal interactions are based on the Biophilia hypothesis, an assertion that an emotional and beneficial relationship exists between humans and nature, in which there is an "innate tendency to focus on life and lifelike processes." These are the shared, dynamic associations between people and animals, and the effects of those relationships on health and well-being. Sparse research exists, and the field and literature is scattered among various disciplines.

In the first article in this work I examined and synthesized literature related to the effects of human-animal interaction on individuals with developmental disabilities, including companion animals and more formal animal-assisted therapy. In the second article in this work I examined, via direct observation, video recording, and Individualized Education Plan goal attainment, whether animal-assisted therapy (here, occupational therapy intervention incorporating a trained therapy dog) affected playfulness during routine occupational therapy sessions with children with developmental disabilities. Finally, in the third article I examined whether occupational therapy incorporating animal-assisted therapy changed participation during routine occupational therapy treatment sessions with children with developmental disabilities.

Children with disabilities often exhibit impairments in play and participation, and enhancing these areas is likely to further their functional ability. The constructs of play and participation are significant in the lives of children with developmental disabilities, and a foundation of pediatric occupational therapy practice. Together they comprise two of the eight "Areas of Occupation" in the Occupational Therapy Practice Framework. The effects of incorporating animal-assisted therapy into occupational therapy are not well documented, although other disciplines have found animal-assisted therapy to be an effectual intervention. Human-animal interaction scholars have called for evidence-based effectiveness studies. This research responded to that call, examining the effectiveness of animal-assisted therapy from a functional perspective not yet addressed in the literature.

Chapter 1: Introduction

Background

Pediatric occupational therapy. Occupational therapy (OT) encompasses interventions geared towards helping individuals achieve a fulfilled and satisfied life through the use of meaningful activity. Treatment focuses on engagement in and performance of age-appropriate occupations. Childhood occupations include, but are not limited to, play, social participation, and activities of daily living (American Occupational Therapy Association [AOTA], 2008). When children face challenges engaging in childhood occupations, OT is often recommended. Interventions are chosen based on the child and family strengths and areas of need, and include objectives related to improving motor coordination and sensory modulation, with the ultimate goal of increasing functional independence and engagement in childhood occupations (Case-Smith & Miller, 1999).

Children with developmental disabilities. Pediatric OT frequently addresses the needs of children with developmental disabilities (DD). Increasing functional independence can improve the quality of life for children with DD and their families (Hume, Loftin, & Lantz, 2009). DD are defined as a variety of chronic conditions due to mental and/or physical impairments, which begin during early development and last throughout the lifetime (Centers for Disease Control [CDC], 2010). Autism Spectrum Disorders, Cerebral Palsy, Intellectual Disability (formerly Mental Retardation), and Down Syndrome are common DD diagnoses. For

this project, the systematic review and intervention study included individuals with DD. The population studied is further defined in Chapters 3 and 4.

Over the past decade, the prevalence of DD has increased 17.1%, which accounts for 1.8 million more children being diagnosed with DD between 2006 and 2008 (CDC, 2011). The impairments that characterize DD cause difficulty with language, mobility, learning, self-help, and independent living skills (CDC, 2010), all of which impact the ability to engage in childhood occupations. Because of these difficulties, and increased prevalence of DD, pediatric OT practitioners are working with an increasing number of children with DD.

Play and participation for children with DD. Play and participation are a foundation of pediatric OT practice. Together they comprise two of the eight "Areas of Occupation" in the Occupational Therapy Practice Framework (AOTA, 2008). Many pediatric occupational therapists consider play to be the main occupation of children and infants (Rodger & Ziviani, 1999). Children are intrinsically motivated to play (Mulligan, 2003), and "playfulness and the joy of childhood create the context for occupational therapy with children" (Case-Smith & O'Brien, 2010, p. 1).

Play can be defined as activities that are freely chosen, intrinsically motivated, and done for personal enjoyment or a sense of challenge (Henry, 2000). A closely related term, playfulness, can be defined as the disposition to play (Rogers et al., 1998), or the way a child approaches play and other tasks (Skard & Bundy, 2008). Playfulness, like play, is intrinsically motivated, internally controlled, and it embodies the freedom to suspend reality (Bundy, 1993). Definition and interpretation of play and playfulness can be complex.

Play is the primary occupation of children, and a strong correlation has been found between playfulness, adaptability and coping (Hess & Bundy, 2003; Rodger & Ziviani, 1999).

Improved play and increased playfulness often form the foundation for OT treatment goals for children. Developmental and physical disabilities create potential challenges for children relative to their participation in meaningful occupations, including play.

Children with DD typically exhibit decreased playfulness as compared to same age peers, and their play is more limited (Lane & Mistrett, 2002; Okimoto, Bundy & Hanzlik, 2000). Children with DD "have difficulty satisfying the need to play that is common to all children" (Ferland, 1994, p. 1). Children with disabilities often exhibit impairments in play, and enhancing play is likely to further their functional ability (Harkness & Bundy, 2001). The cause of limited play in children with DD is unknown, but could be attributed to "a mismatch between the innate drive to play and be playful and a child's ability to play" (Lane & Mistrett, 2002, p. 20). Parents of children with DD yearn for their children to experience the same joys as typically developing children, including the ability to engage in play and experience playfulness. Achieving this goal remains elusive. The ultimate goal of OT intervention in pediatrics is to increase participation in meaningful occupations, including play (Case-Smith & Miller, 1999).

Social participation is another essential element in the lives of children, particularly children with DD, reflected in the AOTA practice framework (AOTA, 2008). The International Classification of Functioning (ICF) defines participation as involvement in life events and situations at home and in the community (World Health Organization [WHO], 2001). Participation can be described as sharing in activity, or more concretely defined as involvement in formal and informal everyday activities (Law, 2002). Social participation is considered an integral part of child development (Bedell & Dumas, 2004).

Participation in home and community settings can lead to skill development, or more specifically, it can teach children skills to interact, work, and live in the community (Law, 2002).

Increased participation has been linked with improved quality of life (Bedell & Dumas, 2004). Additionally, increased participation can decrease negative behaviors, and improve peer relationships (Law, 2002).

Despite the positive ramifications of participation, children with disabilities participate less than typically developing peers (King et al., 2004; Law, 2002). Because participation of children with DD can be restricted, increased participation is often a goal of OT treatment. Because play and participation are crucial in the lives of children, and particularly children with DD who are often challenged in these areas, play and participation were a focus of this work.

Human-animal interaction. Human-Animal Interactions (HAI) are defined as the shared, dynamic associations between people and animals, and the effects of those relationships on health and well-being (McCardle, McCune, Griffin, Esposito & Freund, 2011). HAI is a broad term describing countless examples of contact between human and non-human animals. HAI have grown from the understanding that interacting with animals can be beneficial to humans, and are becoming more prevalent across disciplines. Since the 1970s, HAI have become more frequently researched and increasingly accepted (Esposito, McCardle, Maholmes, McCune, & Griffin, 2011). The academic field of HAI has grown exponentially over the past decade.

However, the notion that animals exert a positive influence on humans has existed for centuries. The idea that animals could serve a beneficial role in the lives of children and patients with mental illness surfaced during the period of enlightenment, and by the 19th century it was more common to introduce animals into institutional care facilities (Serpell, 2006). In the 1960's, Dr. Boris Levinson published Pet-Oriented Child Psychotherapy, in which he theorized that children with emotional disturbance who cared for pets received therapeutic benefits (Levinson

& Mallon, 1997). It is now understood that HAI can prevent illness and promote wellness (Johnson et al., 2003).

Chapter 2, the systematic review component of this study, examined the effects of HAI on individuals with DD. HAI is a broad term encompassing Animal-Assisted Therapy, service animals, and more. After Chapter 2, the study continued with a limited focus, from the wide-ranging HAI, to more specific Animal-Assisted Therapy (AAT).

Animal-assisted therapy. Although companion animals provide health benefits to humans in homes across the country (HAI), AAT are more purposeful, organized, and involve health professionals who determine that HAI, or the incorporation of animals into therapy, would benefit their clients (Johnson, 2011). These professionals "include, but are not limited to registered nurses, nurse practitioners, physicians, physical and occupational therapists, social workers, psychologists, and licensed counselors" (Morrison, 2007, p. 53). Generally, AAT incorporates HAI as a clinical tool.

AAT is generally defined as the deliberate inclusion of an animal in a treatment to facilitate healing and recovery of clients receiving therapeutic care. The therapy must be goal-directed, based on an individualized treatment plan, and carried out by a trained professional who is monitoring the client's progress (McCardle et al., 2011). By definition, AAT incorporates animals that meet specific criteria for temperament and health, and is required to be directed and/or delivered by a health or human service professional. For example, OT-AAT describes occupational therapy incorporating animals.

AAT is theoretically based on the Biophilia hypothesis, an assertion that an emotional and beneficial relationship exists between humans and nature, in which there is an "innate

tendency to focus on life and lifelike processes" (Wilson, 1984). Despite increased clinical and public interest in AAT, the research application to children with DD has been minimal.

Animals in the lives of children—an impact on participation. Companion animals have long been understood to have a pivotal role in child development. Through play with a pet, children can hone social skills, learn to problem solve, and gain a sense of responsibility, often for the first time (Levinson, 1972). These effects are pervasive, because the number of families with animals eclipses those without animals. In 2006, 75% of U.S. households with children had pets (Humane Society of the United States, 2006).

Children are intrinsically motivated to interact with animals (Wilson, 1984). Animals (both pets and therapy animals) have been found to improve the lives of children by enhancing self-esteem, cognitive development, increasing family happiness and fun, and increasing participation in sports, hobbies, clubs or chores (Delta Society, 2009). Animals play an important role in children's development, and can teach children responsibility, improve social skills, and/or provide a best friend (McCardle et al., 2011; Thompson, 2009). Despite this knowledge about animals improving the lives of typically developing children, little is known about the impact animals have, or could have, on the lives of children with DD. Some studies have addressed animals' influence on social interactions, but none have examined the impact of animals on childhood occupations.

Service animals are selected specifically to assist one individual with their daily needs. Service animals are different from therapy animals in that they have legal access to public places. Service animals may bridge social interactions with same age peers (Mader, Hart, & Bergin, 1989) and the presence of animals can improve social interaction for children with DD (Esteves & Stokes, 2008). Some see animals acting as a social lubricant (Fawcett & Gullone, 2001),

easing interactions between individuals. Further, AAT may be effective in improving attention and awareness in children with Pervasive Developmental Disorders (Martin & Farnum, 2000). Children with Autism demonstrated increased frequency of social interaction and language use per minute when participating in OT incorporating animals (Sams, Fortney, & Willenbring, 2006). The animals may increase intrinsic motivation to participate in therapy, which can result in greater treatment gains (Sams et al., 2006).

The research addressing play and AAT is sparse. Play therapy, an intervention based in psychology, was found to enact positive changes when a therapy dog was introduced. More specifically, children's' mood and affect improved, they demonstrated increased ability to engage in play, and demonstrated decreased negative behaviors (Thompson, 2009). Although play therapy and OT incorporating a dog trained for AAT are not the same as psychology-based play therapy, Thompson's research laid a foundation for this investigation.

Play and animal-assisted therapy in occupational therapy. In pediatric OT, play is the most frequently used therapeutic intervention (Mulligan, 2003). Play allows children to practice social and physical skills (Mulligan, 2003). Pediatric OTs use a variety of modalities to facilitate the development of play, playfulness, and the social interactions that come with play. These modalities are chosen based on the environment, availability, and child's needs. Examples of common modalities used by pediatric OTs are therapy balls, board games that require turn taking and fine motor control, and beanbags. The use of animals as a therapeutic modality in OT is much less common, but has potential.

Occupational therapy incorporating animals, or OT-AAT can be seen as simply OT practice, as defined in the Occupational Therapy Practice Framework (AOTA, 2008), incorporating an animal as a modality. Based on the available research, expected outcomes from

OT interventions using AAT (OT-AAT) include changes in childhood occupations, such as playfulness and participation. OT-AAT for children with DD was focus of this investigation.

Summary

Although it is known that individuals, including children, are intrinsically motivated to interact with animals, and increasing evidence suggests contact with animals generally improves human health, the full extent of the research addressing the impact of animals on individuals with DD has not been examined. Prior studies have indicated that OT-AAT can increase social interaction, but potential treatment effects of OT-AAT related to play and participation in children with DD are not known (Esteves & Stokes, 2008; Mader et al., 1989; O'Haire, 2013; Sams et al. 2006). This study will address these gaps in knowledge, as described in Table 1.

Table 1

Gap Table

What is known	Citation	What is not known
Individuals are intrinsically motivated to interact with animals.	Sams et al. (2006), Wilson (1984), Fawcett & Gullone (2001)	What does available literature indicate regarding the impact of HAI on individuals with DD?
Children with DD have challenges related to play and social participation.	Harkness & Bundy (2001)	DOES OT-AAT promote and/or improve playfulness and participation in children with DD?
Animals can increase and improve social interaction.	Sams et al. (2006), Mader et al. (1989), Esteves & Stokes (2008), O'Haire (2013)	HOW does OT-AAT promote and/or improve playfulness and participation in children with DD?

The following research questions addressed the above listed gaps in knowledge via the three articles summarized in Table 2.

Table 2

Summary Table

Paper	Purpose	Research question(s)
Paper 1: A systematic review of the effects of human-animal interactions on individuals with developmental disabilities	Although gaining in popularity and recognition, the field of HAI has limited support from peer-reviewed literature, particularly related to their application to underserved populations. This paper will examine both peer-reviewed and non-peer-reviewed publications to synthesize the literature on HAI and determine whether HAI have been found effective in a specific population of individuals.	What is our current understanding of the effects of Human-Animal Interactions (HAI) on individuals with Developmental Disabilities (DD) based on available literature?
Paper 2: Effects of OT-AAT on playfulness in children with DD: a single subject multiple baseline study	Prior research has shown the presence of animals has a positive effect on children's social skills, but we have little to no knowledge of what effect OT-AAT has on playfulness and in children with DD.	Does incorporation of a trained therapy dog into occupational therapy (OT-AAT) significantly affect playfulness in children with DD? Does length of baseline/ schedule of implementation affect the results?
Paper 3: Effects of OT-AAT on participation in children with DD: a single subject multiple baseline study	Prior research has shown the presence of animals has a positive effect on children's social skills, but limited knowledge exists of OT-AAT's effect on participation in children with DD.	Does inclusion of a trained therapy dog in occupational therapy intervention (OT-AAT) significantly impact participation in children with DD? Does implementation schedule/length of baseline have an influence when introducing OT-AAT?

1. What is our current understanding of the effects of Human-Animal Interaction (HAI) on individuals with developmental disabilities (DD) based on available literature?

2. Does incorporation of a trained therapy dog into occupational therapy (OT-AAT) significantly affect playfulness in children with DD?
3. Does inclusion of a trained therapy dog in occupational therapy intervention (OT-AAT) significantly impact occupational participation in children with DD?
4. Does implementation schedule/length of baseline make a difference in efficacy when introducing OT-AAT?

Scope of Project

Paper I. A systematic review of the effects of HAI on individuals with DD. Although gaining in popularity and recognition, the field of HAI has limited support from peer-reviewed literature, particularly in underserved populations. Despite a few published meta-analyses, the field lacks systematic examination of the literature. This paper gathered peer-reviewed and non-peer-reviewed sources to examine whether HAI have been found effective in a specific population of individuals (with DD).

Paper II. The effect of OT incorporating a dog trained for AAT on playfulness in children with DD. In order to examine the effect of OT incorporating AAT, this single subject multiple baseline A-B study (n=10) examined differences in playfulness in children with DD when OT-AAT was introduced.

Paper III. The relative effect of OT incorporating a dog trained for AAT on participation in children with DD. In order to determine the effects of OT incorporating AAT, the single subject multiple baseline A-B study (n=10) examined differences in participation among children with DD.

Chapter 2: Article I

Systematic Review of the Effects of Human-Animal Interactions on Individuals with Developmental Disabilities

By

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Abstract

Although animals are not commonly incorporated into occupational therapy programs, human-animal interaction (HAI), and specifically animal-assisted therapy (AAT), could improve outcomes in individuals with developmental disabilities (DD). A systematic review of the literature, addressing HAI for individuals with DD from an occupational therapy perspective, revealed 27 peer-reviewed and non-peer-reviewed resources including scholarly articles, dissertations, and conference proceedings. Three broad categories of HAI emerged: AAT, companion animals, and service animals. Categories, or presentation, of HAI and study methods varied widely, but similar positive outcomes were reported, specifically improved social skills, communication, and attention/focus.

Both DD and HAI are highly diverse. Investigations focusing on individuals with specific diagnoses, using standardized outcome measurements, and the effectiveness of specific presentations, or dosage, of HAI are needed to more clearly define the benefits of incorporating animals in occupational therapy practice.

Keywords: human-animal interaction; animal-assisted therapy; developmental disability

Introduction

Companion animals have long been understood to have a positive role in typical development. Through play with a pet, children can hone social skills, learn to problem solve, and gain a sense of responsibility, often for the first time (Levinson, 1972). The impact animals could have on children with developmental disabilities (DD) is not as clear. Approximately 17% of children are diagnosed with DD, resulting in difficulty with language, mobility, learning, self-help, and independent living skills (Centers for Disease Control [CDC], 2013). While individuals with DD often receive multiple therapies and specialized intervention services, the incorporation of animals as companions or in therapy is not widespread.

Human-Animal Interaction (HAI), and more specifically Animal-Assisted Therapy (AAT), is an emerging multidisciplinary practice area with potential to facilitate the development of skills and improve outcomes in individuals with DD. This systematic review describes the state of the literature related to HAI, including AAT, and individuals with DD.

Background

Developmental disabilities are defined as a variety of chronic conditions due to mental and/or physical impairments, which begin during early development and last throughout the lifetime (CDC, 2013). Autism, intellectual disability, Down syndrome and cerebral palsy are common diagnoses that fall under this broad category. As a group of disorders, DDs are highly prevalent and can impact all domains of function.

Typical occupational therapy (OT) provided to individuals with DD focuses on rehabilitation of deficits, strategies to compensate for permanent impairments, and increasing independence in daily activities. It is rare, but becoming increasingly more common, for animals to be incorporated into OT programs. This systematic review examined the effectiveness of HAI

for improving occupational performance in individuals with DD. A multidisciplinary perspective was taken to insure inclusion of relevant literature.

Human-Animal Interactions (HAI) are broadly defined as the shared, dynamic associations between people and animals, and the effects of those relationships on health and well-being (McCardle, McCune, Griffin, Esposito & Freund, 2011). One common variety of HAI is Animal-Assisted Therapy (AAT), in which animal interaction is incorporated as a clinical tool. AAT is defined as the deliberate inclusion of a trained animal in treatment to facilitate healing and recovery of patients with health conditions (Pet Partners, 2011). Therapy must be goal-directed, based on individualized treatment plans, and carried out by a trained professional, who is monitoring client progress (McCardle et al., 2011). Although well defined, presentation of AAT varies widely between professions, settings, and animals incorporated. Determining the efficacy of HAI, and more specifically, AAT on the promotion of occupational performance could provide evidence to support broader incorporation of animals in OT practice.

Previous systematic reviews of HAI indicate interaction with companion and therapy animals can facilitate health and well-being (Barker & Wolen, 2008). Systematic reviews of AAT found a moderate effect in improving outcomes related to autism spectrum behaviors, medical difficulties, behavioral problems, and emotional well-being (Nimer & Lundahl, 2007; O'Haire, 2013; Berry, Borgi, Francia, Alleva, & Cirulli, 2013). O'Haire (2013) reviewed the effects of animal-assisted interventions (AAI) on children with autism, finding great variability across studies, but general improvements in social interaction and communication. She described unanimously positive outcomes and a preliminary "proof of concept" that AAI, including all therapy animals: dogs, horses, etc., effect positive change in children with autism based on eight studies (O'Haire, 2013). Berry et al. (2013) focused their examination on the effects of the use of

assistance and therapy dogs for children with autism. In six studies, two relating to service dogs and four relating to therapy dogs, she found that interaction with therapy dogs helped children with autism to interact more with the dog and the therapist.

The current systematic review is both more broadly inclusive, and more focused than those of O'Haire and Berry et al. Literature has been reviewed addressing the application of HAI incorporating cats or dogs to any population of DD, although articles related to cats were not found. Further improving on past reviews, this review examined levels of evidence (Sackett, Richardson, Rosenberg, & Haynes, 1997). Results identified common populations exposed to HAI, defined outcomes associated with HAI, and identified strengths and weaknesses of incorporating HAI in treatment of individuals with DD. Accordingly, it lays a foundation for future incorporation of HAI into occupational therapy interventions for individuals with DD.

Method

This systematic literature review used the approach outlined by Khan, Kunz, Kleijnen, & Antes (2003), which includes: framing question(s) for a review, identifying relevant work, assessing the quality of studies, summarizing the evidence, and interpreting findings. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement for reporting systematic reviews of studies that evaluate health care interventions (Liberati et al., 2009) was used to guide this review. Initial search terms were derived from the research question *what is known about the effectiveness of HAI on occupation and engagement in individuals with DD?* A pre-search list of search terms, developed based on authors' knowledge of the topic and search terms used in Barker & Wolen's (2008) literature review, were reviewed and revised based on feedback from an expert panel of OT and HAI experts and researchers. A health

sciences research librarian through Virginia Commonwealth University, with experience conducting systematic literature reviews, helped guide the project.

Inclusion criteria used to select resources were: peer-reviewed and non-peer-reviewed articles, published in English since 1988, related to DD and common companion and therapy animals (dogs and cats). Exclusion criteria were: articles published in languages other than English, published more than 25 years ago (before 1988), and describing less typical companion and therapy animals (horses, dolphins) (Fine, 2010).

A recent article mapping the OT literature found MEDLINE and CINAHL had the most comprehensive search coverage. The American Journal of Occupational Therapy, OTJR: Occupation, Participation & Health, and Occupational Therapy in Health Care were most relevant to the profession (Potter, 2010). Those journals, as well as Occupational Therapy International, the British, Canadian, Scandinavian, and New Zealand Journals of Occupational Therapy, the Australian Occupational Therapy Journal, Physical and Occupational Therapy in Pediatrics, and Research in Developmental Disabilities were searched.

Electronic databases searched included CINAHL via EBSCOHost, Medline via PubMed, and PsycINFO. Open access databases, Public Library of Science (PLoS) One, and BioMed Central were included in the databases searched (in PubMed and EBSCOhost Academic Search Complete respectively). HABRI Central, an electronic database dedicated to resources related to the Human-Animal Bond, was also included. Consolidated databases, including the Cochrane Database of Systematic Reviews, Campbell Collaboration, and OT Seeker were also searched. Because databases and collections had different Medical Subject Headings (MeSH terms) and keywords associated with this search, search terms varied slightly between databases. Please see

Table 2.1 for a comprehensive list of terms used to search these databases. A specific database inquiry example, searching Medline via PubMed, is included in Appendix A.

Table 2.1

Search Terms Used in Systematic Review

Category	Search terms used
Human-Animal Interaction	Animal Assisted; Animal assisted therapy; Animal-Assisted therapy; Animal facilitated Therapy, Animal bond; animal facilitated therapy; Animals; Bonding, human-pet; canine visitation; cats; Companion Animal; dog(s); Human-Animal Interaction; Human-Pet Bonding; Interspecies Interaction; pets, Pet Therapy; Rehabilitation
Individuals with Developmental Disabilities	Asperger Syndrome; Atypical Disorders; Autism; Autistic Disorder; Autistic Thinking; Cerebral Palsy; Child Development Disorders; Child Developmental Disorders; Child Development Disorders, Pervasive; Developmental Delays; Disabilities; Disorders; Down Syndrome; Education, Special; Education of Intellectually Disabled; Genetic Disorders; Intellectual Development Disorder; Intellectual Disability; Mental Retardation; Students, disabled; Neurological Impairments; Pervasive; Developmental Disabilities; Pervasive Developmental Disorder-Not Otherwise Specified; Mental Disorders Diagnosed in Childhood
Misc	Occupational Therapy; Rehabilitation

Non-peer-reviewed materials were included because they are invaluable resources, current and relevant to this topic. Narrative and research articles (describing the relationship between at least one person and dog), and both peer-reviewed and non-peer-reviewed publications were collected. Narrative articles without at least one case example were excluded. Literature reviews were excluded, but hand searched for resources.

Two hundred and thirty three (233) citations were identified by the above described electronic database search, and four citations were identified by hand searching books. A list of hand searched books is included in Appendix B. Fifty two (52) duplicates were removed, leaving 185 citations. The 185 citations were screened, and 13 removed from consideration (two articles not published in English, 11 published before 1988). The 172 resources were then examined more closely to determine eligibility based on preselected criteria. Resources included peer-reviewed and non-peer-reviewed articles, conference proceedings, theses, and dissertations.

The flow of information through study phases is depicted in Figure 2.1. Ineligible studies included those which described using animals other than dogs or cats (18), and discussed therapy without animals (27), or described HAI's effects on populations other than DD (45). Further, resources that did not describe a specific relationship between an individual with DD and an animal were excluded (53 narrative texts, textbooks, and systematic reviews). Although excluded, reference lists from these resources were hand searched for resources. Six literature reviews emerged but were excluded. Because the systematic reviews analyzed similar articles, including them in the pool of resources would have doubled the influence of those articles.

Twenty-seven (27) resources remained and were included in this review; well within the range of the 20-40 resources we anticipated collecting prior to the study. Of the 27 resources included, 18 were published in professional journals, five were dissertations or theses, two were conference proceedings, and two were published in a non-peer-reviewed magazine.

Analysis

The final steps of the systematic review included summarizing the appraised material and interpreting the findings (Kahn et al., 2003). AOTA's Critically Appraised Paper (CAP) process (2014) was used to evaluate all resources. This process identified the focused question,

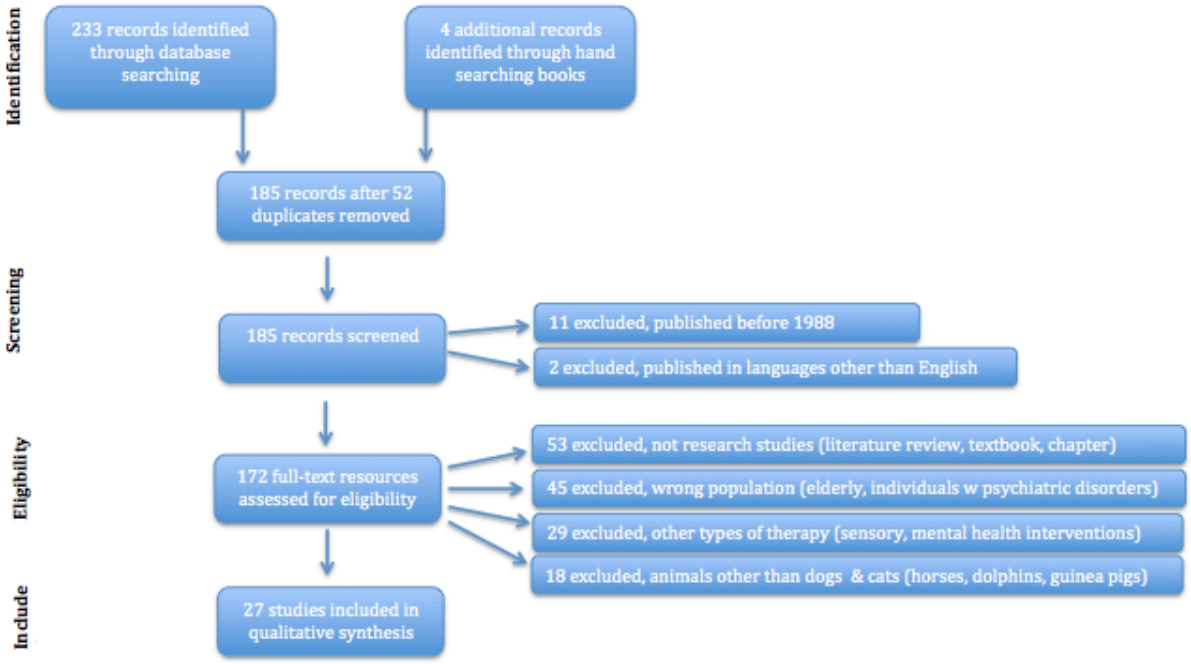

Figure 2.1. Flow of information through the phases of a systematic review (from PRISMA; doi:10.1371/journal.pmed.10001000.g001)

justification of need, research objectives, design type, limitations, sample characteristics, interventions, measures, outcomes, and results of each resource. Each resource was entered into an evidence table based on CAP structure.

For appraisal of collected materials, evidence-based medicine traditionally looks to a research design hierarchy to categorize literature. The research design hierarchy developed by Sackett et al. (1997), organizes evidence along a continuum of strength, from highest level of rigor (Level I, randomized controlled trials) to lowest rigor (Level IV, narratives and case studies).

Studies of the highest rigor, Level I or Level II, were not found. Twelve resources were categorized as Level III, experimental and case control studies. Eight resources were categorized as level IV (correlation and comparative studies) and seven at level V (expert evidence, case study, etc.).

Although levels of evidence are commonly used in evidence-based medicine, the traditional classification system did not fully address the descriptive resources found in this review. The Research Pyramid model (Tomlin & Borgetto, 2011) retains the features of Sackett et al.'s (1997) model, but expands research design format into three dimensions. Including examination of research outcomes from designs other than traditional experimental research allows for a more thorough review of available evidence, inclusive of the outcomes from qualitative and small sample sizes.

Tomlin and Borgetto's (2011) pyramid model is best understood in its three dimensional (3D), full color format (Tomlin, 2014). When conceptualized in 3D, the outer points of each triangle face, representing different research approaches, are at the top of the pyramid, depicting the highest levels of evidence (meta-analyses, studies of groups, and randomized controlled trials) (Tomlin, 2014). The full color 3D pyramid version (Tomlin, 2014) contains a foundation of descriptive evidence, and is included here (Figure 2.2).

This parallels the body of HAI research, which began as descriptive and anecdotal evidence, and has grown to studies with more rigor (McCardle et al., 2011). However, research on HAI is in early stages. As such, it was anticipated that using the pyramid classification system would develop a more thorough understanding of available literature.

Ten studies at the base of the pyramid, descriptive case studies, are foundational but in the category of lowest rigor. The next largest group of studies (9) fell into the bottom row of the pyramid, under experimental single-subject studies. This category includes multiple baseline and alternating treatment (ABA) studies, and is known to be a common analytic method for HAI studies (Nathanson & de Faria, 1993). The remaining studies were primarily classified on the Outcomes face of the pyramid. Two studies fell into the top category "pre-existing groups with

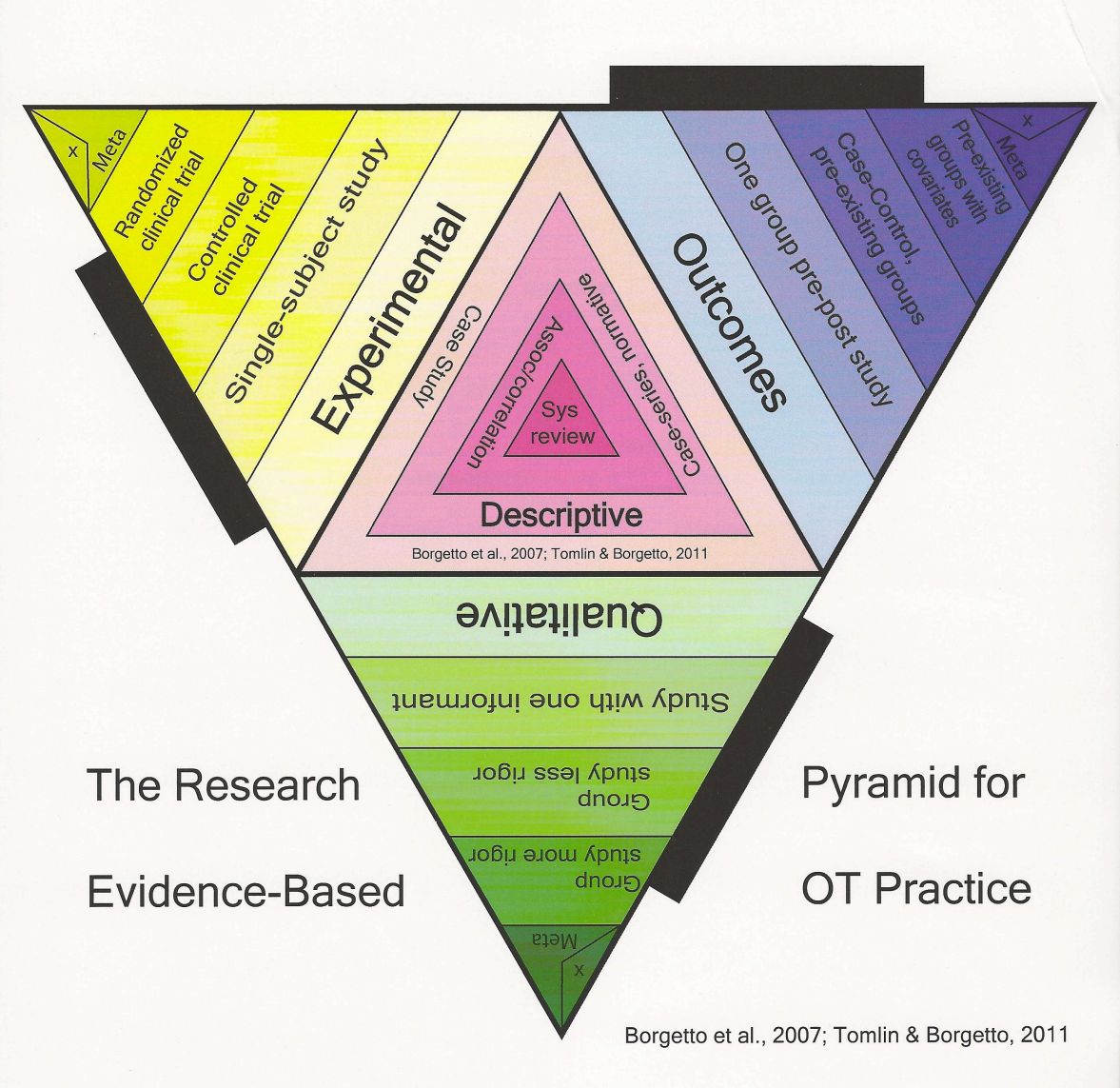

Figure 2.2. Research Pyramid for Evidence-Based OT Practice. Reproduced with permission from Tomlin (2013).

covariates" (Carlisle, 2012; Grandgeorge, 2012). One study (Prothman, 2005) was classified "case-control, pre-existing groups"; one study (Petrongelli, 2012) was classified "one group pre-post study." Figure 2.3 depicts the categorization. Selected resources and their categorization by Sackett et al. (1997) and Tomlin (2014) are contained in Appendix C.

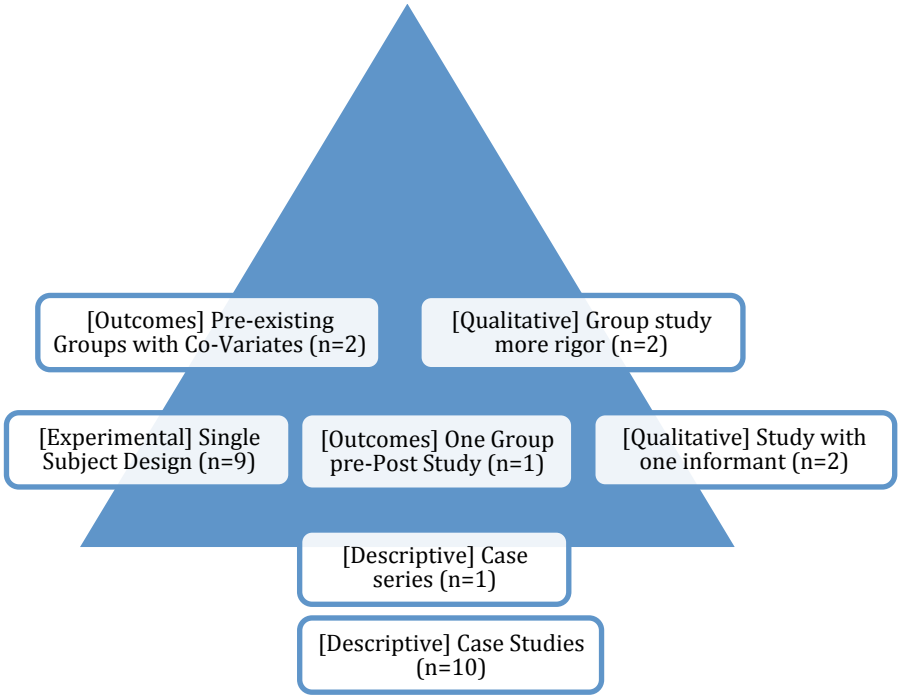

Figure 2.3. Selected studies levels of design rigor

Summarizing the Evidence. As guided by Kahn et al. (2003), the purpose of this review was to identify, categorize, and summarize peer-reviewed and non-peer-reviewed publications, and synthesize the literature related to HAI and individuals with DD. Results defined common presentation of HAI, identified common populations exposed to HAI, defined outcomes, and identified strengths and weaknesses of incorporating HAI (including AAT) in treatment of individuals with DD. Accordingly, it lays a foundation for future intervention planning and effectiveness studies.

Populations exposed to HAI in selected resources included primarily children with autism (12), but children with PDD (3), cerebral palsy (2), Down syndrome (3), mental retardation (intellectual disability) (1), developmental delays (1), and developmental disabilities (1) were also included. Adults with Down syndrome were represented in two studies, other studies included adult subjects with multiple disabilities (1), and intellectual/complex disability (1).

These population descriptions are indicative of the wide range of disabilities and varying terminology in DD. Further reflective of research in DD, most studies focused on children and adolescents (25), while only 2 focused on an adult population (CDC, 2013).

Outcomes associated with HAI across studies were examined to identify commonalities. While presentation of HAI and study methodology varied widely across studies, the use of social outcomes proved to be a common thread. In fact, improved social skills appeared in seven studies as an outcome. Study subjects demonstrated increased positive initiated interactions (single subject multiple baseline study with three participants aged 5–9 with intellectual disabilities; Esteves & Stokes, 2008) and improvement of prosocial behaviors (offering to share, offering comfort; outcomes study of 14 families with children with autism who had recently acquired a pet; Grandgeorge, 2012), improvement in peer relationships (case study of one 12-year-old boy with DD exposed to AAT weekly for 12 weeks; Kogan, 1999), increased turn taking, verbal expression, and eye contact (multiple baseline study with 33 paired subjects with autism, with an average age of 5.8; Yeh, 2008), encouraging interaction (narrative description of two children with autism, ages 3 and 5, who received trained service dogs; Nieves, 2004), positive social interaction, improved understanding of social cues (narrative description of one child with hearing impairment and developmental disorder; Niksa, 2007), and greater social interaction and use of language (school based alternating treatment study of 22 children with autism, ages 7–13; Sams et al., 2006).

Improvements in attention/focus, and concentration were indicated in five studies. Limond & Bradshaw (1997), using a repeated measures design with eight children with Down syndrome ages 6–12, found the children sustained visual attention to a real dog significantly longer than a stuffed dog. Heimlich (2001) conducted an eight-week multiple baseline design

study with 14 subjects ages 7–19 with multiple disabilities, and described general improvements in attention span. Martin & Farnum (2002) found their 10 subjects ages 3–13 with PDD demonstrated more focus when presented with a live dog in a within-participant repeated measures design. Yeh (2008) in another multiple baseline study, used Goal Attainment Scaling to identify significant improvements in concentration time during activities for 33 children with autism, average age 5.89. Obrusnikova (2012) described improved attention to task in a case study of 4 children (ages not specified) with ASD exposed to a "sports club" incorporating a dog. In summary, studies cited sustained visual attention to the dog, more verbal initiations to the dog, and improved attention to the task at hand.

Similarly, HAI was found to effect an increase in positive behaviors in two studies, such as smiling, laughing, giving the dog treats and other positive physical contact (Martin & Farnum, 2002; Silva, 2011). Martin and Farnum's within-participant repeated measures study of 10 children ages 3–13 with PDD, indicated more positive behaviors (laughing more, a more playful mood, and in increase in energy) when a live dog was present as opposed to a stuffed dog (2002). Silva (2011) conducted alternating treatment study with one subject, a 12-year-old boy with autism, who also demonstrated more frequent and longer duration of positive behaviors (smiling, positive physical contact) in the presence of a dog. Conversely, Silva and Limond and Bradshaw found a decrease in negative behaviors, including ignoring adults, aggression, and perseverations (Limond & Bradshaw, 1997; Silva et al., 2011) when a dog was present.

Interaction with a dog improved responsivity to instruction and feedback, also described as compliance (Heimlich, 2001; Obrusnikova, 2012). Multiple authors indicated improved motivation to participate in daily functional activities and therapy sessions as a result of interaction with dogs (Nieves, 2004; Obrusnikova, 2012). For example if a child wants to pet the

dog, they must first communicate using a dog icon on their communication device; also, the dog serves as a model for the child, as the dog sits when the children are told to sit and the children follow the dog's lead (Nieves, 2004).

Heimlich (2001) and Nieves (2004) identified physical and gross motor benefits of HAI. More specifically, using a multiple baseline design, Heimlich described a general improvement in physical movement (in 14 children age 7–19 with multiple disabilities) as a result of AAT. Nieves' 2004 case study identified that a dog provided walking support for two boys with autism, aged 3 and 5. However, Miccinello (2011), using an ABA design, found no significant differences in scores on a standardized movement assessment and heart rate when a therapy dog was present, in 8 boys, ages 9–11, with autism and PDD.

Communication and language were affected by interaction with a dog in multiple studies. Sams et al. (2006) identified an increase in use of language in AAT, and Nieves (2004) indicated children helped giving commands to a companion dog at home. Heimlich (2001) identified a general improvement in communication (Heimlich, 2001) when individuals with disabilities were exposed to AAT.

Children exposed to companion animals in the home did gain companionship, increased self esteem, improved community visibility/perception, and "a new best friend" (Carlisle, 2012; Panish, 2010). Panish's (2010) narrative description of two 7-year-old boys with cerebral palsy demonstrated these positive gains. Specifically, having a dog at home gave the child a public perception "past the disability of glasses, braces, and a walker, and [now] see a child and his dog." (Panish, 2010, p. 27). Carlisle's (2013) exploratory cross sectional study included phone interviews of 70 caregivers of children 8–18 with ASD, 47 with dogs in the home, whose parents reported positive expressions of companionship between the dogs and their children.

Additionally, Solomon's (2010) case study of two families of children with autism (ages 9 and 13) identified the experience of emotional connection between the child with autism and their family members and their dog. Responsibility for caring for an animal and exposure to vocational and recreational interests were also benefits to people with DD identified in the literature (Landreth, 2002; Carlisle, 2012).

Most resources (25) decisively reported positive outcomes, however two were not as positive, nor as conclusive. In contrast with other studies, Carlisle (2012) found no significant difference in social skills of children with autism who lived with a dog, or who had an attachment to a dog, when compared to children with autism who did not live with a dog. Miccinello (2011) found no significant difference in children's heart rate or gross motor skills when dogs were present.

Discussion

Kahn, et al. (2003)'s final step in systematic reviews involves interpreting findings. It is acknowledged that resources identified for this review are largely characterized by low rigor due to small sample sizes, convenience samples, lack of established assessments, and inability to blind raters and researchers to experimental conditions (dog presence); this is consistent with prior literature reviews (Wilson & Barker, 2003). However, 11 studies reviewed used a single-subject design to work within these constraints and minimize external variability (Sackett's Level III; Tomlin & Borgetto's Experimental Single-subject design). Single subject design offers investigators the opportunity to examine the effect of treatments on a single participant or case, and is often used to conduct a systematic evaluation of an intervention or program (Kazdin, 2011). Single subject design is practical, and it allows for evaluation of impact during the intervention, rather than solely at post-testing, thereby negating the need to compare between

group research (Kazdin, 2011). Multiple baseline design and alternating treatment/ABA are both examples of more rigorous single subject design seen in this systematic review.

Findings in this systematic review are consistent with those of O'Haire (2013) and Berry (2013); HAI for individuals with DD produces generally favorable effects. The most prevalent changes occur in the areas of improved social skills and attention, increased frequency of positive behaviors, improved responsiveness, motivation, and communication. Studies with more subjects and higher levels of rigor remain needed, but the consistency in these findings suggests that HAI can have a positive effect on several performance skills that support occupation. And, while this review focused on traditional companion animals, the reviews of O'Haire and Berry suggest that the specific animal is less important than the application of HAI in producing these gains.

In the face of these overall positive findings, weaknesses are acknowledged. First, the lack of standardized outcome measures is problematic. No studies selected for this review used the same outcome measure, and the majority of studies developed their own (unstandardized) measures when no standardized measure could be found to suit their needs. This challenge is not unique to HAI research, but it compounds the difficulties professionals face when implementing and evaluating HAI programs, and the difficulty faced identifying change in individuals with DD, whose levels of function vary widely (CDC, 2013).

A second weakness is found in the heterogeneity of presentation of HAI. Throughout the 27 selected resources, nine reported outcomes based on an interaction with a companion animal, three described service animals, and 14 described AAT. No articles used the term Animal-Assisted Activities (AAA), but approximately 13 could be described as such. The ideal dosage of HAI is currently unclear; finding what presentation best supports the development of

performance skills and improves occupational performance would be helpful. Thus, while studies of greater rigor and larger sample size are needed, there is also a need to understand optimal incorporation of an animal in intervention. This systematic review included studies conducted by occupational therapists, and studies conducted by other professionals; a few studies did not specify what type of professional was delivering the AAT, making it difficult to determine if *who* incorporates animals into treatment will be as important as the presentation of HAI as this field moves forward.

Parental involvement in HAI emerged as both a strength and a weakness. Generally parents were quite interested in HAI as an intervention for children with DD. However, only a few investigators addressed the burden of care in incorporating animals into the lives of already challenged parents (Carlisle, 2013; Coltea, 2011), and the lack of assistance provided for families of children with DD in animal selection (Carlisle, 2013). If HAI is to become a truly useful therapeutic tool, these issues will need to be addressed.

A final weakness noted in incorporating HAI into intervention programs for individuals with DD involves quality control for inclusion of animals in therapy. Limited training exists for clinical specialists in the professional implementation of AAT. There is often a lack of adherence to standards and/or guidelines set out for clinical professionals for safety and training, meaning that any clinical professional may bring untrained, uncertified animals into their treatment sessions and call it AAT. Many of the above described weaknesses; (lack of standardized outcome measures, heterogeneity of HAI presentation, parental burden, and quality control of animals and therapists) exist because HAI is so spread across clinical professions (McCardle et al., 2011).

Conclusion

Animals have been incorporated as a therapeutic tool for individuals with DD for almost two decades, but the field remains in relative infancy. Consistent with prior reviews, this systematic review identified globally favorable performance outcomes from HAI. However, research rigor continues to be low, and current study findings must be applied with caution. Much needs to be done to fully support the use of HAI as a treatment modality for individuals with DD.

Future studies will need to incorporate more rigorous designs. Studies must more carefully define outcomes and identify established measurement tools to determine treatment effectiveness. Because both DD and HAI present with great variability, well designed investigations that focus on individuals with specific diagnoses, as well as the study of the effectiveness of specific HAI, are needed to more clearly define the benefits. Clear descriptions of the presentation of HAI are required, as is quality control for implementation. In addition, parental burden must be considered if parents are involved in the HAI for their child.

Implications for occupational therapy practice

- HAI, including AAT, SDs, and companion animals are generally beneficial to individuals with DD.
- HAI are most effective when treatment needs relate to social function, communication, motivation and responsivity.
- OTs may want to consider becoming trained in AAT, and incorporating animals into their practice with individuals with DD.
- OT incorporating animals should mirror typical OT practice, ensuring safety, individual goal-related treatment and evaluation.

- Safety assurance includes careful screening of animals incorporated in practice.

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References

*(references marked with an asterisk * were analyzed for this systematic review)*

American Occupational Therapy Association. (2014). *AOTA's Evidence exchange*. Retrieved from: http://www.aota.org/en/Practice/Researchers/Evidence-Exchange.aspx

Barker, S.B., & Wolen, A.R. (2008). The benefits of human-companion animal interaction: A review. *Journal of Veterinary Medical Education, 35*, 487-495.

Berry, A., Borgi, M., Francia, N., Alleva, E., & Cirulli, F. (2013). Use of assistance and therapy dogs for children with autism spectrum disorders: A critical review of the current evidence. *The Journal of Alternative and Complimentary Medicine, 19*, 73-80. doi: 10.1089/acm.2011.0835

*Burrows, K. E., Adams, C. L., & Spiers, J. (2008). Sentinels of safety: Service dogs ensure safety and enhance freedom and well-being for families with autistic children. *Qualitative Health Research*, *18*(12), 1642-1649.

*Carlisle, G. K. (2013). Pet dog ownership decisions for parents of children with autism spectrum disorder. *Journal of Pediatric Nursing:* in press. Retrieved from http://dx.doi.org/10.1016/j.pedn.2013.09.005

*Carlisle, G. K. (2012). Pet Dog Ownership in Children of families with Autism. (Doctoral dissertation). Retrieved from ProQuest. Information & Learning (3537870).

Centers for Disease Control. (2013). *Developmental Disabilities*. Retrieved from http://www.cdc.gov/ncbddd/developmentaldisabilities/

*Coltea, C. (2011). Companion dogs: Helping families of children with and without Autism. (Master's thesis.) Retrieved from Proquest Information & Learning (MR81643).

*Coltea, C.G. & Parlow, S.E. (2009). Effects of companion dogs on children with Autism Spectrum Disorders, and on their parents. Proceeding from Human-Animal Interaction: Impacting Multiple Species. Kansas City, MO.

*Esteves, S.W., & Stokes, T. (2008). Social effects of a dog's presence on children with disabilities. *Anthrozoös: A Multidisciplinary Journal of the Interactions of People & Animals, 21*, 5-15.

*Freeman, S. (1997). Treating a dog phobia in a person with Down syndrome by use of systematic desensitisation and modelling. *British Journal of Learning Disabilities, 25*(4), 154-157.

*Grandgeorge, M., Tordjman, S., Lazartigues, A., Lemonnier, E., Deleau, M., & Hausberger, M. (2012). Does pet arrival trigger prosocial behaviors in individuals with autism? *Plos One, 7*(8). doi:10.1371/journal.pone.0041739

*Heimlich, K. (2001). Animal-assisted therapy and the severely disabled child: A quantitative study. *Journal of Rehabilitation, 67*, 48-54.

Khan, K.S., Kunz, R., Kleijnen, J., & Antes, G. (2003). Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine. 96*, 118-121.

*Kogan, L. R., Granger, B. P., Fitchett, J. A., Helmer, K. A., & Young, K. J. (1999). The human-animal team approach for children with emotional disorders: Two case studies. *Child & Youth Care Forum, 28*(2), 105-121. doi:10.1023/A:1021941205934

*Landreth, R., & Wallace, K. (2002). Going out to work — walking the dogs. *Occupation, 10*(1), 19-29.

Levinson, B. M. (1972). *Pets and Human Development*. Springfield, IL: Charles C. Thomas.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., ... Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Annals of internal medicine*, *151*(4), W-65.

*Limond, J.A., Bradshaw, J.W.S., & Cormack, M.K.F. (1997). Behavior of children with learning disabilities interacting with a therapy dog. *Anthrozoös: A multidisciplinary journal of the interactions of people & animals, 10*, 84-89.

*Martin, F., & Farnum, J. (2002). Animal-assisted therapy for children with pervasive developmental disorders. *Western Journal of Nursing Research, 24*(6), 657-670.

McCardle, P., McCune, S., Griffin, J.A., Esposito, L., & Freund, L.S. (2011). *Animals in our lives: Human-animal interaction in family, community & therapeutic settings*. Baltimore, MD: Paul H. Brookes.

*Miccinello, D. (2011). *The Effects of Animal Assisted Interventions on Children with Autism during the Movement Assessment Battery for Children-2 (MABC-2)* (Unpublished masters thesis.) University of Delaware, Newark, DE.

Nathanson, D., & de Faria, S. (1993). Cognitive improvement of children in water with and without dolphins. *Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals*, *6*(1), 17-29.

*Nieves, J. (2004). A golden opportunity for children with autism. *Exceptional Parent, 34*(12), 39-39.

*Nikolskaya, A. V. (2012). Socio-psychological aspects of animal therapy in treating children suffering from forms of dysontogenesis. *Psychology Research, 2*(11), 637-655.

*Niksa, E. (2007). The use of animal-assisted therapy in psychiatric nursing: The story of Timmy and Buddy. *Journal of Psychosocial Nursing and Mental Health Services, 45*(6), 56-58.

Nimer, J. & Lundahl, B. (2007). Animal-Assisted Therapy: A meta-analysis. *Anthrozoös: A Multidisciplinary Journal of the Interactions of People & Animals*, *20*, 225-238.

*Obrusnikova, I., Bibik, J. M., Cavalier, A. R., & Manley, K. (2012). Integrating therapy dog teams in a physical activity program for children with autism spectrum disorders. *Journal of Physical Education, Recreation & Dance, 83*(6), 37-41.

O'Haire, M. E. (2013). Animal-assisted intervention for autism spectrum disorder: A systematic literature review. *Journal of autism and developmental disorders*, *43*(7), 1606-1622.

*Panish, L. (2010). My four children. *Exceptional Parent, 40*(5), 26-27.

*Petrongelli-Halloran, L. (2012). *Evaluation of prosocial behaviors during animal-assisted therapy for children with pervasive developmental disorders.* ProQuest Information & Learning, 626248.

Potter, J. (2010). Mapping the literature of occupational therapy: an update. *Journal of the Medical Library Association, 98,* 235-242.

*Prothmann, A., Albrecht, K., Dietrich, S., Hornfeck, U., Stieber, S., & Ettrich, C. (2005). Analysis of child-dog play behavior in child psychiatry. *Anthrozoös, 18*(1), 43-58. doi:10.2752/089279305785594261.

*Redefer, L. A., & Goodman, J. F. (1989). Brief report: Pet-facilitated therapy with autistic children. *Journal of Autism and Developmental Disorders, 19*(3), 461-467.

Sackett, D.L., Richardson, W.S., Rosenberg, W., & Haynes, R.B. (1997). *Evidence-Based Medicine; How to Practice and Teach EBM.* New York, NY: Churchill Livingstone.

*Sams, M.J., Fortney, E.V., & Willenbring, S. (2006). Occupational therapy incorporating animals for children with autism: A pilot investigation. *American Journal of Occupational Therapy, 60*, 268-274.

*Silva, K., Correia, R., Lima, M., Magalhaes, A., & de Sousa, L. (2011). Can dogs prime autistic children for therapy? evidence from a single case study. *Journal of Alternative and Complementary Medicine (New York, N.Y.), 17*(7), 655-659. doi:10.1089/acm.2010.0436; 10.1089/acm.2010.0436

*Solomon, O. (2010). What a dog can do: Children with autism and therapy dogs in social interaction. *Ethos*, *38*(1), 143-166.

Tomlin, G. & Borgetto, (2011). Research pyramid: A new Evidence-Based Practice model for occupational therapy. *American Journal of Occupational Therapy*, 65, 189-196.

Tomlin, G. (2014). *Research pyramid*. Retrieved from http://www.pugetsound.edu/files/resources/3537_Research%20Pyramid%20%28web%29-12.pdf

*Weiss, S. (2002). *Tails as Teachers: Animal-Assisted Therapy and Children With Autism Spectrum Disorder*. (Unpublished manuscript). Dominican University of California, San Rafael, CA.

Wilson, C. C., & Barker, S. B. (2003). Challenges in designing human-animal interaction research. *American Behavioral Scientist*, *47*(1), 16-28.

*Yeh, M. L. (2008). Canine animal-assisted therapy model for the autistic children in Taiwan. Department of Nursing, Taiwan. Presentation from the 11th international conference on human-animal interactions, people & animals: Partnership in harmony, Tokyo, Japan.

Chapter 3: Article II

Effects of Occupational Therapy Incorporating Animal-Assisted Therapy on Playfulness in Children with Developmental Disabilities

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Abstract

Based on the knowledge that companion animals help typically developing children, Animal-Assisted Therapy is an emerging multidisciplinary practice area which could improve playfulness in children with developmental disabilities. Prior studies (from outside occupational therapy) indicated a more playful mood and other positive changes as a result of AAT.

This single-subject multiple baseline A-B design with repetition (n=10) examined whether incorporation of a trained therapy dog into occupational therapy (OT-AAT) significantly influenced the playfulness of children with developmental disabilities. Participants received 8 weeks of intervention in two phases, occupational therapy using traditional techniques and OT-AAT. Video recorded sessions were scored post-treatment using the Test of Playfulness.

Visual analysis and descriptive statistics of individual playfulness scores varied, but most (60-80%) participants demonstrated small increases in total playfulness during OT-AAT. Paired t-tests of aggregated group data indicated significantly improved playfulness during OT-AAT. Suggestive results establish a foundation for a study examining OT-AAT, free play and associated playfulness.

Introduction

Children and animals have a natural connection (Melson, 2011), commonly forming powerful relationships, and the benefits of animals in the lives of typically developing children are well documented. Through play with a pet, children experience friendship, demonstrate improved communication, and increased participation in social and recreational activities (Beck, 2011). Fully 75% of households in the United States have pets (Humane Society of the United States, 2006), and parents agree that pets are beneficial to their children's development (Melson, Kahn, Beck, & Friedman, 2009). Child-animal interactions are supported and perpetuated throughout children's books, toys, and media (Melson, 2011). In spite of these strengths, the impact of animal relationships on children with atypical development has been less studied and is less clear.

Background

Human-animal interaction. Human-Animal Interaction (HAI) is a broad term that refers to the shared, dynamic associations between people and animals, and the effects of those relationships on health and well-being (McCardle, McCune, Griffin, Esposito, & Freund, 2011). The understanding that interacting with animals can be beneficial to humans has led to increased incorporation of HAI across disciplines. Since the 1970s, HAI has become more frequently researched and increasingly accepted (Esposito, McCardle, Maholmes, McCune, & Griffin, 2011). The academic field of HAI has grown exponentially over the past decade.

Human-Animal Interactions encompass specific interventions that intentionally include animals. One type of HAI, Animal-Assisted Therapy (AAT), is a goal-directed intervention in which a trained animal, that meets specific criteria, is an integral part of the therapy (Delta Society, 2003). In AAT, the trained animal is incorporated as a clinical tool. Although many

species of animals are incorporated in therapy, dogs are the most common and most accessible (Fine, 2010). HAI, and more specifically AAT, are based on the Biophilia hypothesis, an assertion that an emotional and beneficial relationship exists between humans and nature in which there is an "innate tendency to focus on life and lifelike processes" (Wilson, 1984, p. 5).

HAI is "emerging as an academic discipline" (Trujillo, Tedeschi, & Williams, 2011, p. 199). With sparse research currently available, HAI scholars challenge researchers by calling for evidence-based studies supporting interventions including animals (Friedmann, Barker, & Allen, 2010). As Trujillo, et al. (2011) identify, current understanding of AAT is characterized by a largely anecdotal body of research. Systematic, data driven studies are needed to advance understanding. Based on the knowledge that companion animals benefit typically developing children, Animal-Assisted Therapy (AAT) is an emerging multidisciplinary practice area with the potential to improve therapy outcomes in children with Developmental Disabilities (DD) (Trujillo et al., 2011).

Developmental disabilities and HAI. Developmental disabilities are defined as a variety of chronic conditions due to mental and/or physical impairments, which begin during early development and last throughout the lifetime. Impairments cause difficulty with language, mobility, learning, self-help, and independent living skills (Centers for Disease Control, 2010). In addition, children with DD are often excluded from social experiences because of their impairments (Viau, Arsenault-Lapierre, Fecteau, Champagne, Walker, & Lupien, 2010).

Children with DD frequently receive occupational therapy (OT) services. The goal of OT intervention in pediatrics is to increase participation in meaningful occupations, including play (Case-Smith &Miller-Kuhaneck, 2008). Prior research has found that OT incorporating animals positively impacts social function in children with DD (Sams, Fortney, & Willenbring, 2006).

However, little research exists related to the impact of animals on play and playfulness in children with DD, and none from an OT perspective.

Play, HAI, and developmental disabilities. Play can be defined as engagement in activities that are freely chosen, intrinsically motivated, and done for personal enjoyment or a sense of challenge (Henry, 2000). A closely related term, playfulness, can be defined as the disposition to play, or the way a child approaches play and other tasks. Highly playful interactions are intrinsically motivated, under the control of the player, and embrace the freedom to suspend reality (Skard & Bundy, 2008).

Play and playfulness were chosen for this study because of their significance in the lives of children and their impact on functional abilities. Play allows for motor skill acquisition and practice in a fun, informal context. Occupational therapists consider play to be the primary occupation of children. A strong association has been found between playfulness, adaptability and coping (AOTA, 2008; Hess & Bundy, 2003). While children with DD often exhibit impairments in play and playfulness, it has been suggested that enhancing play is likely to further their functional ability (Bundy, Shia, Qi, & Miller, 2007). Animals incorporated into therapy have the potential to increase playfulness (Martin & Farnum, 2002), and in examining this potential, we may gain insight into how AAT can be used to achieve occupational goals.

Although other disciplines have found AAT to be an effective intervention, the effects of incorporating AAT into OT are not well documented (Nimer & Lundahl, 2007; Souter & Miller, 2007). Pertinent to the current study, a pilot investigation in which a variety of animals (llamas, dogs, and rabbits) were incorporated into OT practice in a school-based setting had positive results (Sams et al., 2006). Children with autism and other DD showed greater social interaction and language use during OT sessions incorporating animals than in standard OT sessions (Sams

et al., 2006). While Sams et al. (2006) is the only study identified focusing on a DD population from an OT perspective, OTs have documented preliminary positive occupational performance outcomes when incorporating animals with soldiers in combat (Fike, Najera, & Dougherty, 2012), with elderly populations (Fike, et al, 2012; Zisselman, et al, 1996), and with individuals with mobility challenges (Crowe, Perea-Burns, Sedillo, Hendrix, Winkle, & Deitz, 2014). These broad applications and positive outcomes suggest that further investigation of the impact of AAT on occupational performance areas is worthwhile.

Two systematic reviews examining AAT from perspectives other than OT recently found generally positive outcomes of AAT and service animals (specifically in the areas of social interaction, communication and increased interaction) when incorporated in therapy with children with autism (Berry, Borgi, Francia, Alleva, & Cirulli, 2013; O'Haire, 2013). Despite these systematic reviews, the application of AAT as an intervention for children with DD has yet to be thoroughly examined. Animal-Assisted Therapy may impact at least children's social interaction and language (Sams et al., 2006), and has the potential to impact their playfulness and participation. Based on these preliminary findings, the following research questions were addressed:

- Does incorporation of a trained therapy dog into occupational therapy (OT-AAT) significantly increase playfulness in children with DD?
- Does implementation schedule/length of baseline of introduction of OT-AAT significantly influence playfulness?

Method

Research design. This study used a single-subject multiple baseline A-B design with repetition (n=10), e.g. multiple baseline across subjects. Multiple baseline design intentionally

staggers the treatment of interest so individuals serve as their own controls (Hawkins, Sanson-Fisher, Shakeshaft, D'Este & Green, 2007). In multiple baseline studies, the repeated pattern of an improvement in the outcome (here, increased playfulness) following the implementation of the treatment of interest (here, OT-AAT) would suggest the treatment had an effect (Hawkins et al., 2007). Using a single subject multiple baseline design *with repetition across subjects* (n=10) allowed for examination of behavior change over multiple individuals, and for inferences related to treatment effects based on patterns of behavior change (Kazdin, 2011) Appendix D identifies strengths and weaknesses in reliability and validity of research design.

Participants. Individuals were recruited from a private, non-profit residential and day school for children with multiple disabilities, ages 0–23 years. Most students had multiple disabilities (visual impairment and other DD) and received educational instruction as well as occupational, physical, and speech and language therapy. Occupational therapy services focused on independence with daily occupations (including leisure activities and play), sensory motor integration, as well as adaptive strategies related to visual impairment. Inclusion criteria in the current study selected participants 6–13 years of age, who were currently receiving OT, and had documented diagnosis of one or more of the following developmental disabilities: Autism Spectrum Disorder, sensory impairment, and/or intellectual disability. Individuals selected may have had visual or hearing impairment, but were able to navigate their environment and respond to verbal communication. The heterogeneity of this sample was a function of the population, and was part of the rationale for the single subject research design. Selected participants were unknown to the treating therapist and trained therapy dog prior to the start of the study, except that the treating therapist observed one OT session with the student and his/her primary OT prior

to the start of Phase 1. The intervention was scheduled as an additional therapy, or "bonus OT" session.

Exclusion criteria encompassed allergy to dogs, fear of dogs and the inability to ambulate without a wheelchair. These exclusionary factors were determined based on parent report. Participants' ages ranged from 6–13 (M=10.4;SD=2.87). Six participants were female (60%) and four were male (40%), and all had multiple disabilities (100%). Most were diagnosed with visual impairment (60%) and another genetic or developmental disorder, e.g. autism (10%), pervasive developmental disorder (10%), and cerebral palsy (10%). Disabilities of the visual system included Retinopathy of Prematurity (30%), Cortical Visual Impairment (20%), and optic nerve hypoplasia. Other rare genetic diagnoses were also represented, but not specifically reported here to protect the identities of subjects (30%). A descriptive table of subjects is included as Table 3.1.

Individual participants demonstrated great variation in level of function both between individuals, and within individuals between sessions. Participant 1 was a willing participant who seemed to enjoy OT sessions. Participant 2 showed disinterest in "bonus" OT in general, and generally a low level of playfulness, possibly due to her (pre-teen) age, or relatively high level of function. Participant 3 was cheerful and enthusiastic, however she commonly displayed avoidance behaviors (lying on the floor, refusing to enter the classroom, etc.) during bonus OT sessions. Participant 4's participation in school and therapy was often disrupted by sensory seeking behaviors (e.g. touching others, lying on the floor) and inappropriate perseverations (usually on individuals or activities). Participant 5's performance during bonus OT varied due to fatigue and other environmental factors, but she was an eager participant. Participant 6 was cheerful and playful, and demonstrated genuine interest in all therapeutic activities presented.

Table 3.1

Description of Individual Participants

Participant ID	Characteristics					Pet at home	Concurrent Therapies
	Age	Gender	Dx*	Comm.**	Mobility***		
1_A	6	F	RGD	NV	AMB, walker	cat	OT, PT, SLP
2_B	11	F	ONH	V	AMB	rabbit	OT
3_B	9	F	RGD	V	AMB, cane	dog	OT, PT, SLP
4_A	7	M	RoP	V	AMB, cane	dog	OT, PT, SLP
5_B	12	F	RoP	V	AMB, walker	dog	OT, PT, SLP
6_A	7	F	RoP	V	AMB, cane	dog	OT, PT
7_C	13	M	CVI	V	AMB	dog	OT, SLP
8_B	13	F	RGD	NV	AMB	dog	OT, PT, SLP
9_C	13	M	CVI	V	AMB	no pet	OT, SLP
10_C	13	M	Autism	NV	AMB	cat	OT, PT, SLP

Note: Group assignment is reflected in Participant ID (A,B,C). *ONH: Optic nerve hypoplasia; RGD: rare genetic disorder, where the identitiy of the disorder would reveal the identity of the participant; RoP: Retinopathy of Prematurity; CVI: Cortical Visual Impairment; **Comm: communication, V: verbal, NV: non verbal; ***AMB: ambulatory

Participant 7 demonstrated difficulty transitioning to bonus OT, and displayed avoidance behaviors (e.g. refusing to enter the classroom) in response to novel situations. Participant 8 demonstrated a generally positive attitude. Participant 9 acted slightly reserved and verbalized anxiety throughout the study, but willingly completed tasks as introduced. Participant 10 demonstrated willingness to participate, however novel interventions were met with resistance (e.g. standing up and walking away). In addition to these characteristics, and those presented in Table 3.1, all participants demonstrated cognitive delays of varying degrees. These individual

descriptions are intended to describe the wide range of variability of response characterized by the study sample.

To ensure human subject protection, approval to complete this study was received by the Institutional Review Board at Virginia Commonwealth University. Parent/guardian consent and child verbal assent were gathered. Ten participants began the study and all completed all eight weeks of intervention.

Instrument. The Test of Playfulness, version 4.2 (ToP) was used to assess playfulness (Bundy, 2010). The ToP is a 29 item standardized observational assessment designed to evaluate play in children ages 6 months to 18 years whose playfulness is a concern (Bundy, 2010). Appendix E includes the rating form in its entirety. The test can be scored post-therapy if the session is videotaped (Brentnall, Bundy, & Scott Kay, 2008), as in this study. Items, scored from 0-3, reflect the extent, intensity, or skill relative to playfulness. These components of playfulness can be separated into subscales. The Extent Subscale refers to the proportion of time the player engages in the described items. The Intensity Subscale relates to the degree to which the player demonstrates the described items, and the Skillfulness Subscale relates to the ease of performance of the described items (Bundy et al., 2007). Examples of items include "initiates play with others," "pretends," "clowns or jokes," and "shares" (Skard & Bundy, 2008, p. 78). Items are defined in detail within the ToP Manual (Bundy, 2010). When completed, the ToP identifies a raw total playfulness score, which can be standardized, and three subscale scores as described above (Extent, Intensity, and Skillfulness). The ToP was developed based on typically developing children and children with disabilities (Bundy, 2010). Reliability and validity of the ToP have been established among children with disabilities (Okimoto, Bundy, & Hanzlik, 2003; Skard & Bundy, 2008). Okimoto et al. (2003) determined that children with developmental

delays score significantly lower than typically developing children. Although the ToP was designed to systematically examine playfulness during free play (Bundy, 2010), in this study it was used to examine changes in the playfulness of children within an OT treatment session focused on achieving child-specific goals, primarily related to daily living skills and improving fine motor coordination. There was no expectation that children would demonstrate the full extent of their playfulness. Instead, the ToP was used to determine if playfulness would differ in the presence or absence of the therapy dog.

To avoid measurement bias, three OT graduate students at Virginia Commonwealth University not involved in any other aspect of this project were trained and calibrated for ToP scoring. Student raters were trained by the third author, engaged in rating practice videotapes, and were subsequently calibrated as raters by the developer of the ToP. Once calibrated, student raters were randomly assigned subjects to rate; one rater scored all sessions for a given subject. Sessions were randomized for raters, such that they did not know the specific sequence of sessions.

Intervention. This study investigated children with DD who demonstrate varied behavior on a day-to-day basis; therefore, it was important to establish a reliable baseline of performance. All 10 participants received intervention concurrently over a period of eight weeks. Standard treatment, or Phase 1 of the current study, ran between 3 and 5 weeks, and included 6-10 sessions of traditional occupational therapy treatment (TT). Study participants started Phase 2 variably at weeks 4, 5, or 6. Phase 2 (OT-AAT) was conducted over a subsequent block of 3–5 weeks, as described in Table 3.2. Individual participants were randomly assigned to groups and the only purposeful difference between the groups was length of phases.

Table 3.2

Group Makeup and Study Timeline

	Weeks 1-3	Week 4	Week 5	Week 6-8
Group A: Subjects 1, 4, 6	OT-TT	OT-AAT	OT-AAT	OT-AAT
Group B: Subjects 2, 3, 5, 8	OT-TT	OT-TT	OT-AAT	OT-AAT
Group C: Subjects 7, 9, 10	OT-TT	OT-TT	OT-TT	OT-AAT

Although groups were assigned randomly, group characteristics varied. Group 1 was made up of two females and one male, their average age was 7. Two were diagnosed with retinopathy of prematurity (RoP), one with a rare genetic disorder. Group 2 consisted of four females and no males, with an average age of 11.5. Two were diagnosed with rare genetic conditions, one with RoP, and one with optic nerve hypoplasia. Group 3 included four males, no females, whose average age was 13. Two were diagnosed with cortical visual impairment and one was diagnosed with autism spectrum disorder.

As noted, intervention was divided into two phases: the first phase, OT/TT, included typical OT techniques, and the second phase, OT/AAT, included typical OT techniques incorporating a trained therapy dog. In both phases, intervention was administered by the first author, an occupational therapist with eight years experience. An eclectic approach to pediatric OT was utilized based on motor skill acquisition, biomechanics, sensory integration theory, and the acquisitional frame of reference (Berry & Ryan, 2002). The overall focus of therapy was to increase independence in childhood occupations, though sessions were tailored to specific participants based on their individual IEP goals. All sessions were provided individually in the school's OT treatment space for approximately 30 minute periods outside of students' regularly

scheduled classes with a therapist who was initially unfamiliar to participants. Sessions occurred once or twice weekly, depending on participants' availability. Sessions were video recorded for later analysis. During the sessions, safety of the participants, dog, and staff was always paramount. The therapy dog, used in phase 2, was trained and selected specifically to work with students with visual impairment and DD. The first author and the therapy dog were certified to provide AAT by Canine Companions for Independence. Therapeutic activities were chosen based on goals and objectives written into the child's Individualized Education Plan (IEP), which focused on daily living skills like dressing and handwriting, as well as improving fine motor coordination including bimanual coordination. An example of a typical session is illustrated in Table 3.3.

The presence or absence of a dog was the only purposeful difference in therapeutic and play activities between Phase 1/OT-TT and OT-AAT sessions. During Phase 2, AAT, the dog was incorporated into treatment just as any novel therapy tool and interaction depended on the child's cues and tolerance. Some equipment used by the dog and handler was introduced in Phase 1 sessions to familiarize the participants with the equipment and activities. For example, a therapeutic activity used in each session included using tongs to pick up balls from a dog dish. Further examples are provided in Table 3.3. Intervention was manualized for this study and is available from the first author (Feinstein, 2013).

Previously initiated/ongoing interventions the participants received at the start of the study (OT, PT, or SLP) remained unchanged throughout the study. See Table 3.1, which identifies concurrent therapies received by each subject throughout the study. Concurrent therapies could have potentially influenced results by improving play skills in their sessions, but it was not possible to halt concurrent therapies without significant impact on participants.

Table 3.3

Specifics of Session Characteristics Addressing Sample Goal

Time	OT-TT	OT-AAT
Minutes 0-10: Warm-up activity	Introduction to activity, therapist Review plan Choose warm-down/reward activity	Introduction to activity, therapist, therapy dog Review plan Choose warm-down/reward activity
Minutes 10-25: goal-directed activity, including free play Sample goal: James will increase strength and coordination for functional play, as demonstrated by: Using both hands together to complete a functional activity with minimal verbal reminders	Free play with sensory equipment: Sit on beanbag chair with weighted blanket, sensory fidget Yoga with animal poses Connect pop beads to make a necklace	Free play with sensory equipment with dog present: Sit on beanbag chair with dog on lap Yoga (animal poses) next to dog Connect pop beads to make a dog collar
Remaining minutes: Warm-down or reward activity	Listen to music Read book Review plan for next session High five with therapist	Listen to music Read book to dog Review plan for next session High five with dog

Additional OT sessions and assessments for this study were provided to each participant at no charge; a significant benefit to the children with DD and their families.

Having one treating therapist allowed the possibility that changes in the treating therapists' affect during the two types of interventions might influence outcomes (performance bias). However, in this study, the benefit of consistency in treating therapist was believed to outweigh the potential bias. Therapy sessions for this study were provided twice per week when possible, though some participants were only available once per week. Individual participants received between 9 and 15 sessions each (see Appendix F). The ToP is scored on independent observations, so the number of sessions should not have an effect on individual scores, however

it is possible that the cumulative difference in the number of sessions may have had an effect on outcomes.

Analysis

Variables examined were presence/absence of a dog; group membership/treatment schedule; total playfulness standardized score, playfulness extent, intensity, and skillfulness raw subscores. One hundred and twenty (120) sessions were conducted, video recorded and analyzed; of those, 59 were OT-TT and 61 were OT-AAT. Because this study is based on single-subject design, individual scores were examined first, then scores by Group, and finally, all data points combined by phase. Different levels of analyses were chosen in order to answer the research questions. Research question 1 was answered with individual, group level, and aggregate phase analysis. Research question 2 regarding schedule of implementation was answered with group level analysis. The research question related to the difference in playfulness between treatment conditions (OT-TT and OT-AAT) in children with DD was answered by individual visual time series analysis and effect size calculations, as well as aggregated analysis using paired *t*-tests. The second research question, related to the effects of schedule of intervention/length of baseline, was answered with Group level visual time series analysis and change in slope calculations. Visual inspection of individual subject responses graphed over time is a common method of data analysis in single-subject rehabilitation research (Bobrovitz & Ottenbacher, 1998; Dermer & Hoch, 2001) and is appropriate for time series analysis in this study. The median was the chosen measure of central tendency with all raw scores because it is less susceptible to extreme outliers than the mean (Lund, 2013). For standardized scores, the mean was considered sufficient. Visual inspection of time series graphs was the primary mode of analysis for individual scores. Individual visual analysis preceded the group analysis.

When scoring the ToP, items can be marked N/A if raters determine they cannot be scored for that child or session. In the current study items such as skillfulness in "pretending and creativity" was omitted by most raters, as was skillfulness of "enters and initiates." Sessions did not lend themselves to a great deal of creativity on the part of the child, and all sessions were 1:1, giving the children no opportunity to enter and initiate interaction with others. Missing scores were estimated by the scoring software, based on what was known about the child and the item (Bundy, personal communication, December 1, 2014).

In this study, standardized total score means were not markedly different between phases. Subsequent analyses looked at aggregated subscale scores to determine if phase differences might be apparent in specific aspects of playfulness. Raw subscale scores were aggregated across subjects to examine the effects of presence or absence of a dog trained for AAT on playfulness. Although data collected via single subject multiple baseline design can violate the assumptions of normality due to serial dependence (Kazdin, 2011), this dataset was found to be normally distributed as noted below.

Visual inspection of the 120 raw and standardized ToP scores via histogram and Q-Q plots revealed a normal distribution (see Appendix G). Specifically, skewness was calculated at 0.79, and kurtosis at 0.68 (both significant at less than 1). The Kolmogrov-Smirnov test of normality resulted in a score of 0.65 (p = .20), indicating the data set was normally distributed. A single subject multiple baseline study collects data that is potentially correlated, violating the assumption of independence of observations. The presence of autocorrelation can affect the analysis of single subject data (Kazdin, 2011). Significant levels (<0.05) of autocorrelation were found in this dataset (120 total standardized ToP scores), with a range of -0.17 to 0.24 (M=0.05,

SD=0.12). The presence of autocorrelation limits statistical analysis because many statistical analyses assume independence of observations.

Dependent, or paired *t*-tests are designed to compare means from related samples; thus, paired *t*-tests were conducted to account for the presence of autocorrelation/ lack of independence. Paired *t*-tests were conducted to see whether a significant difference existed between treatment conditions. No covariates of interest were identified for this sample.

Results

Descriptive analysis. Individual standardized scores for total playfulness ranged from a -5.21 to -0.63 (*M*= -2.94; SD 0.27). ToP subscale scores produced only raw data, as standardized scores were not available. Raw scores for the Extent Subscale ranged from 9 to 22 (*Mdn* 17; *SD* 2.56); the Intensity Subscale ranged from 0 to 13 (*Mdn* 9: *SD* 2.16); and the Skillfulness Subscale from 3 to 41 (*Mdn* 18.5; *SD* 7.04). ToP subscale scores (Extent, Intensity, Skillfulness) were not designed to be analyzed separately. As such, descriptive analysis was conducted, but not reported due to a lack of substantial results. Total playfulness across phases and corresponding measures of central tendency are displayed by phase in Table 3.4.

Based on the above descriptive results, 8 out of 10, or 80% of participants demonstrated increased mean total playfulness during OT-AAT, although most mean increases were notably small. Effect sizes (based on Cohen's *d*; 1988) varied by participant, however 60% demonstrated medium or large intervention effects (30% medium and 30% large) with 40% of participants demonstrating small or no meaningful effect. Participants 3 and 9 mean total playfulness scores were higher during OT-TT phase, so effect sizes indicate greater playfulness during OT-TT.

Individual subject analysis. Individual standardized scores were plotted to identify differences between phases based on visual analysis for all participants (see Figure 3.1).

Table 3.4

Descriptive Analysis: Total Playfulness

Participant	OT-TT M	OT-AAT M	SE	*d*	Effect
1	-2.88	-2.67	0.26	0.41	medium
2	-3.01	-2.86	0.25	0.70	large
3	-3.22	-3.33*	0.26	0.15	small
4	-3.41	-3.34	0.27	0.21	medium
5	-3.18	-3.14	0.26	0.06	not meaningful
6	-2.44	-2.38	0.27	0.73	large
7	-2.81	-2.71	0.26	0.17	small
8	-2.79	-2.78	0.27	0.01	not meaningful
9	-3.24	-3.70*	0.27	0.51	large
10	-2.43	-1.98	0.32	0.41	medium
All	-2.94	-2.89	0.27	0.21	medium

M: Total Playfulness mean score * indicates mean total playfulness decreased during OT-AAT. Effect size interpretation: small ≤ 0.2; medium ≤0.5, and large ≤ 0.8 (Cohen, 1988).

Trendlines were added to examine slope and identify patterns in individual data (Kromrey, 1996). Variability in playfulness was observed across participants and phases, indicating inconsistency in performance. Small changes in performance across phases were present for most subjects, as shown in Figure 3.1 and represented in Table 3.4. Indicators were positive (mean difference and slope change between OT-TT and OT-AAT) for 6 of 10 participants, suggesting increased playfulness during OT-AAT.

Group-level visual analysis. Group visual analysis was conducted to see whether length of phases had an effect on playfulness when implementing OT-AAT. As previously stated group membership was randomly assigned, so the only purposeful difference between groups was phase length. The relationship of groups by phase start time and phase length was presented in Table 3.2. Figure 3.2 displays mean total playfulness across groups, across study phases.

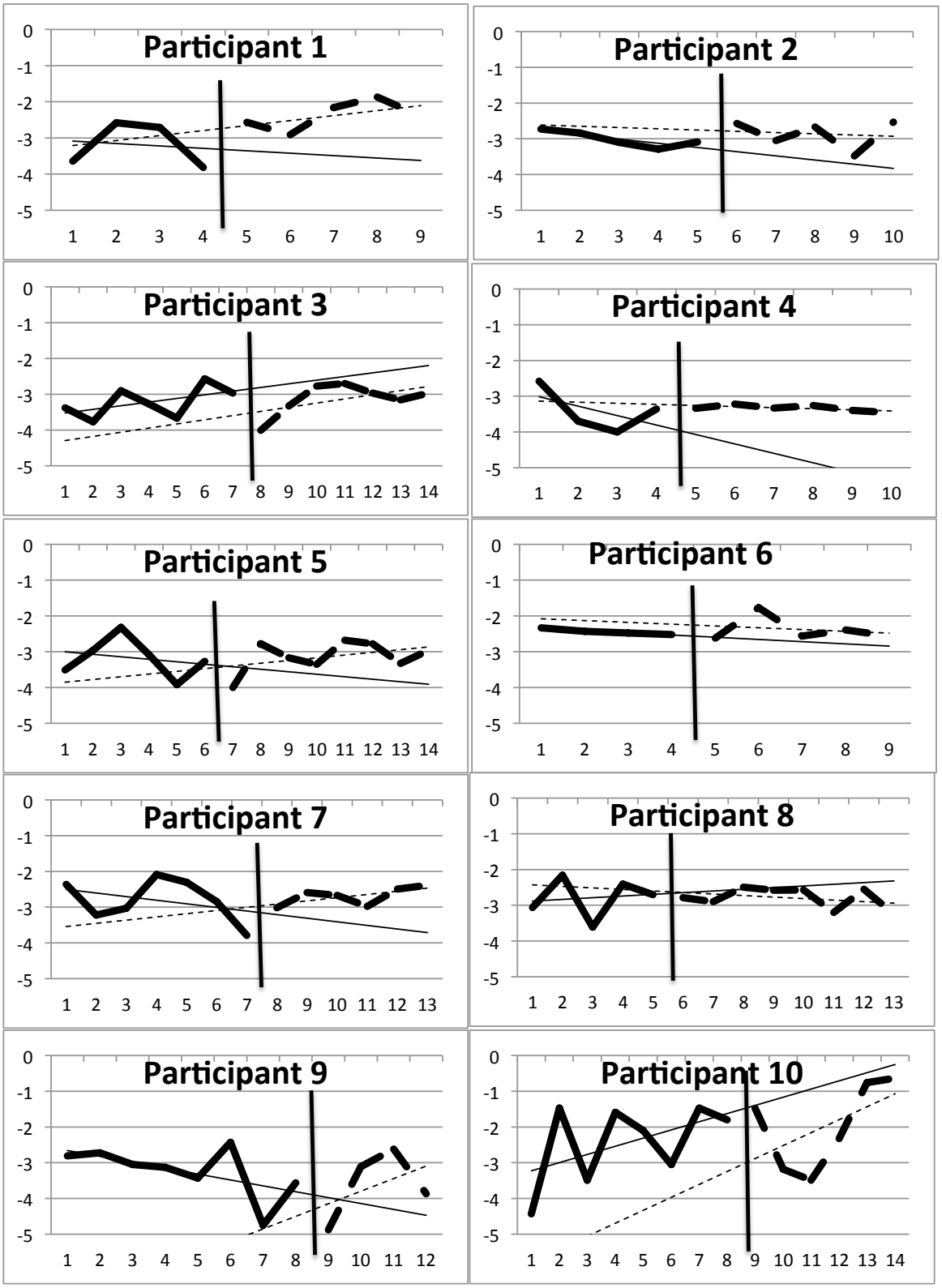

Figure 3.1.Visual analysis of individual standardized scores by session sequence
Note: Solid line=OT-TT ; Dashed line= OT-AAT for both data (bold) and trendlines

Trend lines in the time series graphs in Figure 3.2 show changes in playfulness when OT-AAT was introduced for groups A and C; trend line slope for Group B is less steep after the introduction of AAT. Group C received the shortest Phase 2/OT-AAT, and also demonstrated the most variability in performance.

Aggregate level analysis. Next, mean playfulness scores for all participants were aggregated by phase for comparison. Statistically significant differences at the 0.05 level were found between the OT-TT and OT-AAT phase scores for all variables. Results of the paired-samples t-test indicated that mean Total Playfulness differed during OT-TT and OT-AAT ($t(9)=3.9$, df=9, $p < .05$). Examining subscales, a significant effect of OT-AAT on the Extent subscale ($t(9)=5.22$, $p < .05$); Intensity subscale ($t(9)=2.38$, $p < .05$), and Skillfulness subscale ($t(9)=3.11$, $p <.05$) were noted. See Table 3.5 for means, standard deviations, mean differences and confidence intervals.

Comparison of mean raw scores between phases was conducted to examine direction of change, and to look at change on subscales. A statistically significant positive change in any one of the four ToP scores (Extent, Intensity, Skillfulness subscales, or Total playfulness) during OT-AAT was considered a meaningful change. Raw Total Playfulness and all subscale scores were significantly increased during OT-TT, as compared to OT-AAT, indicating a significant increase in playfulness when a trained therapy dog was present.

Discussion

These results suggest that introducing a dog into OT sessions can increase playfulness in some children with DD. This multiple baseline study featured variation in the time of introduction of OT-AAT. Because length of phase did not appear to affect the outcome, the findings can be confidently attributed to the treatment of interest (OT-AAT) (Kazdin,

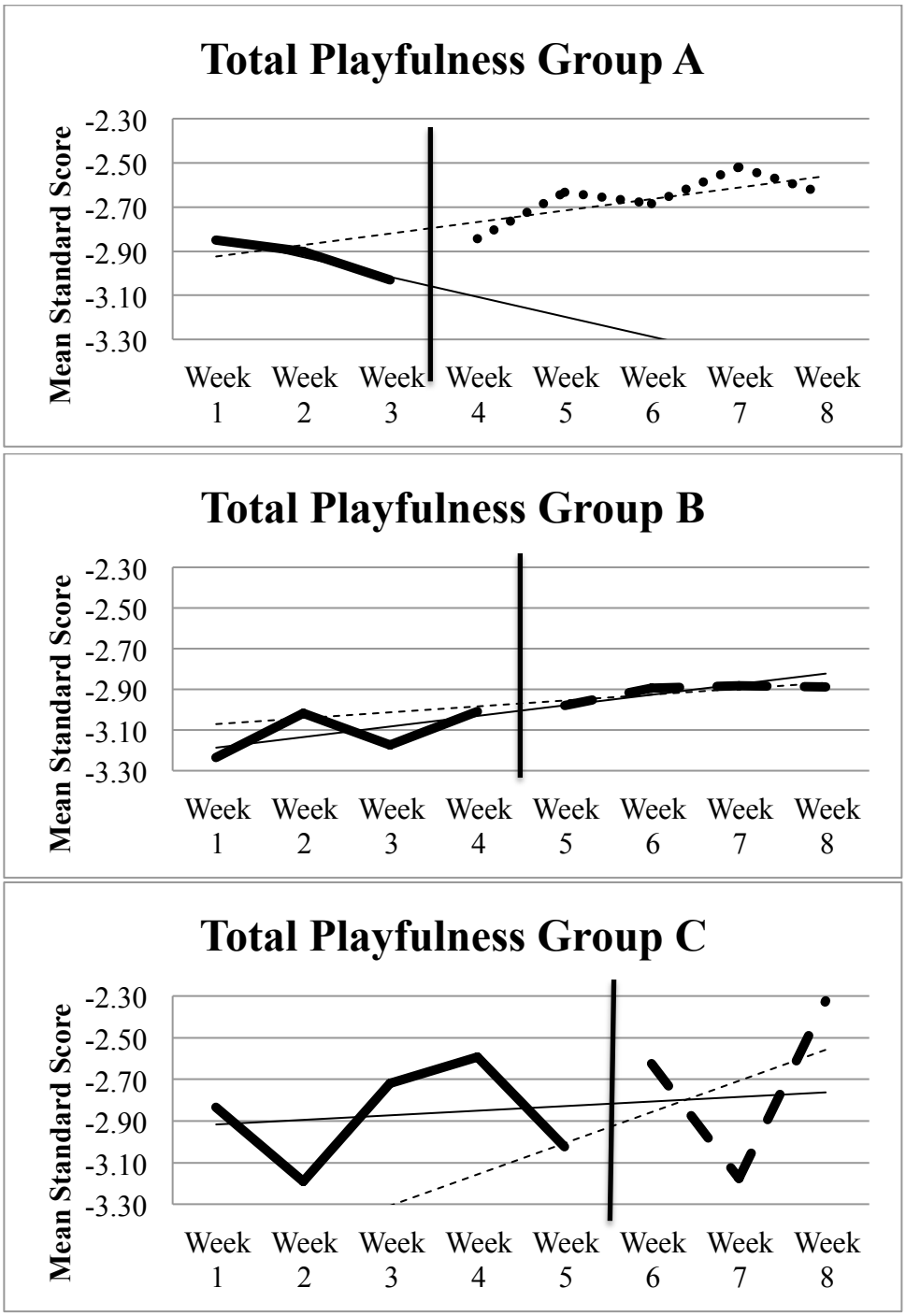

Figure 3.2. Time series analysis by group
Note: Solid line= OT-TT; Dashed line=OT-AAT for both data lines and trend lines

2011). This study emphasizes that in the presence of the dog, there were increases in playfulness that are encouraging.

Generally, based on the Biophilia hypothesis, animals may benefit people in AAT by taking advantage of the natural tendency to interact with people (Nimer & Lundahl, 2007; Wilson, 1984). Therapy animals seek attention and interaction with people, which can lead to increased feelings of safety and improved motivation in therapy (Nimer & Lundahl, 2007). The incorporation of animals into therapy has also been shown to increase playfulness (Martin & Farnum, 2002). As identified, play allows children to practice social and physical skills, and can improve functional ability (Mulligan, 2003). AAT in this study was used as a tool to promote playfulness, and a means to support attainment of more functional goals. It was expected that playfulness scores would increase during OT-AAT because play can improve functional ability by allowing motor skill practice and improvement, and animals may increase playfulness when incorporated in therapy (AOTA, 2008; Martin & Farnum, 2002). For most children in this study this was shown to be the case.

Nonetheless, changes in playfulness were generally small. This may be due to the design of the therapy sessions. As described in Table 3.3, besides the presence of absence of a dog, differences between OT-TT and OT-AAT phases were designed to be minimal. Specifically, individual sessions were conducted using the same format, similar equipment, and the presence or absence of the dog was designed to be the only difference between phases.

An alternative explanation for the observed small changes may be the overall focus of therapy sessions. Although it was anticipated that sessions with the dog would be more playful, the sessions were directed toward achieving individual educational goals, none of which were specifically related to playfulness. Although increased playfulness can be sought alongside individual goals related to fine motor skill improvement and increased independence with daily

living skills, and may facilitate their attainment, overall therapy session structure likely impacted study outcomes.

As expected, all children in this study were relatively unplayful, with or without the presence of the therapy dog. As Okimoto et al. (2000) found when they compared ToP scores in children with and without disability, it is typical for children with disabilities to receive low and/or negative standardized score on the ToP, indicating a lack of playfulness, as they did here. Decreased playfulness has also been identified in individuals with visual impairment (Pizzo & Bruce, 2010; Hughes, Dote-Kwan, & Dolendo, 1998). Specifically, these authors indicated that children with visual impairment demonstrate less spontaneous play and more delays in play development compared to typically developing peers. As such, the overall low scores in this dataset are likely explained due to the participants' disabilities, but could also be attributed to the use of the ToP in traditional OT sessions rather than free play.

Individual analysis. Individual responses to the presence of a dog varied greatly. Themes observed throughout the study included variance in performance both between and within-subjects, fear of the dog, indifference towards the dog, and varying levels of interest in the dog.

Variability of performance. Although this population was selected for their common diagnoses (developmental disabilities), their levels of function and consistency in performance varied widely as described in Table 3.1 and Figure 3.1. Participant 1 communicated with signs and verbal sounds, while participant 2 verbalized coherent arguments against working on daily living skills. Some participants required assistance for mobility, and used wheelchairs for long distance mobility, and others were fully ambulatory without assistance. This variance in the sample likely contributed to the individual varied results identified in this study.

The overall pattern of inconsistency in behavior observed here is not uncommon in a population of children with DD, who thrive on routine and can be thrown off by environmental circumstances (CDC, 2013; Schoen, Miller, Brett-Green, & Hepburn, 2008). This pattern was expected in this study and was the rationale for using the repeated measures and multiple design. Additionally, novelty of bonus OT-TT and OT-AAT could have caused variance in the performance. Because children with DD are often resistant to change, novelty effects could be both positive and negative. Visual analysis of scores in Figure 3.1 show increased playfulness for some children in the first 2-4 sessions after AAT was introduced, followed by variability in performance. It has been noted that OT-AAT is especially susceptible to novelty effects (Marino, 2012), and this was the case with some, but not all, participants. This was not a parameter under study in this investigation, but is one that should be considered for future research.

Interest in interacting with the dog. Participants 1, 3, 4, 5, 6, and 8 expressed interest in interacting with the dog. Most did so verbally upon entering the OT area, asking "where is Norm?" and/or "is Norm here?" Others expressed interest by ambulating over to the dog, or choosing to spend time with the dog when presented with options for free choice time. Participants 1 and 3 showed moderate interest in the dog, participating enthusiastically when the dog was introduced but not asking specifically for the dog. Participants 5 and 6 showed somewhat more interest in the dog, e.g., asking about the dog and wanting to pet him at the start of every session, and always choosing to brush or sit with him during free choice time. Participants 4 and 8 were the most enthusiastic about interaction with the dog, and the dog's presence appeared to distract them from other therapeutic activities. These individuals (4,8) acted impatient, and often rushed through therapeutic activities (e.g. making a collar) that did not directly involve the dog so they could interact with the dog. Interest in the dog is a common

response to AAT, and this intrinsic motivation to interact, described as biophilia by Wilson (1984), is a component of the foundation of HAI. Varied responses to introduction of an animal are common, ranging from interest in interacting to fear of the dog (Mason & Hagan, 1999).

Fear of the dog/Indifference to the dog

Although fear of dogs was an exclusionary qualification (as identified by parent/guardian report), two participants were observed to show fear in interacting with the dog (Participants 7 and 10). Both participants tolerated the presence of the dog, but at the beginning of the study, resisted interaction with the dog by stating "no dog," and/or turning away from the dog. Throughout the study, these individuals avoided touching the dog. Both individuals were observed to demonstrate increased tolerance of interaction, however, feeding the dog a treat by the conclusion of the study. Fear of dogs can be common in individuals without prior exposure, or who have had negative prior exposure to dogs. Prothmann, Albrecht, Dietrich, et al. (2005) found children with autism commonly showed fear of dogs, and suggested that such fear could be attributed to novelty of experience, or fear of change, rather than actual fear of the dog. Participants 2 and 9 demonstrated indifference to the dog, e.g. they tolerated activities presented where the dog was present, but did not express interest nor actively seek interaction with the dog.

Individual descriptive analysis. Effect size, or standardized mean difference, was used in addition to visual analysis and clinical observation to identify individual effectiveness and differences in effectiveness between individual participants. As described in Table 3.3, individual effect sizes varied, but eight out of ten participants showed positive changes in playfulness during OT-AAT. Specifically, 60% of participants demonstrated medium or large effects (of increased playfulness during OT-AAT). Participants 2, 6, and 9 showed the largest effects, which conflicted with individual visual analysis. Participants 1, 4, and 10 showed

medium effect size results; these paralleled visual analysis. Only two participants, 3 and 9, showed increased playfulness during OT-TT, but the other eight participants' effects were shown in OT-AAT phases. Despite individual difference in responses, an overall mean effect size of 0.21 across the study indicated a medium effect size (Cohen, 1998), indicating a moderate percent of change in playfulness can be attributed to OT-AAT.

Group analysis. The visual analysis of group differences suggested that length of phases did not influence changes in playfulness when implementing OT-AAT. Group C had the longest OT-TT phase at 5 weeks and only 3 weeks of OT-AAT. These lengths could have influenced outcomes as Group C showed great variability in performance. Group makeup, although assigned randomly, did differ greatly in that Group A was the youngest, and Group C was much older at age 13. Additionally, the participants assigned to Group C demonstrated less consistent performance, and were more fearful of the dog. Despite these possible influences, in Groups A and B, OT-AAT, and not environmental factors, appeared to influence playfulness.

Limitations. In this study, the ToP was used outside of its intended purpose, during OT as opposed to during free play, failing to capture playfulness in its purest form. Here, although the ToP examined playfulness, the OT sessions were focused on functional/IEP goal attainment. Enhancing play is likely to further the functional ability of children with disabilities, so these different outcomes were not expected to create a limitation (Harkness & Bundy, 2001). It is possible that a measure more closely associated with goal attainment may have demonstrated more conclusive changes. In future studies, the outcome measure more closely reflecting treatment goals might facilitate the ability to document consistent differences in intervention effects.

Unfortunately, blinding was not possible in this study, as is the case in many HAI studies (Wilson & Barker, 2003). Although the raters were not provided with the study hypothesis, the presence or absence of a dog was visible in the videos. The inability to blind participants caused the possibility of expectation bias by the participants, performance bias by the treating therapist, and detection bias by the scorers (Polit & Beck, 2012), an unavoidable potential weakness in the study.

Implications for clinical application. Faced with a dearth of OT literature related to AAT, this study used a sound research design and an established outcome measure to contribute in a meaningful way to the existing knowledge. Incorporating a dog in OT practice with individuals with DD can improve playfulness in some individuals. The study findings support the incorporation of AAT in OT for individuals with DD on a case-by-case basis.

Conclusion

Because children with DD have such varied levels of function, AAT should not be a "one-size-fits-all" intervention. Increases in playfulness were identified in most, but not all, participants. Studies of the effectiveness of AAT may benefit from identifying what populations of children with DD benefit the most. This could be examined by level of function, diagnosis, or age, and could help clinicians to identify when to incorporate AAT. Conversely, it may be instructive to assess AAT qualitatively due to the significant individual differences in performance when AAT is presented. Novelty should be considered in future OT-AAT studies (Marino, 2012). Due to the variance in presentation of AAT, the effectiveness of certain dosages of OT-AAT should be examined. Overall, the suggestive results indicate that incorporating AAT into OT practice can increase playfulness in children with DD, providing rationale for future studies examining free play and associated playfulness.

References

American Occupational Therapy Association. (2008). AOTA's Societal statement on play. *American Journal of Occupational Therapy, 62*, 707-708.

Beck, A. (2011). Animals and child health and development. In P. McCardle, S. McCune, J. A. Griffin, L. Esposito, & L. S. Freund (Eds.), *Animals in our lives: Human-animal interaction in family, community & therapeutic settings* (pp. 43-52). Baltimore, MD: Paul H. Brookes.

Berry, A., Borgi, M., Francia, N., Alleva, E., & Cirulli, F. (2013). Use of assistance and therapy dogs for children with autism spectrum disorders: A critical review of the current evidence. *The Journal of Alternative and Complimentary Medicine, 19*, 73-80. doi: 10.1089/acm.2011.0835

Berry, J., & Ryan, S. (2002). Frames of reference: Their use in paediatric occupational therapy. *The British Journal of Occupational Therapy*, *65*(9), 420-427.

Bobrovitz, C.D. & Ottenbacher, K.J. (1998). Comparison of visual inspection and statistical analysis of single-subject data in rehabilitation research. *American Journal of Physical Medicine and Rehabilitation, 77,* 94-102.

Brentnall, J., Bundy, A., & Scott Kay, F. (2008). The effect of the length of observation on Test of Playfulness scores. *Occupational Therapy Journal of Research, 28,* 133-145.

Bundy, A. (2010). *Test of Playfulness Manual*, Version 4.2. Sydney: Author

Bundy, A. C., Shia, S., Qi, L., & Miller, L. J. (2007). How does sensory processing dysfunction affect play? *American Journal of Occupational Therapy, 61,* 201–208.

Case-Smith, J., & Miller-Kuhaneck, H. (2008). Play preferences of typically developing children and children with developmental delays between ages 3 and 7 years. *OTJR: Occupation, Participation and Health. 28*, 19-29.

Centers for Disease Control (CDC). (2013). *National Center on Birth Defects and Developmental Disabilities: Monitoring Developmental Disabilities*. Retrieved from http://www.cdc.gov/ncbddd/index.html

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Crowe, T., Perea-Burns, S., Sedillo, J., Hendrix, I., Winkle, M., & Deitz, J. (2014). Effects of Partnerships Between People With Mobility Challenges and Service Dogs. *American Journal of Occupational Therapy*, *68*(2), 194-202.

Delta Society. (2003). *Standards of practice for animal-assisted activities and therapy*. Renton, WA: Author.

Dermer, M.L., & Hoch, T.A. (2001). Improving Descriptions of Single-Subject Experiments in Research Texts Written for Undergraduates. *The Psychological Record, 49*, 15-17.

Esposito, L., McCardle, P., Maholmes, V., McCune, S., & Griffin, J.A. (2011). Introduction. In P. McCardle, S. McCune, J.A. Griffin, L. Esposito, & L.S. Freund (Eds.), *Animals in our lives: Human-animal interaction in family, community and therapeutic settings* (pp. 1-5). Baltimore, MD: Paul H. Brookes.

Feinstein, J. (2013). Manual for the implementation of OT-AAT in dissertation study. Unpublished paper.

Fike, L., Najera, C., & Daugherty, D. (2012). Occupational therapists as dog handlers: the collective experience with animal-assisted therapy in Iraq. *US Army Medical Department Journal,* 51-54.

Fine, A.H. (Ed.). (2010). *Handbook on animal-assisted therapy: theoretical foundations and guidelines for practice* (3rd ed.). London: Academic Press.

Friedmann, E., Barker, S.B., and Allen, K.M. (2010). Physiological Correlates of health benefits from pets. In P. McCardle, S. McCune, J. Griffin, & V. Maholmes (Eds.), *How animals affect us: Examining the influences of human-animal interaction on child development and human health.* Washington, DC: American Psychological Association.

Hawkins, N., Sanson-Fisher, R., Shakeshaft, A., D'Este, C., Green, L. (2007). The multiple baseline design for valuating population-based research. *American Journal of Preventative Medicine*. *33*, 62–168.

Henry, A.D. (2000). *Pediatric Interest Profiles Manual.* San Antonio, TX: Therapy Skill Builders.

Hess, L. & Bundy, A.C. (2003). The association between playfulness and coping in adolescents. *Physical and occupational therapy in pediatrics, 23*, 5-17.

Hughes, M., Dote-Kwan, J., & Dolendo, J. (1998). A Close Look at the Cognitive Play of Preschoolers with Visual Impairments in the Home. *Exceptional Children*, *64*(4), 451-62.

Humane Society of the United States. (2006). *US Pet ownership statistics*. Greenfield, CT: Author.

Kazdin, A.E. (2011). *Single-case research designs*, 2nd Ed. New York, NY: Oxford University Press.

Kromrey, J., & Foster-Johnson, L. (1996). Determining the efficacy of intervention: The use of effect sizes for data analysis in single-subject research. *The Journal of Experimental Education*, *65*(1), 73-93.

Lund Research, Ltd. (2013). *Laerd Statistics: Measures of Central Tendency*. Retrieved from: https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php

Marino, L. (2012). Construct Validity of Animal-Assisted Therapy and Activities: How Important Is the Animal in AAT?. *Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals*, *25*(Supplement 1), 139-151.

Martin, F., & Farnum, J. (2002). Animal-assisted therapy for children with pervasive developmental disorders. *Western Journal of Nursing Research, 24*(6), 657-670.

Mason, M., & Hagan, C. (1999). Pet-assisted psychotherapy. *Psychological Reports*, *84*(3c), 1235-1245.

McCardle, P., McCune, S., Griffin, J. A., Esposito, L. & Freund, L.S. (2011). Animals in our lives: Human-animal interaction in family, community & therapeutic settings. Baltimore, MD: Paul H. Brookes.

Melson, G. F., Kahn, P. H., Beck, A. M., & Friedman, B. (2009). Robotic pets in human lives: Implications for the human-animal bond and for human relationships with personified technologies. *Journal of Social Issues, 65*, 545-567.

Melson, G.F. (2011). Principles for human-animal interaction research. In P. McCardle, S. McCune, J. A. Griffin, & V. Maholmes (Eds.), *How animals affect us: Examining the influences of human-animal interaction on child development and human health* (pp. 13-33). Washington, DC: American Psychological Association.

Missiuna, C., & Pollock, N. (1991). Play deprivation in children with physical disabilities: The role of the occupational therapist in preventing secondary disability. *American Journal of Occupational Therapy*, *45*(10), 882-888.

Nimer, J. & Lundahl, B. (2007). Animal-Assisted Therapy: A meta-analysis. *Anthrozoös: A Multidisciplinary Journal of the Interactions of People & Animals*, *20*, 225-238.

O'Haire, M. E. (2013). Animal-assisted intervention for autism spectrum disorder: A systematic literature review. *Journal of autism and developmental disorders*, *43*(7), 1606-1622.

Okimoto, A. M., Bundy, A., & Hanzlik, J. (2000). Playfulness in children with and without disability: Measurement and intervention. *American Journal of Occupational Therapy, 54,* 73–82.

Pizzo, L., & Bruce, S. M. (2010). Language and play in students with multiple disabilities and visual impairments or deaf-blindness. *Journal of visual impairment & blindness*, *104*(5), 287-297.

Polit, D., & Beck C. (2012). *Nursing research; generating and assessing evidence for nursing practice*. Philadelphia, PA: Lippincott Williams & Wilkins.

Sams, M.J., Fortney, E.V., & Willenbring, S. (2006). Occupational therapy incorporating animals for children with autism: A pilot investigation. *American Journal of Occupational Therapy, 60*, 268-274.

Schoen, S. A., Miller, L. J., Brett-Green, B., & Hepburn, S. L. (2008). Psychophysiology of children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *2*(3), 417-429.

Skard, G. & Bundy, A. (2008). Test of playfulness. In: L.D. Parham & L.S. Fazio (Eds.), *Play in occupational therapy for children,* 2nd ed. (pp. 71–93). St. Louis, MO: Mosby.

Souter, M. A., & Miller, M.D. (2007). Do Animal-Assisted Activities effectively treat depression? A meta-analysis. *Anthrozoös: A Multidisciplinary Journal of the Interactions of People & Animals*, *20*, 167-180.

Trujillo, K., Tedeschi, P., & Williams, J.H. (2011). Research meets practice: Issues for evidence-based training in human-animal interaction. In P. McCardle, S. McCune, J.A. Griffin, L. Esposito, & L.S. Freund (Eds.), *Animals in our lives: Human-animal interaction in family, community & therapeutic settings* (pp. 199-215). Baltimore, MD: Paul H. Brookes.

Viau, R., Arsenault-Lapierre, G., Fecteau, S., Champagne, N., Walker, C., & Lupien, S. (2010). Effect of service dogs on salivary cortisol secretion in autistic children. *Psychoneuroendocrinology*, *35*, 1187-1193.

Wilson, C.C. & Barker, S.B. (2003). Challenges in designing Human-Animal Interaction research. *American Behavioral Scientist.47*, 16-28.

Wilson, E.O., (1984). *Biophilia: The human bond with other species*. Cambridge, MA: Harvard University Press.

Zisselman, M. H., Rovner, B. W., Shmuely, Y., & Ferrie, P. (1996). A pet therapy intervention with geriatric psychiatry inpatients. *American Journal of Occupational Therapy*, *50*(1), 47-51.

Chapter 4: Article III

Effects of Occupational Therapy Incorporating Animal-Assisted Therapy on Participation in Children With Developmental Disabilities

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Abstract

Animals are prevalent in families and have become increasingly present in occupational therapy practice. Prior studies cite occupational therapy incorporating animals as promoting beneficial change in children with disabilities. Children with disabilities generally participate less than typically developing peers.

This single-subject multiple baseline AB study with repetition (n=10) examined whether including a trained therapy dog in occupational therapy intervention (OT-AAT) made a significant difference in occupational participation in children with developmental disabilities. Intervention was provided over 8 weeks, in two phases: occupational therapy using traditional techniques and OT-AAT, and participation was measured at each session. Most subjects (70-80%) demonstrated increased participation during OT-AAT via descriptive measures and visual analysis. However, a comparison test of aggregated scores found no significant difference in participation between phases.

Future research should employ larger samples, and/or a more homogenous sample and evaluation tools more closely aligned with treatment goals. Identifying what delineates a good candidate for OT-AAT would be invaluable for therapists considering this approach.

Introduction

Children with developmental disabilities (DD) often receive occupational therapy services geared towards improving participation (Bedell & Dumas, 2004). Animals have been increasingly present in occupational therapy practice and have been found to improve social interaction in children with disabilities (Sams, Fortney & Willenbring, 2006). This study investigated whether occupational therapy incorporating a dog trained for Animal-Assisted Therapy (AAT) was effective in improving participation in children with DD.

Background

Human-animal interaction. Companion animals are common; in 2006, 75% of U.S. households with children had pets (Humane Society of the United States, 2006) and pets have long been understood to have a pivotal role in child development (Levinson, 1972). Children are intrinsically motivated to interact with animals, and can learn responsibility, improve social skills, and/or experience friendship when relating to animals (McCardle, McCune, Griffin, Esposito, & Freund, 2011; Thompson, 2009; Wilson, 1984). Both pets and therapy animals have been found to improve the lives of typically developing children by enhancing self-esteem and cognitive development, and increasing participation in sports, hobbies, clubs or chores (Delta Society, 2009).

Human-Animal Interactions (HAI) are defined as the shared, dynamic associations between people and animals and the effects of those relationships on health and well-being (McCardle et al., 2011). HAI is a broad term describing contact between human and non-human animals, including Animal-Assisted Therapy (AAT), service animals, and more. HAI are theoretically grounded within the Biophilia hypothesis, an assertion that an emotional and beneficial relationship exists between humans and nature in which there is an "innate tendency to

focus on life and lifelike processes" (Wilson, 1984, p. 5). Despite increased clinical and public interest in AAT, and current knowledge about animals improving the lives of typically developing children, the research application to children with DD has been minimal.

AAT is defined as the deliberate inclusion of an animal (that meets specific criteria) in individualized, goal-directed intervention to facilitate healing and recovery of clients receiving therapeutic care (McCardle et al., 2011). Although companion animals provide health benefits to humans in homes across the country, AAT is more purposeful and organized, involving health professionals who determine that the incorporation of animals into a therapeutic environment would benefit their clients (Johnson, 2011). These professionals include, but are not limited to, registered nurses, nurse practitioners, physicians, physical and occupational therapists, social workers, psychologists, and licensed counselors. While clinical application is broadening, investigation of the impact of AAT on the health and well being of the clients and patients of these professionals is limited.

Through play with a pet, typically developing children demonstrate increased participation in social and recreational activities (Beck, 2011). A few studies have addressed animals' influence on social interactions in children with DD (Esteves & Stokes, 2008; Mader, Hart, & Bergin, 1989; Sams, Fortney, & Willenbring, 2006). Service animals may bridge social interactions with same age peers (Mader et al., 1989) and the presence of animals can improve social interaction for children with DD (Esteves & Stokes, 2008). Sams et al. (2006) also found AAT improved social interaction and language in children with DD and had the potential to improve their motivation. Despite these findings, no research could be found that examined the impact of animals on the occupational participation of children with DD.

Children with DD are frequent recipients of occupational therapy services related to occupational participation, and AAT is a potentially effective intervention tool to promote functioning in this area (Bedell & Dumas, 2004; Sams et al., 2006). The use of AAT with children with DD, to improve participation and health, warrants investigation.

Children with DD. DD are defined as a variety of chronic conditions due to mental and/or physical impairments, which begin during early development and last throughout the lifetime (CDC, 2010). Autism Spectrum Disorders, Cerebral Palsy, Intellectual Disability (formerly Mental Retardation), and Down Syndrome are common DD diagnoses. Over the past decade, the prevalence of DD have increased 17.1%, which accounts for 1.8 million more children being diagnosed with DD between 2006 and 2008 (CDC, 2010). Due to functional difficulties common in children with DD, and increased prevalence of DD, pediatric occupational therapy practitioners are working with an increasing number of children with DD. Impairments that characterize DD cause difficulty with language, mobility, learning, self-help, and independent living skills, all of which impact the ability to participate in childhood occupations (Centers for Disease Control [CDC], 2010). One important focus of occupational therapy practice with children with DD is participation and increased independence in functional activities of childhood. Increasing functional independence can improve quality of life for children with DD and their families (Hume, Loftin, & Lantz, 2009).

Participation. Participation is considered an integral part of development for all children, but children with disabilities generally participate less than typically developing peers (Bedell & Dumas, 2004; Law, 2002). Increased participation has been linked to improved quality of life in children (Bedell & Dumas, 2004). Childhood participation in home and community settings can lead to skill development necessary for interaction with others, working, and living in the

community (Law, 2002). Additionally, increased participation can decrease negative behaviors and improve peer relationships (Law, 2002).

Participation is prevalent in the Occupational Therapy Practice Framework (OTPF: AOTA, 2014), as part of the definition of the practice and domain of occupational therapy. The International Classification of Functioning (ICF) defines participation as involvement in life events and situations at home and in the community (World Health Organization, 2001). Participation can be described as sharing in activity, or more concretely defined as the ability to make choices and navigate one's environment freely, doing what one wants and/or needs to do (Law, 2002; Ward, Mitchell, & Price, 2007). From an occupational therapy perspective, participation refers to engaging in occupations including play, work and activities of daily living (Kielhofner, 2008). Although the definition of participation is somewhat ambiguous, categories of participation have emerged in the occupational therapy literature (Ward et al., 2007), with social participation and occupational participation being most common.

Occupational participation takes a task-based view of the construct, while social participation is based on the individual and their social interactions. Occupational participation refers to "engaging in work, play, or activities of daily living that are part of one's socio-cultural context and are desired/necessary to one's well-being" (Kielhofner, 2008, p. 101). Children typically participate in play, learning, and family environments, so occupational participation in children usually encompasses play, educational activities, and self care. Please see Appendix H for a glossary of terms used in this article, including participation.

In this study, occupational participation pertained to therapeutic activities encountered during the therapy session. Participation in occupational therapy is a small part of overall

participation, but occupational participation served as a starting point to determine whether AAT had an impact.

This study addressed the following research questions:

- Does inclusion of a trained therapy dog in occupational therapy intervention (OT-AAT) significantly increase occupational participation in children with DD?
- Does implementation schedule/length of baseline when introducing OT-AAT influence the outcome of participation in children with DD?

Method

Research design. This study used a single subject multiple baseline A-B design with repetition (n=10). In multiple baseline design, the introduction of the intervention of interest is purposefully staggered. This design can support examination of the efficacy of intervention on a behavior across a population group, here, participation in children with DD (Hawkins, Sanson-Fisher, Shakeshaft, D'Este, & Green, 2007). A repeated pattern in the outcome after the implementation of the treatment of interest (here, OT-AAT) suggests the treatment had an effect (Hawkins et al., 2007). Reliability and validity of research design are addressed in Appendix I.

Participants. Participants were recruited from a private not-for-profit residential and day school for children with multiple disabilities (visual impairment and another DD). Inclusion criteria identified children ages 6–13 with DD who were receiving occupational therapy and could navigate their environment without assistance. Exclusion criteria included allergy to dogs, fear of dogs (per parent report), and wheelchair mobility. Although all participants had DD and were receiving OT, this population demonstrated varied levels of function. Due to the presence of heterogeneity of the sample, individuals served as their own control.

Table 4.1 describes participant characteristics and concurrent therapies received throughout the duration of the study. Six participants were female (60%), and four were male (40%), between 6 and 13 years old (*M*=10.4, *SD*=2.87), all with multiple disabilities (100%).

Table 4.1

Description of Individual Participants

Participant ID	Characteristics					Pet at home	Concurrent Therapies	# of sessions (OT-TT, OT-AAT)
	Age	Gender	Dx*	Comm.**	Mobility***			
1_A	6	F	RGD	NV	AMB, walker	cat	OT, PT, SLP	9 (4, 5)
2_B	11	F	ONH	V	AMB	rabbit	OT	10 (5, 5)
3_B	9	F	RGD	V	AMB, cane	dog	OT, PT, SLP	15 (7, 8)
4_A	7	M	RoP	V	AMB, cane	dog	OT, PT, SLP	10 (4, 6)
5_B	12	F	RoP	V	AMB, walker	dog	OT, PT, SLP	15 (6, 9)
6_A	7	F	RoP	V	AMB, cane	dog	OT, PT	9 (4, 5)
7_C	13	M	CVI	V	AMB	dog	OT, SLP	13 (7, 6)
8_B	13	F	RGD	NV	AMB	dog	OT, PT, SLP	13 (5, 8)
9_C	13	M	CVI	V	AMB	no pet	OT, SLP	12 (8, 4)
10_C	13	M	Autism	NV	AMB	cat	OT, PT, SLP	14 (8, 6)

Note: Group assignment is reflected in Participant ID (A,B,C). *ONH: Optic nerve hypoplasia; RGD: rare genetic disorder, where the identitiy of the disorder would reveal the identity of the participant; RoP: Retinopathy of Prematurity; CVI: Cortical Visual Impairment; **Comm: communication, V: verbal, NV: non verbal; ***AMB: ambulatory

Specific disabilities included those impacting vision (Retinopathy of Prematurity, Cortical Visual Impairment, and Optic Nerve Hypoplasia), autism, pervasive developmental disorder, and cerebral palsy. Rare genetic diagnoses were present, but not specifically reported here to protect the identities of subjects. All participants had visual impairment but could navigate their

environment and understand verbal communication, and were currently receiving school-based occupational therapy. Consent from parents/guardians and verbal assent from participants were gathered. This study was approved by the Institutional Review Board at Virginia Commonwealth University.

Instrument. Participation can be measured in multiple dimensions, including intensity of participation, frequency of participation, and enjoyment (Bedell, 2012). For this study, an observational assessment tool was used to examine children's participation in everyday occupations. The Short Child Occupational Profile (SCOPE) (Bowyer, Kramer, Ploszaj, Ross, Schwartz, Kielhofner & Kramer, 2008) is an occupation-based assessment that examines occupational participation. Based on the Model of Human Occupation (MOHO) (Kielhofner, 2008), the SCOPE allows the therapist to examine the child's relative strengths and weaknesses, especially related to occupational participation.

The SCOPE is a 25-item rating scale that appraises how children's volition, habituation, communication, process and motor skills, and the environment support or hinder participation, and these constructs are reflected in the six subscales. The SCOPE Summary Rating Form is included as Appendix J. The SCOPE was chosen for this study because it examines children's participation in everyday occupations, can be used at regular intervals to document client progress, is easy to administer and score, and allows data collection via observation. These strengths of SCOPE have been supported in the literature (Bowyer, Lee, Kramer, Taylor, & Kielhofner, 2012). Limitations of the SCOPE include its relative newness, which translates into lack of use in the occupational therapy literature, and the lack of standardized scores (Bowyer et al., 2012). Despite these limitations, the SCOPE is based on the MOHO, a well-respected and well known occupational therapy based theory, and despite its newness, it is well defined and

limitations well documented (Bowyer, Kramer, Kielhofner, Maxiero-Barbosa, & Girolami, 2007).

The Volition Subscale measures individuals' motivation to participate, which guides their choices (Bowyer et al., 2008). The Habituation Subscale measures occupational performance patterns that recur in everyday life (Bowyer et al., 2008). The Communication and Interaction Subscale examines participants' ability to convey needs and wants, and the Process and Motor Skills Subscales refer to how children move their bodies, sequence activities, and adapt performance to suit the activity at hand (Bowyer et al., 2008). The Environment subscale is a central component of MOHO (Kielhofner, 2008) and measures how the environment supports participation in context. Each subscale includes 4 or 5 individual related items, which are rated on a 4 point scale: F- facilitates occupational participation, A- allows occupational participation, I- inhibits occupational participation, R- restricts occupational participation. Once scored, the rating scale was quantified (i.e. F-4; A-3; I-2; R-1), and total and subscale scores calculated.

OT sessions were videotaped by research assistants (who were not involved in scoring) or using a camera mounted on a tripod, and analyzed by independent raters using the SCOPE. The SCOPE can be completed using any dependable source of information, but observation is often used, and supplemented with information from subjects and their families/caregivers (Forsyth et al., 2008). To avoid possible measurement bias, VCU OT graduate students not part of any other aspect of this study rated all tapes. They were trained by the second author to understand the theory and structure of and to score the SCOPE. Raters engaged in rating practice videos individually and as a group, and agreement was reached on the practice video scores before beginning on the study videos. Session numbers were randomized for raters, such that they did not know the sequence of sessions.

To address internal consistency and inter-rater reliability, at least two raters scored each session. All scores (120) were combined and internal consistency reliability of these scores was calculated (Cronbach's alpha coefficient) at 0.70, which suggests adequate reliability (Polit & Beck, 2012). Total scores from two raters were averaged together for each child and each subscale. When more than two raters scored a session, raters with the greatest consistency were selected. Consistency between raters was calculated for all 120 scores at 0.768 for acceptable inter-rater consistency (Cicchetti & Sparrow, 1981).

Intervention. Occupational therapy intervention focused on independence with daily occupations (including participation in daily routines and leisure activities) and sensory motor integration, as well as adaptive strategies related to visual impairment. Because this study investigated children with DD, who demonstrate varied behavior on a day-to-day basis (CDC, 2011), this study attempted to establish a stable baseline. All 10 subjects received occupational therapy concurrently, over a period of eight weeks. Participants received one or two sessions weekly, as available.

Since the introduction of the treatment of interest was staggered to create multiple baselines, the length of phases varied between groups. Baseline/Phase 1, occupational therapy using traditional techniques (OT-TT) ran between 3 and 5 weeks. Study participants were divided randomly into three groups, A, B, and C, and each group started Phase 2 at a different time (week 4, 5, or 6). Phase 2, occupational therapy incorporating a trained therapy dog (OT-AAT), was conducted during a subsequent block of 3-5 weeks, as described in Table 4.2. Individual participants were randomly assigned to groups, so that the only purposeful difference between the groups was length of phase. Groups were designed to have a different intervention schedule, but be similar in participant make-up. Despite random assignment, the group

Table 4.2

Study Timeline by Group

Group	Weeks 1-3	Week 4	Week 5	Week 6-8
A: Subjects 1, 4, 6	OT-TT	OT-AAT	OT-AAT	OT-AAT
B: Subjects 2, 3, 5, 8	OT-TT	OT-TT	OT-AAT	OT-AAT
C: Subjects 7, 9, 10	OT-TT	OT-TT	OT-TT	OT-AAT

composition differed: Group 1 had both female and male participants with an average age of 7. Group 2 was all female with an average age of 11.5, and Group 3 was all male, with an average age of 13.

The first phase, OT-TT, included typical OT techniques. The second phase, OT-AAT, included typical OT techniques incorporating a trained therapy dog. In both phases, intervention was administered by the first author, an occupational therapist with eight years of experience, using an eclectic approach to pediatric OT including theoretical applications of motor skill acquisition, biomechanical, and sensory integration approaches (Berry & Ryan, 2002). Sessions were designed to achieve participants' individual goals as established in their Individualized Education Plans, many of which were related to daily living skills activities, e.g. sitting at a desk, handwriting, completing fasteners. All sessions were provided individually in the school's OT treatment space for approximately 30 minutes outside of students' regularly scheduled classes. Sessions were described to students and teachers as "bonus" OT, and were video recorded for later analysis. During intervention, safety was always paramount. The therapy dog was trained and selected specifically to work with students with visual impairment and DD. The first author and the therapy dog are certified as a therapy team by Canine Companions for Independence, and have received training, education and testing related to AAT. The dog and therapist were unknown to the subjects prior to the study, except for a brief introduction and observation by the

first author prior to the start of Phase 1. Therapeutic activities were chosen based on the child's Individualized Education Plan (IEP), which identifies specific OT goals and objectives. An example of a typical session is illustrated in Table 4.3. Therapeutic activities varied between Phase 1/OT-TT and OT-AAT sessions only based on the presence or absence of a dog. During Phase 2, AAT, the dog was incorporated into treatment just as any novel therapy tool, and interaction depended on the child's cues and tolerance. Therapy was manualized prior to the start of the study, in order to improve study strength (Feinstein, 2013).

Table 4.3

Chronologic Specifics of Session Characteristics

Time	OT-TT	OT-AAT
Minutes 0-10: Warm-up activity	• Introduction to space, therapist • Review session plan • Make choices about warm-down/reward activity	• Introduction to space, therapist, therapy dog • Review session plan • Make choices about warm- down/reward activity
Minutes 10-25: goal-directed activity Sample goal: James will increase participation in functional skills, as demonstrated by: • Participating in a bimanual therapeutic activity while sitting at a treatment table for 30 seconds • Following 1-2 step directions for a therapeutic exercise	• Bimanual games, e.g. joining pop beads to make a necklace; using tweezer tongs to pick up 1" balls and place them in a dog dish • Complete 1-2 animal yoga poses	• Bimanual games, e.g. joining pop beads to make a dog collar; using tweezer tongs to pick up 1" dog treats and place them in a dog dish • Complete 1-2 animal yoga poses next to the therapy dog
Remaining minutes: Warm-down or reward activity	• Listen to music • Read a book • Review plan for next session • High five with therapist	• Listen to music • Read a book to the dog • Review plan for next session • High five with dog

Concurrent therapies and other services participants received at the start of the study remained constant throughout the eight weeks. Although concurrent therapies could have impacted participation in this study, halting concurrent therapies was not reasonable because it would not have been beneficial to the participants. Concurrent therapies are included in Table 4.1. All OT sessions and evaluations completed as part of this study were provided at no charge to participants; this was a significant benefit to participants and their families. Because the first author completed all therapy sessions in this study, it is possible that performance bias could have influenced outcomes. However, we expected that consistency in the treating therapist would also be a strength, in that it decreased variability of intervention.

Analysis

Two independent variables were examined: presence/absence of a dog and group membership/treatment schedule. Seven dependent variables examined included: occupational participation, as measured by the SCOPE total score, and Volition, Habituation, Communication & Interaction, Process & Motor Skills, and Environment SCOPE subscale ratings. One hundred and twenty sessions (59 OT-TT, 61 OT-AAT) were conducted, video recorded, and analyzed. Items marked NA in SCOPE ratings were excluded from analysis. For example, "Daily Routines" and "Family Activities" were omitted by most raters because sessions did not allow for observation of family activities, and raters did not consider daily routines to be a clinic-based construct. These excluded scores decreased total potential SCOPE score by eight points (100 to 92), and decreased possible subscale scores by four points each (Habituation subscale from 16 to 12; Environment subscale from 20 to 16). All 120 scores over 10 participants were subject to these changes, so influence of these exclusions was minimal especially in terms of comparison across individuals.

Because this study was based on single-subject design, individual scores were examined first, next aggregated by group, and finally aggregated by phase to examine differences. Research question 1 was answered with individual, group level, and aggregate analysis. Research question 2 regarding schedule of implementation was answered with group-level analysis. Total scores and subscale scores were examined on an individual level. Next, group-level analysis was conducted on total scores. Finally, total scores for all participants were combined for analysis by phase.

Autocorrelation can affect the analysis of single subject data and should be considered in such studies (Kazdin, 2011; Robey, Schultz, Cawford, & Sinner, 1999). Significant levels (<0.05) of autocorrelation were found in this dataset, with a range of -0.19 to 0.70 (M=0.09, SD=0.30). The presence of autocorrelation can violate the assumption of independence of observations, thus limiting statistical analysis possibilities. Thus, the statistical analysis conducted in this paper should be considered with caution. Visual time series analysis is a common method of analysis in single-subject rehabilitation research (Bobrovitz & Ottenbacher, 1998; Dermer & Hoch, 2001), and appropriate for this study. Visual analysis is affected by autocorrelation, but is still recommended in the presence of autocorrelation (Kazdin, 2011). Individual performance (via total participation scores for each SCOPE administration) across phases was plotted via time series analysis to examine change within individuals between interventions based on visual inspection.

Data assumptions. All 120 raw total score data points were aggregated to test for normality, and found to be non-normally distributed (see Appendix K). Specifically, skewness was calculated at -.505, and kurtosis at -.128 (values between 0 and 1 are significant). The Kolmgrov-Smirnov test statistic of 0.116 (p=.000) also indicated the data set was not normally

distributed. Log transformations were attempted, but did not create a normal distribution. Medians were calculated as a preferable alternative to means for non-normally distributed data because the median is less susceptible to extreme outliers than the mean (Lund, 2013). Kromrey & Foster-Johnson (1996) recommend calculating effect sizes using mean shift absent strong trends in the data, so effect sizes were purposefully calculated on means rather than medians. Because the assumption of normality was violated, parametric statistics could not be pursued. As such, inferential analysis employed a non-parametric Wilcoxon signed-rank test for a within-subjects design.

Results

Descriptive analysis. A descriptive summary of data is included in Table 4.4. Because the Environment subscale was not variable (a 2 point change over 10 participants), it was excluded from further evaluation. Habituation was also excluded, as it was deemed less important to this study of occupational participation. The other four subscale results were analyzed due to their potential contribution to findings.

Individual analysis. Total scores for all subjects, corresponding median, and effect sizes are displayed by individual by phase in Table 4.5. Looking first at median scores, 9 out of 10, or 90% of participants demonstrated increased overall participation during OT-AAT, although most were small increases, with most scores not found to increase more than one standard deviation. Effect sizes were calculated using mean shift, which describes the difference in "typical level of behavior in the two conditions in terms of standard deviation units." (Kromrey & Foster-Johnson, 1996, p. 79). An effect size of 0.5 can be attributed to an average of one half SD increase in behavior score. Effect sizes *(d)* ranged from 0.1 to 1.77, with an average of 0.65 (see Table 4.5). Effect size varied by participant, but most results suggested positive intervention

Table 4.4

Descriptive Summary Data

	# of items	Max score	Range	*Mdn*	SD
Overall participation	25	100	46-88	74.75	8.68
Volition	4	16	6-16	14	2.25
Habituation	4*	16	4-12	10	2.25
Communication & Interaction	4	16	5-16	12.5	2.98
Process Skills	4	16	4-16	12.3	2.29
Motor Skills	4	16	9-16	13	2.13
Environment	5*	20	14-16	16	0.68

Note: *Mdn* indicates Median; * indicates that one item from this subscale was omitted by raters due to irrelevance/inability to score.

effects, with 70% of participants' scores suggesting a large effect when OT-AAT was introduced. Participants 5 and 10 effect sizes indicated increased participation during OT-TT.

Individual responses to OT-TT and OT-AAT varied greatly upon clinical observation as well. Some participants (5, 6, and 8) participated in "bonus" OT (as it was called) eagerly, entering the classroom and asking "what are we doing today?" or "where is Norm?" Other participants (3, 4, and 9) were interested, but less enthusiastic, entering and participating in tasks happily but not seeking out therapeutic activities. Some participants (1 and 2) were generally compliant, transitioning to bonus OT easily and completing the activities asked of them. Finally, a few participants (7 and 10) were averse to "bonus" OT and interacting with the dog, displaying avoidance behaviors or refusing to enter the classroom.

Table 4.5

Participation Scores and Effects by Participant

Participant	Number of sessions	*Mdn/M* OT-TT	*Mdn/M* OT-AAT	SD	*d*	Effect
1	9 (4, 5)	56.75/54.87	62.25/61.00	6.38	0.96	large
2	10 (5, 5)	83.00/83.60	84.50/84.20	2.27	0.26	medium
3	15 (7, 8)	69.00/70.07	72.75/73.47	5.41	0.62	large
4	10 (4, 6)	74.00/74.125	76.50/75.66	2.39	0.64	large
5	15 (6, 9)	70.50/70.08	69.50/69.66*	4.05	**0.1	small
6	9 (4, 5)	83.25/82.75	85.00/85.70	2.02	1.46	large
7	13 (7, 6)	68.00/69.00	72.00/72.25	4.50	0.72	large
8	13 (5, 8)	83.50/83.30	86.00/86.00	1.52	1.77	large
9	12 (8, 4)	83.75/83.62	85.00/84.75	1.55	0.72	large
10	14 (8, 6)	71.00/71.81	71.25/70.83*	1.89	**0.52	large
All subjects	120 (58, 62)	74.35/74.32	76.48/76.35	3.19	0.65	large

Number of sessions: Total number of sessions received over 8 weeks (OT-TT sessions, OT-AAT sessions); *Mdn/M:* Overall participation median score/mean score; *indicates participation decreased during OT-AAT. ** indicates increased effects during OT-TT. Effect size interpretation: small < 0.2; medium <0.5, and large < 0.8 (Cohen, 1988).

Raw total scores were plotted to identify individual differences based on visual time series analysis (see Figure 4.1). Visually, little difference existed in participation scores for the group as a whole between phases. Variability in performance was common among participants. Trend lines were added to observe differences in slope between phases. Participant 1 had a higher slope during OT-AAT, and participants 3 and 4 showed steeper slopes reflecting greater change during OT-AAT. All of these changes suggest greater participation during OT-AAT. For participants 3 and 4 this change was consistent and sustained past the introduction of the dog. Participants 2, 5, 6, 8 and 9 had similar patterns between phases, suggesting no change in participation. Participant 7 demonstrated increased participation prior to the change in phases, making it difficult to attribute the increased participation in OT-AAT to the dog. Participant 10 showed slightly decreased participation during OT-AAT, but the difference was negligible. These changes did not parallel findings in Table 4.3, specifically subjects' 2, 3, 4, 7, and 9.

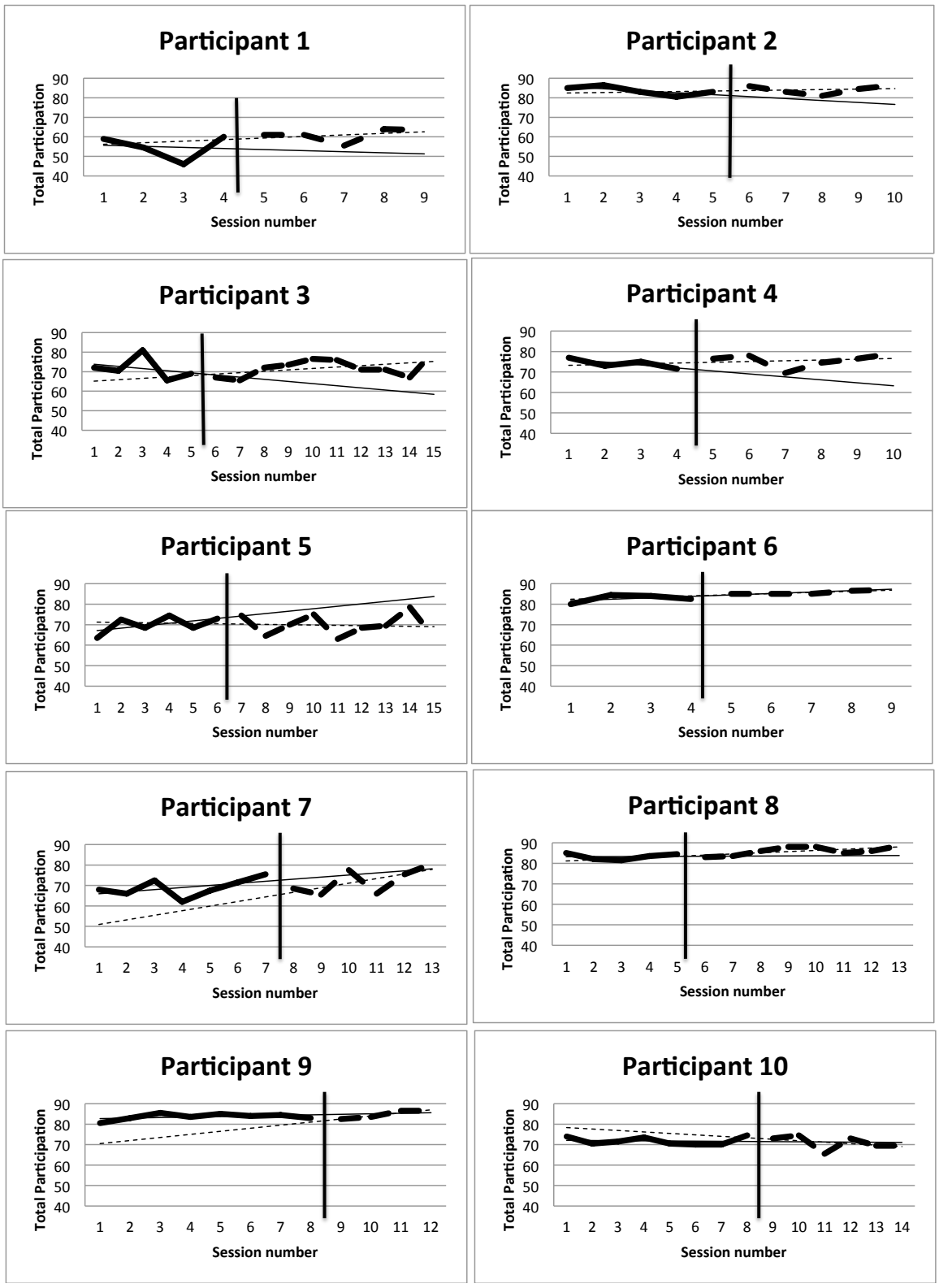

Figure 4.1. Individual participant data across phases
Note: Solid line: OT-TT; Dotted line: OT-AAT for both data lines and trend lines.

Subscale scores were calculated for Volition, Communication & Interaction, Process Skills, and Motor Skills, and analyzed on an individual level. Out of the five included subscales, 70% of participants respectively showed increases in these subscales during OT-AAT. Table 4.6 describes subscale scores by participant. The Process Skills and Motor Skills subscales showed the most positive change, in that 80% and participation scores indicated medium or large effects, whereas for participants 5 and 10, participation effects were seen in OT-TT.

Table 4.6

Subscale Descriptive Analysis

Participant	Volition OT-TT, OT-AAT	Communication & Interaction OT-TT, OT-AAT	Process Skills OT-TT, OT-AAT	Motor Skills OT-TT, OT-AAT
1	8, 8	5, 5	**6, 9**	**8.5, 10**
2	14, 14	15, 15	14, 14	15, 14
3	10, 11	**10, 11.5**	**11, 12**	11, 11
4	**13.5, 14**	**12.5, 13.5**	14, 14	16, 16
5	13.5, 13	**11, 12**	**11.5, 12**	**11.5, 12**
6	**14, 15**	16, 16	**15, 16**	**15, 16**
7	13, 12.5	**11, 14**	**12, 12.5**	**12, 13**
8	16, 16	14, 14	**12, 13.5**	**13, 14.5**
9	15, 15	16, 16	**14, 14.5**	**15, 15.5**
10	13.5, 12	10, 9	**13, 13.25**	**12.5, 14**
All	13.5, 13.5	**13.25, 13.5**	**13, 13.25**	14, 14

Note: All reported scores are median. **Bolded** scores reflect an increase during OT-AAT

Thirty percent of participants scored higher on the Volition subscale during OT-AAT, but it should also be noted that 40% of participants did not demonstrate any change, and 30% of participants received lower Volition scores during OT-AAT. For the Communication & Interaction subscale, 40% of participants received higher scores during OT-AAT, 50% remained the same, and 10% decreased. Overall, 55% of subscale scores increased, 32.5% of scores remained the same, and 12.5% of subscale scores decreased.

Group-level analysis. Group-level analysis was conducted to see whether length of phase/time of introduction of OT-AAT had an effect on participation outcomes. To address this research question data were aggregated by group. Groups were formed randomly, and the only decided difference between groups was the intervention schedule, in terms of the length of phases. Table 4.2 identifies group membership and length of phases. Figure 4.2 shows median total participation by group across study phases.

The time series graphs in Figure 4.2 show treatment effects by group and schedule of introduction of the dog. Group A and B had clearly higher scores/increased participation during AAT. Group C showed less conclusive changes. Trend lines were added to show differences in slope between two phases. All groups showed increased slope during OT-AAT when compared to OT-TT, suggesting a higher rate of change in participation during OT-AAT.

Aggregated analysis. The Wilcoxon signed-rank is a non-parametric test that assumes data are paired and come from the same population, and the data are measured on an ordinal scale. These assumptions were met with this data set, and the null hypothesis could be tested. A Wilcoxon signed-rank test showed that over 8 weeks, OT-AAT did not elicit a statistically significant change in participation in individuals with developmental disabilities ($Z = -1.826$; $p = 0.068$), thus the null hypothesis was accepted.

Discussion

Generally positive descriptive findings indicated that participation increased during OT-AAT for the majority of participants based on effect size, change in slope, and visual analysis. However these descriptive results were not supported by aggregated hypothesis testing, which found no significant difference in participation across phases. Small sample size, study limitations, or varied response to treatment are all possible causes of conflicting findings.

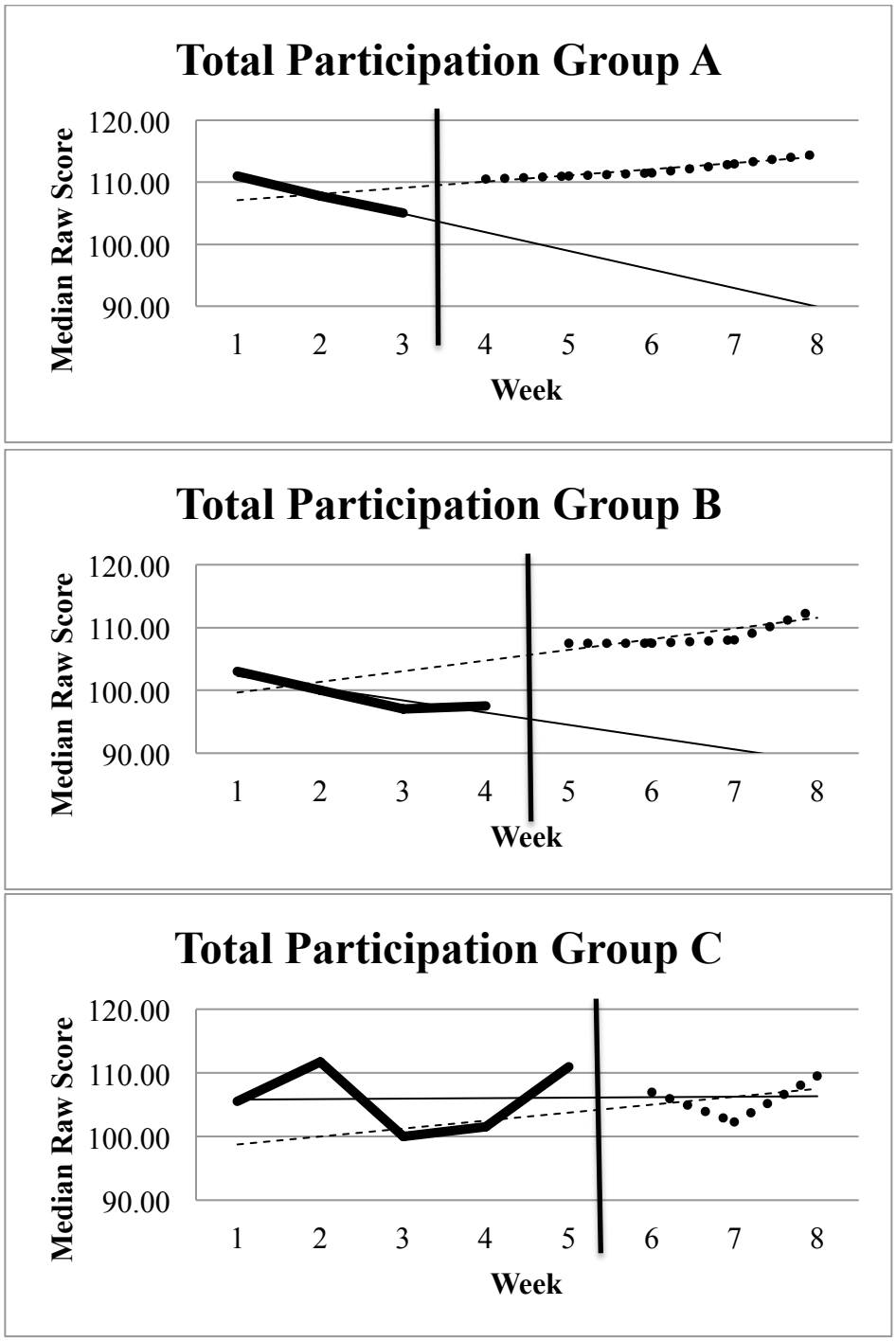

Figure 4.2 Time series analysis of total participation score by group and phase
Note: solid line= OT-TT; -dashed line=OT-AAT for both data lines and trend lines.

Individual results. Clinical observation indicated varied response to treatment, which was supported by time series analysis and descriptive findings. Generally, the three youngest

participants (1, 4, and 6) showed increased participation, these subjects were in the groups that also showed positive results of AAT. For the remaining participants, OT-AAT was as beneficial in supporting participation as OT-TT. As such, incorporating a trained dog into therapy proved to be a good therapeutic tool.

For some participants, gains occurred at the start of OT-AAT, and some (but not all) participants sustained that increase. The initial increase in participation could be attributed to novelty, as has been identified in other AAT studies with similar time lines (O'Haire, 2013). However, sustained participation in some subjects suggests that AAT was a useful tool for some children. While varied performance of children with developmental disabilities was not surprising (CDC, 2011), the variability in performance in this study likely affected our ability to document overall consistent changes in participation.

Effect sizes varied, but generally large effects were indicated in favor of increased participation during OT-AAT. Individual visual analysis was less convincing than effect size findings, with only three out of 10 participants showing clear increases in participation during OT-AAT. These participants 1, 3, and 4 had both large effect sizes and clearly increased participation on visual analysis. Participants 1, 3, and 4 were clinically observed to be either generally compliant/cooperative (1) or slightly interested in the dog (3 and 4), suggesting that moderate response to the dog supported greater participation as determined by SCOPE scores and corresponding effect sizes. Participants 1, 3, and 4 were also all on the younger range of age (6, 9 and 7 respectively), possibly suggesting that younger participants were more responsive to dog presence.

Participation effects were not as clear on visual analysis for participants 5, 6, 7, 8, and 9, despite large effect sizes. Of these 5 participants, 4 were observed to be either barely or

extremely interested in (5, 6, 8) or aversive to (7) the dog, suggesting that when children showed extreme responses (either positive or negative) to the dog participation was more difficult to interpret. Clinical observations suggested that for those children with stronger negative responses to the dog, participation was reduced. In contrast, those children with strongly positive responses to the dog became so involved with the dog that they did not focus on the therapeutic activities presented. The one child with a more moderate response to the dog was participant 9.

Based on results of similar studies (Sams et al., 2006), as well as a systematic review of the HAI literature conducted by the first author, it was predicted that participation would improve, specifically in the areas of volition and communication/ interaction. However, these expectations were not realized, as participants in this study did not show improvements in these SCOPE subscales. Suggestive increased subsection results were shown in motor and process skills subsections. This may be due to the focus of intervention in both phases, on functional outcome IEP goals related to daily living and fine motor skills.

An occupational therapy perspective, particularly one based on the MOHO (Kielhofner, 2008), focuses on the environment and objects in the environment as influencing behavior, causing examination of changes in environment between the two treatment phases in this study. Since all sessions were held in the same treatment space, the absence or presence of the dog in the environment was the only planned difference. The dog can be considered by MOHO to be an object in the environment, however raters did not identify this as a change between phases, and the environment subscale was not variable.

Group results. Individual effect size findings of increased participation (in 70% of participants) were generally supported by aggregate group data. Two out of three groups (A and B) had greater participation during OT-AAT, which speaks in favor of the incorporation of

animals into OT, at least for some children. Visual analysis of participation in Group C indicated participation that was very different, with increased variability in both phases. This may be due to the makeup of the group or the treatment schedule. Group C received the shortest OT-AAT phase, but since both phases were so variable, it is unlikely that the inconsistency in performance can be attributed to phase length. As such it is possible to look to the population of Group C and consider that individuals in this group were less likely to be affected positively by OT-AAT. Specifically, this group was older and included Participant 10,who did not like the dog, factors which might have influenced group outcomes.

Aggregated results. Aggregated results described hypothesis testing of data from all 10 subjects, specifically median scores of each participant between phases. Results indicated no significant difference in participation between phases among the 10 participants. Results could be attributed to the relatively small sample size or relatively short length of Phase 2 received by Group C.

Limitations. A number of limitations may have impacted results. First, the non-normal data distribution and presence of autocorrelation limited statistical analysis. Non-normal distribution of data was addressed statistically, however, so it should not have impacted findings greatly.

Although the SCOPE is based on a well-established OT theory, it is not standardized, has not been used in other published studies, and may have been too broad to capture changes in participation. In hindsight, choosing a measure more closely related to the goals of treatment (achieving individual IEP goals) may have been more illustrative. Goal Attainment Scaling (GAS: Mailloux, May-Benson, Summers, et al., 2007) has been previously used in OT intervention evaluation with good results. Also measures examining motivation/volitional change

have been successful with similar study designs, albeit with different populations and different interventions (Taylor, Kielhofner, Smith, Butler, Cahill, … Gehman, 2009).

Alternatively, it is possible that raters did not receive sufficient training to be fully aware of all aspects of scoring for the SCOPE. Unfortunately no other studies were found that have used the SCOPE to quantify outcomes, so it was not possible to identify whether the assessment contributed to the skewed distribution. Examining effects with a larger sample size, or in a population with increased homogeneity may have yielded further information for occupational therapists wishing to introduce AAT. Developing more concise inclusion criteria might have led to more consistent changes. Specifically, selecting younger children who like dogs and have one at home (increasing their familiarity with the animal) might be indicated by the data.

Another limitation of the study was that blinding of the intervention was not possible in this study as is the case in many HAI studies (Wilson & Barker, 2003), although the raters were not provided with the study hypothesis the presence or absence of a dog was visible in the videos. Expectation bias was possible among the participants, and performance bias by the treating therapist due to the inability to blind participants to the intervention.

Implications for clinical practice. Occupational therapists who want to introduce animals into practice have more information to help them understand the effects of OT-AAT on participation in children with DD. Animals are one of many therapeutic tools to incorporate in sessions aimed at attaining goals. For some children, AAT may result in greater changes in participation, and for other children, OT-AAT is at least as effective as OT-TT. OT-AAT can be considered as a therapeutic tool when a therapist plans intervention for children with DD. As with all therapeutic activities, introducing a dog into OT should be considered on an individual basis.

Conclusion

Overall, these findings are suggestive but not conclusive, and increased participation during OT-AAT should be considered as a possible outcome in children with DD. OTs wishing to incorporate animals into practice can explore those possibilities, knowing that OT-AAT increases occupational participation in some individuals with DD. As with any therapeutic intervention, OT-AAT should be considered on an individual basis. Future studies utilizing stronger study designs (such as ABA or ABAB), more established outcome measures and larger sample sizes, or more homogeneous samples would likely yield further information for occupational therapists wishing to incorporate animals into their practice.

References

American Occupational Therapy Association. (2008). AOTA's Societal statement on play. *American Journal of Occupational Therapy, 62*, 707-708.

American Occupational Therapy Association (2014). Occupational therapy practice framework: Domain and process (3rd ed.). *American Journal of Occupational Therapy*, 68 (Suppl. 1), S1-S48.

Backman, C.L., & Harris, S.R. (1999). Case studies, single-subject research, and n of 1 randomized trials: Comparisons and Contrasts. *American Journal of Physical Medicine & Rehabilitation*, *78*, 170-176.

Beck, A. (2011). Animals and child health and development. In P. McCardle, S. McCune, J. A. Griffin, L. Esposito, & L. S. Freund (Eds.), *Animals in our lives: Human-animal interaction in family, community & therapeutic settings* (pp. 43-52). Baltimore, MD: Paul H. Brookes.

Bedell, G. (2012). Measurement of social participation. In V. Anderson, & M.H. Beauchamp, (Eds.), *Developmental Social Neuroscience and Childhood Brain Insult Theory and Practice*. (pp. 184-204). New York: Guilford Press.

Bedell, G. M., & Dumas, H. M. (2004). Social participation of children and youth with acquired brain injuries discharged from inpatient rehabilitation: a follow-up study. *Brain Injury*, *18*, 65-82.

Berry, J., & Ryan, S. (2002). Frames of reference: Their use in paediatric occupational therapy. *The British Journal of Occupational Therapy*, *65*(9), 420-427.

Bloom, M., Fischer, J., & Orme, J.G. (2003). Evaluating practice: Guidelines for the accountable professional. Boston, MA: Allyn & Bacon.

Bobrovitz, C.D. & Ottenbacher, K.J. (1998). Comparison of visual inspection and statistical analysis of single-subject data in rehabilitation research. *American Journal of Physical Medicine and Rehabilitation, 77,* 94-102.

Bowyer, P., Lee, J., Kramer, J., Taylor, R.R., & Kielhofner, G. (2012). Determining the clinical utility of the Short Child Occupational Profile (SCOPE). *British Journal of Occupational Therapy, 75*, 19-28.

Bowyer, P., Kramer, J.M., Kielhofner, G., Maxiero-Barbosa, V., Girolami, G. (2007). Measurement properties of the Short Child Occupational Profile (SCOPE). *Physical and Occupational Therapy in Pediatrics, 27*, 67-85.

Bowyer, P., Kramer, J., Ploszaj, A., Ross, M., Schwartz, O., Kielhofner, G., & Kramer, K. (2008). *The Short Child Occupational Profile (SCOPE)* (version 2.2). Model of Human Occupation Clearing House, University of Illinois at Chicago, Chicago, Illinois.

Centers for Disease Control (CDC). (2010). *National Center on Birth Defects and Developmental Disabilities: Monitoring Developmental Disabilities*. Retrieved from http://www.cdc.gov/ncbddd/dd/default.htm

Centers for Disease Control. (2011). *Feature: Developmental Disabilities Increasing in US.* Retrieved from http://www.cdc.gov/Features/dsDev_Disabilities/

Cicchetti, D.V., & Sparrow, S.S. (1981). Developing criteria for establishing interrater reliability of specific items: Applications to assessment of adaptive behavior. *American Journal of Mental Deficiency, 86*, 127-137.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Delta Society. (2009). *Healthy Reasons to Have a Pet; Compiled List of Some Research Findings*. Retrieved from http://www.deltasociety.org/Document.Doc?id=380

Dermer, M.L., & Hoch, T.A. (2001). Improving Descriptions of Single-Subject Experiments in Research Texts Written for Undergraduates. *The Psychological Record*, *49*, 15-17.

Esteves, S. W., & Stokes, T. (2008). Social effects of a dog's presence on children with disabilities. *Anthrozoös: A Multidisciplinary Journal of the Interactions of People & Animals, 21*, 5-15.

Fawcett, N., & Gullone, E. (2001). Cute and cuddly and a whole lot more? A call for empirical investigation into the therapeutic benefits of Human-Animal Interaction for children. *Behavior Change, 18*, 124-133.

Feinstein, J. (2013). Manual for the implementation of OT-AAT in dissertation study. Unpublished paper.

Forsyth, K., Kielhofner, G., Bowyer, P., Kramer, K., Ploszaj, A., Blondis, M., Hinson-Smith, R., & Parkinson, S. (2008). Assessments combining methods of information gathering. In G. Kielhofner (Ed.), *Model of human occupation,* 4th ed. (pp. 288-310). Baltimore, MD: Lippincott Williams & Wilkins.

Gutman, S., Rafael, E., & Rao, A**.** (2012). Effect of a motor based role play intervention on the social behaviors of adolescents with high functioning Autism: Multiple baseline single subject design. *American Journal of Occupational Therapy, 66*, 529-537.

Haley, S. M., & Fragala-Pinkham, M. A. (2006). Interpreting change scores of tests and measures used in physical therapy. *Physical Therapy, 86*, 735-743.

Hawkins, N. G., Sanson-Fisher, R. W., Shakeshaft, A., D'Este, C., & Green, L.W. (2007). The multiple baseline design for valuating population-based research. *American Journal of Preventative Medicine*. *33*, 62–168.

Humane Society of the United States. (2006). *US Pet ownership statistics*. Greenfield, CT: Author.

Hume, K., Loftin, R., & Lantz, J. (2009). Increasing independence in autism spectrum disorders: A review of three focused interventions. *Journal of Autism and Developmental Disorders, 39*, 1329-1338.

Johnson, R. A. (2011). Animal-Assisted Interventions in Health care contexts. In McCardle, P., McCune, S., Griffin, J.A., & Maholmes, V. (Eds.), *How animals affect us: Examining the influence of Human-Animal Interaction on child development and human health*. (pp. 183-192). Washington, DC: American Psychological Association.

Kazdin, A. E. (2011). *Single-case research designs*, (2nd ed.) New York, NY: Oxford University Press.

Kielhofner, G. (Ed.) (2008). *Model of human occupation,* (4th ed.). Baltimore, MD: Lippincott Williams & Wilkins.

Kromrey, J. D., & Foster-Johnson, L. (1996). Determining the Efficacy of Intervention: The Use of Effect Sizes for Data Analysis in Single-Subject Research. *The Journal of Experimental Education*, *65*, 73-93.

Lammi, B. M., & Law, M. (2003). The effects of Family-Centred Functional Therapy on the occupational performance of children with cerebral palsy. *Canadian Journal of Occupational Therapy, 70*, 285-297.

Law, M. (2002). Participation in the occupations of everyday life, 2002 Distinguished Scholar Lecture. *American Journal of Occupational Therapy, 56*, 640–649.

Levinson, B. M. (1972). *Pets and human development*. Springfield, IL: Charles C. Thomas.

Lund Research, Ltd. (2013). *Laerd Statistics: Measures of Central Tendency*. Retrieved from: https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php

Mader, B., Hart, L.A., & Bergin, B. (1989). Social acknowledgements for children with disabilities: Effects of service dogs. *Child Development, 60*, 1529-1534.

Mailloux, Z., May-Benson, T. A., Summers, C. A., Miller, L. J., Brett-Green, B., Burke, J. P., et al. (2007). The Issue Is-Goal attainment scaling as a measure of meaningful outcomes for children with sensory integration disorders. *American Journal of Occupational Therapy, 61*, 254–259.

McCardle, P., McCune, S., Griffin, J. A., Esposito, L., & Freund, L.S. (2011). *Animals in our lives: Human-animal interaction in family, community & therapeutic settings*. Baltimore, MD: Paul H. Brookes.

O'Haire, M., McKenzie, S., McCune, S., & Slaughter, V. (2013). Effects of animal-assisted activities with guinea pigs in the primary school classroom. *Anthrozoos: A Multidisciplinary Journal of the Interactions of People & Animals*, *26*(3), 445-458.

O'Haire, M. E. (2013). Animal-assisted intervention for autism spectrum disorder: A systematic literature review. *Journal of autism and developmental disorders*, *43*(7), 1606-1622.

Polit, D., & Beck C. (2012). *Nursing research; generating and assessing evidence for nursing practice*. Philadelphia, PA: Lippincott Williams & Wilkins.

Robey, R. R., Schultz, M. C., Crawford, A. B., & Sinner, C. A. (1999). Review: Single-subject clinical-outcome research: designs, data, effect sizes, and analyses. *Aphasiology*, *13*(6), 445-473.

Sams, M., Fortney, E., & Willenbring, S. (2006). Occupational therapy incorporating animals for children with autism: A pilot investigation. *American Journal of Occupational Therapy, 60*, 268-274.

Taylor, R. R., Kielhofner, G., Smith, C., Butler, S., Cahill, S. M., Ciukaj, M. D., & Gehman, M. (2009). Volitional change in children with autism: A single-case design study of the impact of hippotherapy on motivation. *Occupational Therapy in Mental Health*, *25*(2), 192-200.

Thompson, M. (2009). Animal-assisted play therapy; Canines as co-therapists. In G. Walz, J. Bleuer, & R. Yep (Eds.), *Compelling counseling interventions: VISTAS 2009* (p. 199-209). Alexandria, VA: American Counseling Association.

Vismara, L.A., Colombi, C., & Rogers, S.J. (2009). Can one hour per week of therapy lead to lasting changes in young children with autism? *Autism*, *13*, 93-115.

Ward, K., Mitchell, J., & Price, P. (2007). Occupation-Based Practice and Its Relationship to Social and Occupational Participation in Adults With Spinal Cord Injury. *OTJR: Occupation, Participation and Health, 27*, 149-156.

Wilson, C. C., & Barker, S. B. (2003). Challenges in designing Human-Animal Interaction research. *American Behavioral Scientist. 47*, 16-28.

Wilson, E. O. (1984). *Biophilia: The human bond with other species*. Cambridge, Massachusetts: Harvard University Press.

World Health Organization (Ed.). (2001). *International Classification of Functioning, Disability, and Health* (ICF). World Health Organization.

Yeh, M. L. (2008). Canine animal-assisted therapy model for the autistic children in Taiwan. Department of Nursing, Taiwan. Presentation from the 11th international conference on human-animal interactions, people & animals: Partnership in harmony, Tokyo, Japan.

Chapter 5: Conclusion

Human-Animal Interaction (HAI), and more specifically, Animal-Assisted Therapy (AAT), are increasingly prevalent, and interest from occupational therapy (OT) practitioners and clients/parents is growing (AOTA, 2014). The study of HAI and of AAT in particular is important to the field of OT, to examine the utility of incorporation of an animal in therapy, and to help OTs become more informed about this unique intervention as a potentially potent therapeutic tool. As is the case in other interventions in occupational therapy, the field would benefit from data driven evidence and guidelines for implementation of AAT (Schaaf & Blanche, 2012). The research described in this dissertation moved the field toward this goal by examining the effectiveness of HAI, and more specifically AAT, for individuals with DD, from an OT perspective.

The overarching goal of this dissertation was to explore the effects of HAI on individuals with DD. The aims were (a) to determine the state of the literature related to HAI (incorporating common household animals such as dogs and cats) and individuals with DD, and to examine the effectiveness of OT incorporating a trained therapy dog (OT-AAT) on (b) playfulness and (c) participation in children with DD. An additional aim was to determine (d) whether length of baseline or timing of introduction of OT-AAT influenced outcomes. These aims were achieved through the work in this paper, presented in three-article format.

All three articles were based on the Biophilia hypothesis, an assertion that an emotional and beneficial relationship exists between humans and nature, in which there is an “innate

tendency to focus on life and lifelike processes" (Wilson, 1984). Additionally, OT treatment theories including sensory integration, acquisitional, and biomechanical frames of reference guided the intervention study (Berry & Ryan, 2002).

The three articles presented here focused on the results of relationships between individuals with DD and common household animals (dogs and cats), as opposed to less common therapy animals (dolphins and guinea pigs) and therapy conducted with animals that are not household pets (horses; hippotherapy). While common household companion animals can be brought to any established OT clinic, AAT using larger animals, such as hippotherapy, is generally conducted in a farm environment, which is markedly different from most OT clinics.

Overview of findings

Table 3 summarizes the three papers presented in this body of work. The results of the systematic literature review examining HAI with common household pets, in populations of individuals with DD, indicated generally positive outcomes across 27 selected studies. Most (59%, or 16/27) selected materials were published in peer-reviewed journals, 10 of 27 (37%) were descriptive case studies, and 7 of27 (26%) were unpublished theses/dissertations or conference proceedings. This distribution reveals a dearth of studies with large sample sizes and high rigor, endemic to the HAI field of study.

Throughout the review, three broad categories of HAI emerged: AAT, companion animals, and service animals. Categories of HAI and study methods varied widely but similar positive outcomes were reported, specifically improved social skills, communication, and attention/focus. Weaknesses emerged in the body of evidence including lack of standardized outcome measures for examining AAT, heterogeneity of HAI presentation, parental burden, and quality control of animals and therapists. Findings of the systematic review were consistent with

Table 3

Summary Results

Article	Results	Future recommendations
Systematic review	-27 resources selected -Three categories emerged: AAT, companion animals, service animals. -Generally positive outcomes: improved social skills, communication, and attention/focus -These results are similar to recently published studies with similar aims	- Studies with larger samples, more rigor -Use established measurement tools -Improve quality control in animal and therapist/handler selection and training
Effects of OT-AAT on playfulness	-Descriptive results indicated higher playfulness scores for most (80%) participants during OT-AAT. -Paired *t*-tests indicated a significant positive difference in playfulness between phases. -Not all participants benefitted from OT-AAT (20%).	-May be beneficial to use measurement tools established to measure AAT -"Dosage" of AAT was consistent in this study, in terms of session length and presentation, but participants received different number of sessions. What dosage of AAT is best? -Population of DD varies greatly, perhaps narrow scope to participants with DD who have a dog at home. -Future research should study free play/playfulness
Effects of OT-AAT on participation	-Descriptive results indicated increased overall participation in most (70-80%) participants during OT-AAT. -Non-parametric summary testing of the aggregated means found no significant difference in participation between phases.	-Future research: more rigor, larger samples; use evaluation tools more closely matched with outcome -Attempt to achieve a more homogeneous sample, try to identify what delineates a good candidate for OT-AAT

other literature reviews published recently with similar populations from diverse professional perspectives (Berry, 2013; O'Haire, 2013). These literature reviews included many overlapping articles, but were more broadly inclusive of all animals in therapy (horses, dolphins, guinea pigs, etc.). Further improving on past reviews, the literature review in this dissertation examined levels of evidence (Sackett, et al., 1997; Tomlin & Borghetto, 2011). Categorizing materials by level of evidence indicated a pool of resources with middle and low rigor, characterized by small sample sizes.

The systematic review in Chapter 2 identified that future studies examining HAI should endeavor to include more subjects and higher levels of rigor, but the consistency in findings suggested that HAI could have a positive effect on several performance skills that support occupation. The intervention study following the literature review focused on occupational outcomes, and narrowed HAI down to AAT, still a broad category but less variable than HAI.

The systematic literature review laid the groundwork for the intervention study which provided data for the two articles that followed. Established OT assessments were examined, the presentation of AAT was manualized, and the therapist and animal went through rigorous training in AAT before participating in the study. The therapy manual is attached in Appendix L. Although a sample size of 10 is small for a design that compares two treatment groups, it is large for a single subject design, and it was the maximum number of students possible and practical for this study.

Using a single-subject multiple baseline two phases (OT-TT and OT-AAT) design with repetition (n=10) over eight weeks, the intervention study examined two occupation based outcomes, play and participation, in children with DD. In the second paper the effects of OT-AAT on a primary occupation of childhood, play, are examined. Playfulness, as assessed by the

ToP (an established OT evaluation tool) was measured during each session over an eight-week period. Subsequent analysis revealed generally positive results via effect size and visual analysis, suggesting increased playfulness during OT-AAT at an individual level, in most children. These changes occurred in spite of the fact that sessions themselves were not designed to focus on playfulness. Changes in playfulness were not sustained for some participants, likely reflecting the high degree of variability in this population. Variation in length of baseline did not influence overall findings.

In Chapter 4, Article 3, the video data from the intervention study was analyzed to determine whether including a trained therapy dog in occupational therapy intervention (OT-AAT) significantly changed occupational participation in children with DD. Video recordings of the treatment sessions were analyzed to identify trends in participation using the Short Child Occupational Profile. Most subjects (70-80%) demonstrated increased participation during OT-AAT as indicated by mean shift, effect size, and visual analysis of change in slope. However, a hypothesis summary test comparing aggregated scores found no significant difference in participation between phases. These varied results suggest some participants' participation increased during OT-AAT, but future research should consider using larger samples, a more homogeneous population, more established evaluation tools for participation, or an evaluation tool more aligned with intervention goals. Identifying what delineates a good candidate for OT-AAT would be invaluable for therapists considering this approach.

The data analysis for participation and playfulness results varied based on the distribution of data (non-normal vs. normal), presence of standardized scores (not present vs. present). Both articles relied on visual time series analysis because of the single subject study design, and paired *t*-tests (or non-parametric equivalent) because of the presence of serial dependency. Both

uncovered a mix of results, but the playfulness data was somewhat more conclusive.

Although both play and participation are crucial to the lives of children with DD, the outcomes in this investigation are somewhat different. Playfulness is an occupation, while participation/occupational participation is more a description of the level of engagement (intensity, frequency, and enjoyment; Bedell, 2012) an individual has in or with an activity or occupation. It appears from these studies that introduction of a trained therapy dog into OT sessions results in signs of greater playfulness for children who are comfortable with the dog. Somewhat in contrast to this, the effect on participation in therapy was inconsistent, potentially influenced by comfort with the dog. The influence of comfort with the dog on participation appeared to be dichotomous; children who were very comfortable with and interested in the dog as well as those who were not comfortable with the dog showed less participation. Less participation when the child was not comfortable with the dog is fairly understandable. For those children who showed a great deal of interest in the dog, the presence of the dog appeared to interfere with participation in therapy as the child wanted only to interact with the dog. Interestingly, participants who showed increased playfulness did not necessarily show increased participation. In fact, participants 5 and 10 showed decreased participation during OT-AAT, but showed increased playfulness. Participants 3 and 9 demonstrated decreased playfulness during OT-AAT, but increased participation.

Despite these differing participant-level results, the two articles paralleled each other in that the results were not universal. Supporting the premise that OT-AAT is not a "one size fits all" intervention, individual responses differed within participants across the two outcomes. These findings indicate OT-AAT should be considered on a case-by-case basis. Further, since the timeline of implementation of OT-AAT did not appear to make a difference in the outcomes,

longer periods in OT-AAT may afford the ability to circumvent novelty with the dog presence. This would be something to consider in future studies.

Limitations

Participants in the treatment study comprised a subset of children with DD with visual and auditory impairments, demonstrating highly varied levels of function between them, and individual unpredictable behavior. Many participants displayed affection for the dog and interest in interacting with the dog independently without practitioner intervention or encouragement. Although this study kept a consistent format for presentation of OT-AAT to enhance study reliability, future studies should attempt to identify what dosage of OT-AAT is most effective, including frequency and duration of OT-AAT, whether age or disability affects outcomes, whether the dog's presence is enough, or whether it is the actual interaction that influences results. This could help guide future implementation of OT-AAT.

Study limitations included no established assessments designed to measure the effects of AAT, and the varied dosage of AAT. A more rigorous design such as ABAB may have strengthened findings. In terms of playfulness, length of phase did not seem to influence outcomes, but the length of phase may have had an effect on Group C in the participation data. As such, longer study to allow Group C to receive a longer Phase 2 may have strengthened findings, at least for participation. Because this population demonstrates such varied levels of function, OT-AAT should not be a "one size fits all" intervention. Most, but not all, participants demonstrated increased playfulness. Future studies could attempt to examine characteristics of children with DD who benefit from AAT, or assess the effects of AAT qualitatively in children with DD.

This dissertation study suggests OTs may find incorporating a trained therapy dog is

beneficial in their work with children with DD. As with all treatment modalities, practitioners must base the decision to incorporate a novel treatment tool on knowledge of their client. Considering the child's reaction to pets at home may help to determine whether a therapy dog would be beneficial. Additionally, having a trained therapy dog present before or after an earlier session could help to determine the child's potential interest. The results of this investigation lay a foundation for future OT-AAT intervention planning and investigative inquiry into the effectiveness of OT-AAT with children with DD.

References

American Occupational Therapy Association (AOTA). (2014). Conversations that Matter: Animal-Assisted Therapy. Proceedings from *AOTA 2014: Annual Conference*. Baltimore, MD.

American Occupational Therapy Association (AOTA). (2008). Occupational therapy practice framework: Domain and process, 2nd Ed. *American Journal of Occupational Therapy, 62,* 625–683.

Bedell, G. (2012). Measurement of social participation. In V. Anderson, & M.H. Beauchamp (Eds.), *Developmental Social Neuroscience and Childhood Brain Insult Theory and Practice*. (pp. 184-204). New York: Guilford Press.

Bedell, G., & Dumas, H. (2004). Social participation of children and youth with acquired brain injuries discharged from inpatient rehabilitation: a follow-up study. *Brain Injury*, *18,* 65-82.

Berry, A., Borgi, M., Francia, N., Alleva, E., & Cirulli, F. (2013). Use of assistance and therapy dogs for children with autism spectrum disorders: A critical review of the current evidence. *The Journal of Alternative and Complimentary Medicine, 19*, 73-80. doi: 10.1089/acm.2011.0835

Berry, J., & Ryan, S. (2002). Frames of reference: Their use in paediatric occupational therapy. *The British Journal of Occupational Therapy*, *65*(9), 420-427.

Bundy, A.C. (1993). Assessment of play and leisure: Delineation of the problem. *American Journal of Occupational Therapy, 47,* 217-222.

Case-Smith, J. & Miller, H. (1999). Occupational therapy with children with pervasive developmental disorders. *American Journal of Occupational Therapy, 53*, 506-513.

Case-Smith, J., & O'Brien, J. C. (2010). *Occupational therapy for children* (6th ed.). Maryland Heights, MO: Mosby Elsevier.

Centers for Disease Control. (2011). *Feature: Developmental Disabilities Increasing in US*. Retrieved from: http://www.cdc.gov/Features/dsDev_Disabilities/

Centers for Disease Control. (2010). *National Center on Birth Defects and Developmental Disabilities: Monitoring Developmental Disabilities*. Retrieved from: http://www.cdc.gov/ncbddd/dd/default.htm

Delta Society. (2009). *Healthy Reasons to Have a Pet; Compiled List of Some Research Findings*. Retrieved from: http://www.deltasociety.org/Document.Doc?id=380http://www.deltasociety.org/Document.Doc?id=380.

Engel, B. T., & MacKinnon, J. R. (Eds.). (2007). *Enhancing human occupation through hippotherapy: A guide for occupational therapy*. Baltimore: AOTA Press.

Esposito, L., McCardle, P., Maholmes, V., McCune, S., & Griffin, J.A. (2011). Introduction. In P. McCardle, S. McCune, J.A. Griffin, L. Esposito, & L.S. Freund (Eds.), *Animals in our lives: Human-animal interaction in family, community and therapeutic settings* (pp. 1-5). Baltimore, MD: Paul H. Brookes.

Esteves, S.W., & Stokes, T. (2008). Social effects of a dog's presence on children with disabilities. *Anthrozoös: A Multidisciplinary Journal of the Interactions of People & Animals, 21*, 5-15.

Fawcett, N. & Gullone, E. (2001). Cute and cuddly and a whole lot more? A call for empirical investigation into the therapeutic benefits of Human-Animal Interaction for children. *Behavior Change, 18*, 124-133.

Ferland, F. (1994). *Play, children with physical disabilities, and occupational therapy: The Ludic model*. Ottowa, Canada: University of Ottowa Press.

Harkness, L. & Bundy, A.C. (2001). The Test of Playfulness and children with physical disabilities. *Occupational Therapy Journal of Research, 21*, 73-89.

Henry, A.D. (2000). *Pediatric Interest Profiles Manual*. San Antonio, TX: Therapy Skill Builders.

Hess, L. & Bundy, A.C. (2003). The association between playfulness and coping in adolescents. *Physical and occupational therapy in pediatrics, 23*, 5-17.

Humane Society of the United States. (2006). *US Pet ownership statistics*. Greenfield, CT: Author.

Hume, K., Loftin, R., & Lantz, J. (2009). Increasing independence in autism spectrum disorders: A review of three focused interventions. *Journal of Autism and Developmental Disorders, 39*, 1329-1338.

Johnson, R. A., Meadows, R.L., Haubner, J.S., & Sevedge, K. (2003). Human-Animal Interaction, a Complementary/Alternative Medical (CAM) intervention for cancer patients. *American Behavioral Scientist, 47*, 55-69.

Johnson, R.A. (2011). Animal-Assisted Interventions in Health care contexts. In P. McCardle, S. McCune, J.A. Griffin, & V. Maholmes, V. (Eds.), *How animals affect us: Examining the influence of Human-Animal Interaction on child development and human health*. (pp. 183-192). Washington, DC: American Psychological Association.

King, G., Law, M., King, S., Hurley, P., Hanna, S., Kertoy, M., … Young, N. (2004). *Children's Assessment of Participation and Enjoyment (CAPE) and Preferences for Activities of Children (PAC)*. San Antonio, TX: Harcourt Assessment, Inc.

Lane, S.J. & Mistrett, S. (2002). Let's play! Assistive technology interventions for play. *Young Exceptional Children, 5*, 19-27.

Law, M. (2002). Participation in the occupations of everyday life, 2002 Distinguished Scholar Lecture. *American Journal of Occupational Therapy, 56*, 640–649.

Levinson, B. M. (1972). *Pets and Human Development*. Springfield, IL: Charles C. Thomas.

Levinson, B.M. & Mallon, G.P. (1997). *Pet-oriented child psychotherapy*, 2nd Ed. Springfield, IL: Charles C. Thomas.

Mader, B., Hart, L.A., & Bergin, B. (1989). Social acknowledgements for children with disabilities: Effects of service dogs. *Child Development, 60*, 1529-1534.

Martin, F. & Farnum, J. (2002). Animal-Assisted Therapy for children with Pervasive Developmental Disorders. *Western Journal of Nursing Research, 24*, 657-670.

McCardle, P., McCune, S., Griffin, J. A., Esposito, L. & Freund, L.S. (2011). *Animals in our lives: Human-animal interaction in family, community & therapeutic settings*. Baltimore, MD: Paul H. Brookes.

McCardle, P., McCune, S., Griffin, J.A., & Maholmes, V. (2011). *How Animals Affect Us: Examining the influence of human-animal interaction on child development and human health*. Washington, DC: American Psychological Association.

Morrison, M.L. (2007). Health benefits of animal-assisted interventions. *Complementary Health Practice Review, 12*, 51-62.

Mulligan, S. (2003). *Occupational Therapy Evaluation for Children*. Baltimore, MD: Lippincott Williams & Wilkins.

O'Haire, M. E. (2013). Animal-assisted intervention for autism spectrum disorder: A systematic literature review. *Journal of autism and developmental disorders*, *43*(7), 1606-1622.

Okimoto, A.M., Bundy, A., & Hanzlik, J. (2000). Playfulness in children with and without disability: Measurement and intervention. *American Journal of Occupational Therapy*, *54*, 73-82.

Rodger, S. & Ziviani, J. (1999). Play-based occupational therapy. *International Journal of Disability, Development, and Education, 46*, 337-361.

Rogers, C. S., Impara, J. C., Fray, R., Harris, T., Meeks, A., Semanic-Lauth, S., & Reynolds, M. (1998). Measuring playfulness: Development of the child behaviors inventory of playfulness. *Play and cultural studies*, *4*, 121-135.

Sackett, D.L., Richardson, W.S., Rosenberg, W., & Haynes, R.B. (1997). *Evidence-Based Medicine; How to Practice and Teach EBM*. New York, NY: Churchill Livingstone.

Sams, M.J., Fortney, E.V., & Willenbring, S. (2006). Occupational therapy incorporating animals for children with autism: A pilot investigation. *American Journal of Occupational Therapy, 60,* 268-274.

Schaaf, R., & Blanche, E. (2012). Emerging as leaders in autism research and practice: Using the data-driven intervention process. *American Journal of Occupational Therapy*, *66*(5), 503-505.

Serpell, J. A. (2006). Animal-assisted interventions in historical perspective. In A. H. Fine (Ed.), *Handbook on* Animal-*Assisted Therapy: Theoretical Foundations and Guidelines for Practice*, 2nd Ed. (pp. 3-20). London: Elsevier.

Skard, G., & Bundy, A.C. (2008). Test of Playfulness. In L.D. Parham & L.S. Fazio (Eds.), *Play in occupational therapy for children*, 2nd Ed. (pp. 71-93). St. Louis, MO: Mosby.

Thompson, M.J. (2009). Animal-assisted play therapy; Canines as co-therapists. In G.R. Walz, J.C. Bleuer, & R.K. Yep (Eds.), *Compelling counseling interventions: VISTAS 2009* (p. 199-209). Alexandria, VA: American Counseling Association.

Tomlin, G. & Borgetto, (2011). Research pyramid: A new Evidence-Based Practice model for occupational therapy. *American Journal of Occupational Therapy*, 65, 189-196.

Wilson, E.O., (1984). *Biophilia: The human bond with other species*. Cambridge, MA: Harvard University Press.

World Health Organization (Ed.). (2001). *International Classification of Functioning, Disability, and Health* (ICF). World Health Organization.

Appendix A:

Example of Database Inquiry

Medline via PubMed search 2/15/14
Search strategy:
(MeSH terms in all capitals, phrases in upper/lowercase)
1. REHABILITATION

AND

PETS
OR DOGS
OR CATS
OR BONDING, HUMAN-PET
OR ANIMAL ASSISTED THERAPY (NoExplode)
OR Animal Bond
OR Animal Facilitated Therapy
OR Canine Visitation

AND

2. DEVELOPMENTAL DISABILITIES
OR AUTISTIC DISORDER
OR CEREBRAL PALSY
OR DOWN SYNDROME
OR INTELLECTUAL DISABILITY

Appendix B:

Pertinent Textbooks Hand Searched

Fine, A.H. (Ed.). (2010). *Handbook on animal-assisted therapy: theoretical foundations and guidelines for practice* (1st, 2nd, & 3rd ed.). London: Academic Press.

Levinson, B.M. & Mallon, G.P. (1997). Pet-oriented child psychotherapy, 2nd Ed. Springfield, IL: Charles C. Thomas.

McCardle, P., McCune, S., Griffin, J. A., Esposito, L. & Freund, L.S. (2011). *Animals in our lives: Human-animal interaction in family, community & therapeutic settings*. Baltimore, MD: Brooks Publishing Co.

McCardle, P., McCune, S., Griffin, J.A., & Maholmes, V. (2011). *How animals affect us: Examining the influence of human-animal interaction on child development and human health*. Washington, DC: American Psychological Association.

Melson, G. F., & Melson, L. G. (2009). *Why the wild things are: Animals in the lives of children*. Cambridge, MA: Harvard University Press.

Pavlides, M. (2008). *Animal-assisted interventions for individuals with Autism.* London: Jessica Kingsley Press.

Van Fleet, R., (2008). Play therapy with kids and canines: Benefits for children's development and psychosocial health. Sarasota, FL: Professional Resource Press.

Wilson, C. C., & Turner, D. C. (Eds.). (1998). *Companion animals in human health*. New York, NY: Sage.

Appendix C:

Table C1. Summary Table of Selected Resources

Appendix C. Table C1.

Summary Table of Selected Resources

First author, (Year)	Sackett's Levels of Evidence	Tomlin & Borghetto's Pyramid level	Population	Intervention	Outcomes attributed to intervention
Burrows, (2008)	IV	Qualitative group study, less rigor (3C)	10 families of children with autism ages 4.5 to 14 7 boys, 3 girls	Service animal	facilitated family outings & activities Improved safety & freedom social interaction, recognition & status quality of life for families quality & quantity of sleep for child and parents
Carlisle, (2013)	IV	Qualitative group study less rigor (3C)	70 caregivers of children w ASD age 8–18	Companion animal	increased play & sharing improved responsibility provided companionship
Carlisle, (2012)	IV	Outcomes, pre-existing groups w covariates (2B)	47 caregivers of children w ASD ages 8-18	Companion animal	no significant difference in social skills of children who lived/did not live with a dog Children who were more attached to their pet dog did not have significantly better social skills than those not as attached
Coltea, (2011)	IV	Qualitative, group study more rigor (3B)	12 families of children w ASD ages 4-12	Companion animal	Children who interacted w dogs at least 45 min/day had - better language scores - more attached to their dogs

Coltea, C. (2009)	IV	Qualitative, group study, more rigor (3B)	20 families of children w and w/o ASD, diverse group, ages 1-80	Companion animal	Families of children with ASD - experienced more positive effects than families w/o children w ASD - increased direct social support - increased indirect social support
Esteves, (2008)	III	Experimental, single-subject study (1C)	3 children w MR, Down, ages 5-9	Companion animal	Dog presence: increased + initiated interactions decreased - interaction generalized improvements post-intervention
Freeman, (1997)	V	Descriptive, case study (4D)	1 male with Down Syndrome and dog phobie, age 31	Companion animal	Client's: + overall fear of dog reduced + increased community presence - unwilling to pet dog after program
Grandgeorge, (2012)	III	Outcomes, pre-existing groups w covariates (2B)	40 individuals w ASD ages 6-34, mean age 15	Companion animal	+ improvement in prosocial behaviors (offering to share, offering comfort) + more significant effects on group who experienced pet arrival
Heimlich, (2001)	III	Outcomes, one group pre- post-test (2D)	14 individuals w multiple disabilities ages 7-19	Animal-assisted therapy	+general movement of ratings in a positive direction (attention span, physical movement, communication, compliance)
Kogan, (1999)	IV	Experimental, single subject study (1D)	12 y.o. boy w developmental delays, mild MR, ADD,	Animal-assisted therapy	+ growth observed in all areas (attention, hyperactivity, social skills, oppositional

			emotional disorders, sensory needs		behavior) + relationship with peers + negative comments decreased + decreased distractibility
Landreth, (2002)	IV	Descriptive, case study (4D)	1 adult w intellectual/ complex disabilities	Companion animal	Gained prevocational knowledge Learned: guidelines for walking dogs social information responsibility
Limond, (1997)	III	Experimental, single subject (1C)	8 children w Down syndrome, ages 7-12	Animal-assisted therapy	Real dog condition increased visual attention, responsivity to adults, verbal initiation
Martin, (2002)	III	Experimental, single subject (1C)	10 children w PDD, ages 3-13	Animal-assisted therapy	live dog condition: more positive behaviors laughing interaction w dog increased energy • increased focus happier, more playful mood
Miccinello, (2011)	III	Experimental, single subject (1C)	8 boys, 6 w ASD, 2 w PDD/NOS, ages 9-11	Animal-assisted therapy	- no significant differences in Total Score on Movement Assessment Battery for Children - no significant difference seen in mean heart rate data, and/or beats per minute
Nieves, (2004)	V	Descriptive, case study (4D)	2 boys w ASD, ages 3 & 5	Service animal	assists children at home, in OT & SLP by being: a motivator, model,

					providing walking support, encouraging interaction, help give commands
Nikolskaya, (2012)	V	Descriptive, case study (4D)	30 families of children w developmenta l disabilities	Companion animal	30 cases: majority of cases, dog presence yielded positive benefits 26% of cases, dog presence negatively influenced family dynamics & no therapeutic benefit found., however family disharmony existed prior to dog arrival
Niksa, (2007)	V	Descriptive, case study (4D)	Boy w hearing impairment & brain disorder, age not specified	Animal-assisted therapy	- allowed for a positive social interaction experience (w dog) - increased understanding of social cues
Obrusnikova (2012)	V	Descriptive, case study (4D)	4 children w ASD, aged 11	Animal-assisted therapy	When therapy dog present, 3 out of 4 children displayed increased -motivation to attend & participate in therapy -attention to task, -responsiveness to instruction & feedback
Panish (2010)	V	Descriptive case study (4D)	2 boys with cerebral palsy, age 7	Service animal	-Received another best friend, -increased self esteem -improved public visibility/ perception
Petrongelli-Halloran	III	Experimental, single subject study (1C)	26 subjects w PDD, ages 6-	Animal-assisted	Therapy dog condition showed

(2012 (2010?)			19	therapy	increased frequency of all prosocial behaviors (awareness, cooperation, responsiveness, more)
Prothmann 2005)	IV	Descriptive, Association/correlation (4B)	40 subjects w ASD, eating disorder, and anxiety, ages 6-19	Animal-assisted therapy	- children w autism displayed multiple brief interaction phases w dog - Child–dog interaction analysis can contribute to psycho-diagnosis of children and adolescents
Redefer (1989)	III	Experimental, single subject study (1C)	12 subjects w ASD, ages 5-10	Animal-assisted therapy	no sig improvement Isolation or Social Interaction; interaction w/therapist increased sig interaction with dog decreased
Sams et al. (2006)	III	Experimental, single subject study (1C)	22 subjects w ASD receiving school based OT, ages 7-13	Animal-assisted therapy	significantly greater Use of Language significantly greater Social Interaction during OT w/animals vs. standard OT
Silva et al. (2011)	III	Single case study	1 subject w ASD, age 12	Animal-assisted therapy	Increased frequency, longer duration of positive behaviors (smiling, positive physical contact) Decreased frequency, shorter duration of negative behaviors (aggressive manifestations, Obsessive

					behaviors)
Solomon (2010)	V	Case study	5 children w ASD, ages 4-14	Animal-assisted therapy	Improved emotional connection between - child w ASD and family members, - child w ASD and dog
Weiss (2002)	III	Experimental, single subject study (1C)	1 girl w ASD, age 7	Animal-assisted therapy	Increase in spontaneous utterances, child initiated social interactions
Yeh (2008)	III	Experimental, single subject study (1C)	33 children w ASD, average age 6	Animal-assisted therapy	significant improvements: social skills, oral expression, turn taking, eye contact, concentration

Appendix D:

Table D1. Reliability and Validity of Research Design

Appendix D. Table D1

Reliability and Validity of Research Design

Concern	How addressed in this study
External validity of study design: Generalizability of study	• Population of children with DD is broad, and using individuals with multiple DD (as in this study) will provide a wide range of levels of function; generalizability to other populations should be done with caution. • Randomization is not feasible given the size of the accessible population. • Limits to generalizability, given the size of the accessible population and sample, will be offset by filling an identified research void and by the potential contributions of treatment of specific group.
Internal validity of study design: ability to infer that the treatment caused observed effects	• PI will provide all therapy, but will not score outcome measure. PI's potential bias could influence outcomes but will provide more consistency than having different treating therapists. • Scorers will be trained in scoring ToP but will not provide therapy • Multiple baselines will allow decreased probability that outside events cause changes, and increased confidence that the treatment of interest (OT-AAT) caused the changes • Long baseline phase will ensure stability before treatment is applied
Reliability: that the research is measuring what it intends to measure	• Test of Playfulness was written for "children for whom playfulness is a concern" and this outcome • Multiple baselines will allow decreased probability that outside events cause changes, and increased confidence that the treatment of interest (OT-AAT) caused the changes • Long baseline phase will ensure stability before treatment is applied

Appendix E:

Test of Playfulness

TEST OF PLAYFULNESS (ToP) (Version 4.0 – 9/04)

Child (#):_____ Age: _____ Rater: _____ In Out Video Live (Circle)	EXTENT 3 = Almost always 2 = Much of the time 1 = Some of the time 0 = Rarely or never NA = Not Applicable	INTENSITY 3 = Highly 2 = Moderately 1 = Mildly 0 = Not NA = Not Applicable	SKILLFULNESS 3 = Highly skilled 2 = Moderately skilled 1 = Slightly skilled 0 = Unskilled NA = Not Applicable

ITEM	EXT	INT	SKILL	COMMENTS
Is actively engaged.				
Decides what to do.				
Feels sufficiently safe to keep playing.				
Tries to overcome barriers or obstacles to persist with an activity.				
Modifies activity to maintain challenge or make it more fun.				
Engages in playful mischief or teasing.				
Engages in activity for the process rather than primarily for the end product.				
Pretends (to be someone else: to do something else: that an object is something else: that something else is happening.				
Incorporates objects or other people into play in unconventional or variable ways.				
Negotiates with others to have needs/desires met.				
Engages in social play.				
Supports play of others.				
Enters a group already engaged in an activity.				
Initiates play that others take up.				
Clowns or jokes.				
Shares (toys, equipment, friends, ideas).				
Gives readily understandable cues (facial, verbal, body) that say, "This is how you should act toward me."				
Responds to others' cues.				
Demonstrates positive affect during play.				
Interacts with objects.				
Transitions from one play activity to another.				

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Appendix F:

Table F1. Number of Sessions Per Participant and Concurrent Therapies

Appendix F. Table F1.

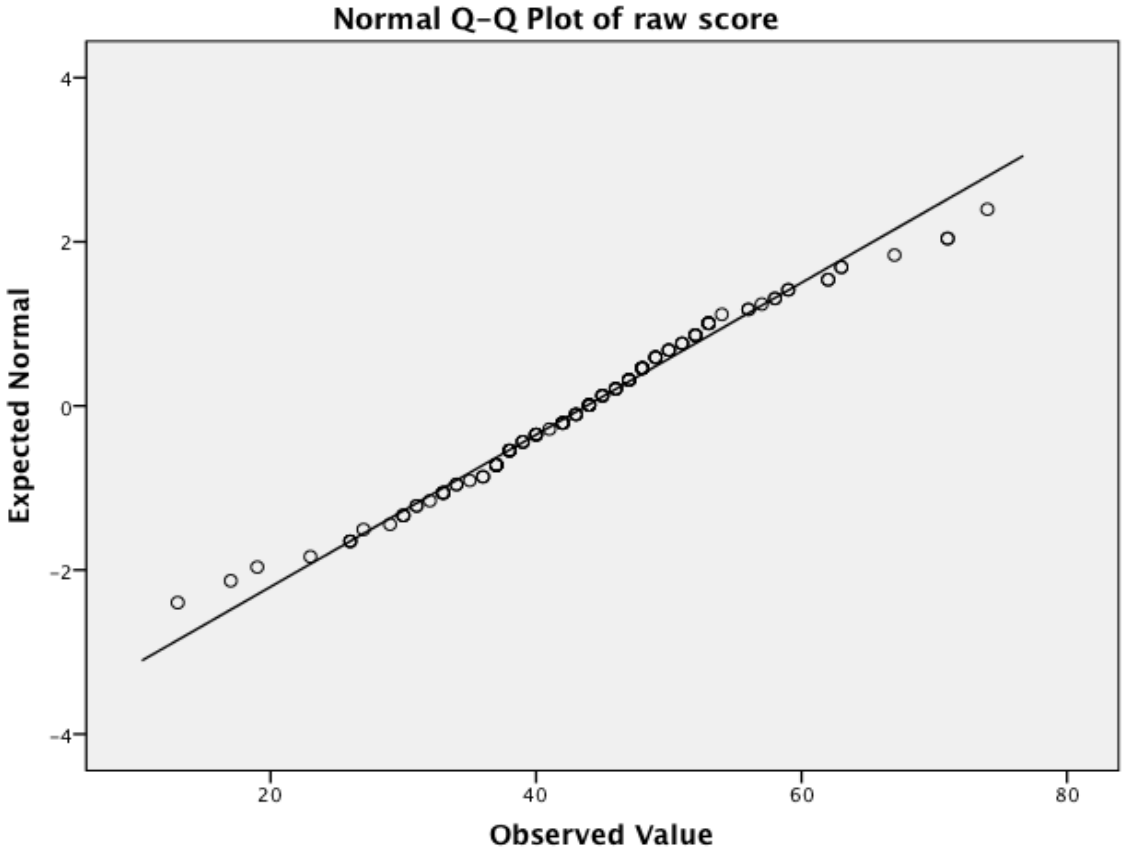
Number of Sessions Per Participant and Concurrent Therapies

Participant	Number of sessions (OT-TT, OT-AAT)
1	9 (4, 5)
2	10 (5, 5)
3	15 (7, 8)
4	10 (4, 6)
5	15 (6, 9)
6	9 (4, 5)
7	13 (7, 6)
8	13 (5, 8)
9	12 (8, 4)
10	14 (8, 6)

Note. *N*=10.

Appendix G:

Data Assumptions (Playfulness)



Raw Score Stem-and-Leaf Plot

Frequency Stem & Leaf

2.00 Extremes (=<17)
1.00 1 . 9
1.00 2 . 3
5.00 2 . 66679
12.00 3 . 000112333344
20.00 3 . 56677777777888888999
23.00 4 . 00000122222233334444444
25.00 4 . 5555666777777888888889999
16.00 5 . 0001112222333334
7.00 5 . 6678899
4.00 6 . 2233
1.00 6 . 7
3.00 Extremes (>=71)
Stem width: 10
Each leaf: 1 case(s)

Appendix H:

Glossary of Terms

Animal-Assisted Therapy (AAT) Individualized, goal-directed intervention that deliberately incorporates an animal, and is carried out by a trained professional monitoring the client's progress, to facilitate healing and recovery of clients receiving therapeutic care.

Baseline: Phase in which intervention is provided using traditional techniques (OT-TT), while data is collected prior to experimental treatment, including pre-treatment measures of the dependent variables.

Developmental Disabilities (DD): A variety of chronic conditions due to mental and/or physical impairments, which begin during early development and last throughout the lifetime.

Human-Animal Interaction (HAI): A broad term describing the shared, dynamic associations between people and animals, and the effects of those relationships on health and well-being.

Intervention: Overarching term describing all occupational therapy sessions, including baseline (OT-TT) and treatment (OT-AAT)

Participation: Involvement in life events and situations at home and in the community.

Occupational Participation: Engaging in work, play, or activities of daily living that are part of one's socio-cultural context and are desired/necessary to one's well-being.

Social Participation: Organized patterns of behavior expected of individuals in a social system.

Treatment: The experimental intervention under study; the condition being manipulated (here, OT-AAT).

Appendix I:

Table I1. Reliability and Validity of Research Design

Appendix I. Table I1.

Reliability and Validity of Research Design

Concern	How addressed in this study
External validity of study design: Generalizability of study	• Limitations of generalizability, given the size of assessable population and anticipated sample size, offset by the implications of filling a research void and potential contributions to a specific group's treatment
Internal validity of study design: ability to infer that the treatment caused observed effects	• Multiple baselines decreases probability that outside events cause changes, and increases confidence that the treatment caused the changes • Long baseline phase will ensure stability before treatment is applied
Reliability: that the research is measuring what it intends to measure	• Short Child Occupational Profile (SCOPE) was created for this population and outcome • Multiple baselines decreases probability that outside events cause changes, and increases confidence that the treatment of interest caused the changes • Long baseline phase ensures stability before treatment is applied • Possible moderator variables will be considered during statistical analysis

Appendix J:

Short Child Occupational Profile (SCOPE)

SCOPE v2.2: Short Child Occupational Profile (SCOPE)

SCOPE Summary Rating Form

Client: _____ ID: _____ Age: Years _____ Months _____ Date of Birth: ____/____/____ Gender: Male ____ Female ____ Grade: _____ Date of referal/admission: ____/____/____ Dx./Reason for referral:	Assessor: _____ Signature: _____ Date of Evaluation: ____/____/____ Initial ___ Re-evaluation ___ Discharge ___ Evaluation Setting: _____ CONTRAINDICATIONS (Allergies, etc):

Background Information
Primary caregiver/s:
Where does the client live?
Who else lives in the household?
School/day care Information:
Comments:

F	**Facilitates**	Facilitates participation in occupation.
A	**Allows**	Allows participation in occupation.
I	**Inhibits**	Inhibits participation in occupation.
R	**Restricts**	Restricts participation in occupation.

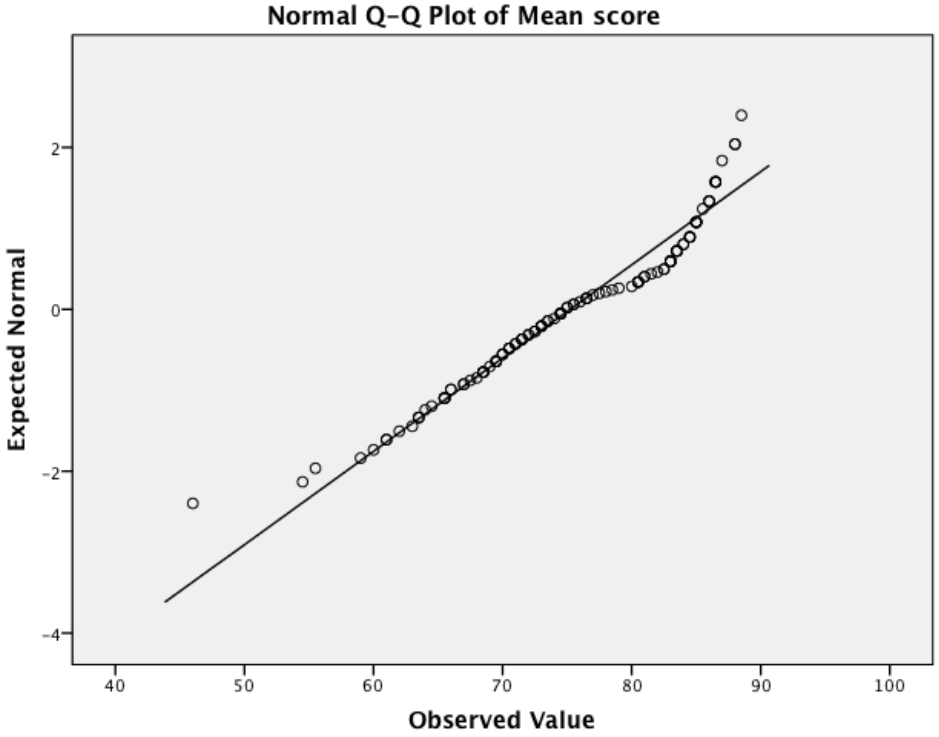
Analysis of Strengths and Challenges:

Summary of Ratings:

Volition				**Habituation**				**Communication & Interaction Skills**				**Process Skills**				**Motor Skills**				**Environment:**				
Exploration	Expression of Enjoyment	Preferences & Choices	Response to Challenge	Daily Activities	Response to Transitions	Routine	Roles	Non-Verbal Communication	Verbal/Vocal Expression	Conversation	Relationships	Understands & Uses Objects	Orientation to Environment	Plan & Make Decisions	Problem Solving	Posture & Mobility	Coordination	Strength	Energy/Endurance	Physical Space	Physical Resources	Social Groups	Occupational Demands	Family Routine
F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Appendix K:

Data Assumptions (Participation Data)



Stem-and-leaf plot

Frequency	Stem & Leaf
1.00	Extremes (=<46)
2.00	5 . 45
.00	5 .
1.00	5 . 9
3.00	6 . 011
5.00	6 . 23333
6.00	6 . 445555
5.00	6 . 66777
10.00	6 . 8888899999
11.00	7 . 00000011111
10.00	7 . 2222333333
10.00	7 . 4444445555
6.00	7 . 666677
3.00	7 . 889
8.00	8 . 00000111
13.00	8 . 2223333333333
14.00	8 . 44444455555555
9.00	8 . 666666667
3.00	8 . 888

Stem width: 10.0
Each leaf: 1 case(s)

Appendix L:

Manual for the Implementation of OT-AAT for Dissertation Study

1. Treatment goals are individualized, and documented in students' IEP, also in study folder

2. Treatment will occur in OT treatment space in Perkins lower school, rooms 301 and 302.

3. Treatment will be videotaped by either RA or tripod

4. Treatment will focus on IEP goals but will follow the same format: example
Chronologic specifics of session characteristics

James will increase participation in functional play.

Time	OT-TT	OT-AAT
Minutes 0-10 Warm-up activity	• Introduction to space, therapist • Review session plan • Make choices about warm-down/reward activity	• Introduction to space, therapist, therapy dog • Review session plan • Make choices about warm- down/reward activity
Minutes 10-25 goal-directed activity Sample goal: James will increase participation in functional skills, as demonstrated by: • participating in a bimanual therapeutic activity while sitting at a treatment table for 30 seconds • following 1-2 step directions for a therapeutic exercise	• bimanual games, e.g. joining pop beads to make a necklace; using tweezer tongs to pick up 1" balls and place them in a dog dish • complete 1-2 animal yoga poses	• bimanual games, e.g. joining pop beads to make a dog collar; using tweezer tongs to pick up 1" dog treats and place them in a dog dish • complete 1-2 animal yoga poses next to the therapy dog
Warm-down or reward activity.	• listening to music • reading a book • review plan for next session • high five with therapist	• listening to music • reading a book to the dog • review plan for next session • high five with dog

ADL goals will be addressed using real and simulated ADLs, for example a zipper: OT-TT will ask the student to don a hooded, zippered sweatshirt and zip it up; OT-AAT will ask the student to put a zipper bandanna on the dog and zip it up

Yoga or other gross motor activities will take place individually during OT-TT (taking a walk, completing yoga poses), or with the dog incorporated into the activity (walking the dog or completing yoga poses next to the dog who is also mimicking the pose as best as can be expected).

Tabletop activities will incorporate the dog as much as possible (e.g. making a pop bead necklace for the participant during OT-TT, or making a collar for the dog during OT-AAT).

Language and therapy goals will be addressed using similar approaches in both phases, using similar language and equipment.

Safety of the participant/student and the dog will remain the first priority throughout the sessions. If either the participant/student or the dog show signs of undue stress, the therapy session will conclude.

Written by Jennie Feinstein (VCU student investigator) 9/13/2013

Vita

Jennie Dapice Feinstein was born October, 1975, in Boston, Massachusetts. She attended grade school in the metro Boston area. In 1998, she received her Bachelor of Arts degree from Tufts University, Medford, Massachusetts, with a major in Sociology, and a minor in Child Development. Jennie received her Master of Arts in Occupational Therapy in 2005 from the Boston School of Occupational Therapy at Tufts University in Medford, Massachusetts. Jennie is currently employed as an Occupational Therapist at the Perkins School for the Blind. Her areas of expertise are Pediatrics and Human-Animal Interaction.