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Literature Review

Canine-Assisted Therapies in Autism

A Systematic Review of Published Studies Relevant to Recreational Therapy

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Abstract

Recreational therapists and other helping professionals have used animal-assisted therapies in the treatment of multiple psychological and physical issues. In the case of individuals with Autism Spectrum Disorder (ASD), animals have helped with issues ranging from social interaction, to anxiety, to physical balance. While researchers have applied rigorous review methods (including systematic reviews and meta-analyses) to evaluating the efficacy of animal-assisted interventions with various populations, publications detailing such research into canine-specific assisted therapies with individuals with ASD are missing. This review applies Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to evaluating empirical research on this application of animal-assisted therapy. Intensive searches of health care, psychological, educational, sociological, and other relevant resources yielded a limited number of studies meeting criteria for inclusion in this research. Those studies, however, provide a meaningful window into the efficacy of canine-assisted therapies used with individuals with ASD. A review of these studies that explores what the preponderance of the evidence suggests on this topic should benefit recreational therapy practitioners and their clients.

Keywords

Animal-assisted, autism, dogs, recreational therapy, systematic review

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Introduction

Recreational therapies play an important role in aiding individuals with Autism Spectrum Disorder (ASD) (Coyne & Fullerton, 2014; Gray, 2015). Recreational therapists partner with clients with ASD to reach desired behavioral, physical, and psychological outcomes. These professionals strive to help clients increase their motor functioning (Hawkins, Ryan, Cory, & Donaldson, 2014), develop cognitive, interpersonal, and social skills (De Vries, Beck, Stacey, Winslow, & Meines, 2015; Stuhl & Porter, 2015), and help with behavioral issues (Bell, Palace, Allen, & Nelson, 2016). Animal-assisted therapies, due to their popularity and reported positive efficacy, may provide a promising, accessible option for recreational therapy professionals working with individuals with ASD.

Like other areas of the helping professions, recreational therapy has employed animal-assisted interventions to aid clients with diverse care needs (Buettner, Wang, Stevens, Jessup, & Magrinat, 2011; Martindale, 2008; Patrick, 2009; Richeson & McCullough, 2003). As defined by the International Association of Human-Animal Interaction Organizations (IAHAIO), an animal-assisted intervention is a goal-oriented intervention that intentionally includes or incorporates animals in health, education, and human service (e.g., social work) for the purpose of therapeutic gains in humans (2014). Creatures as diverse as ants (Topel & Lachmann, 2008), dolphins (Md Yusof & Chia, 2012), guinea pigs (O'Haire, 2013b), and horses (Borgi et al., 2016) have participated in interventional research addressing behavioral and psychological issues in people with ASD. While these studies generally tout positive outcomes, researchers have sometimes employed problematic methodologies in their scholarship on animal-assisted treatments (Davis et al., 2015; O'Haire, 2013a).

This lack of clarity from existing research on the therapeutic efficacy of animal-assisted interventions for individuals with ASD calls for a much deeper review. The authors of the present study sought to find greater evidence-based consensus on the topic and then put forth what implications these findings may have for recreational therapists. The authors used a research type known as systematic review, noted as arguably the best source" for producing high quality information on an intervention (Hartling et al., 2016, p. 2). As defined by the *Cochrane Handbook for Systematic Reviews of Interventions* on the Cochrane Consumer Network, "A systematic review summarises the results of available carefully designed health care studies (controlled trials) and provides a high level of evidence on the effectiveness of health care interventions. Judgments may be made about the evidence and inform recommendations for health care (Higgins & Green, 2011). The *Handbook* goes on to state that systematic reviews are not only complex, but also depend on available clinical trials, the quality of those trials, and what variables were measured in those trials. As such, this systematic review is, as is most research of this type, limited by the amount of quality evidence available.

This systematic review employed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to examine reported effects of canine interventions with individuals with ASD as measured across recent, empirical studies meeting specific inclusion criteria set to focus upon high-quality research relevant to the topic. The evidence-based practice powerhouse Cochrane Collaboration, influential editorial organizations, and health care and scientific research publications endorse the use of these guidelines (PRISMA, 2015). Cochrane's own systematic reviews, called the

"gold standard of analyses of medical treatment" (Champkin, 2014, p. 26), incorporate aspects of PRISMA guidelines (Higgins & Green, 2011).

Canines' existing participation in service and therapeutic roles with individuals with disabilities make them an optimal focus for this research (Ensminger, 2010; Fine, 2015). Dogs' prevalence in the United States provides an additional reason for selecting them for research. Some 70 million pet dogs live in the United States, and approximately 43 million United States households include dogs (American Veterinary Medical Association, 2012). Research suggests that positive findings stemming from interaction with less common animals such as horses may be due to a fleeting novelty effect (Anestis, Anestis, Zawilinski, Hopkins, & Lilienfeld, 2014). Rather than making long-term therapeutic gains, individuals lacking frequent exposure to these animals may experience only temporary improvements. Dogs' long-standing, unique connection with humans (Payne, Bennett, & McGreevy, 2015) also makes them an optimal focus for review. As Clutton-Brock (1999) asserts, dogs and humans share a "biological link based on social structures and behaviour patterns that are closely similar because they evolved in both species in response to the needs of a hunting team, but which endure today and have become adapted to life in sophisticated, industrial societies" (p. 49).

A review of canine-assisted therapies used with individuals with ASD particular to the practice needs of recreational therapy professionals seemed necessary because similar research is limited. Extensive searching yielded one publication, a critical review by Berry, Borgi, Francia, Alleva, and Cirulli (2013), that meets similar aims. The authors of that review examined six studies involving dogs working with children with ASD. They found most studies had positive results, but described a need for larger studies with greater rigor. Publication of several highly relevant studies since 2013, application of PRISMA guidelines to the review, and the relative paucity of similar research on the topic made the present study appropriate.

Method

The study team carried out this systematic review. The team was composed of a recreational therapy educator with more than 25 years' experience in the profession and a librarian with more than 15 years' experience in health care research. Where applicable, this review followed PRISMA guidelines for systematic reviews and meta-analyses (Liberati et al., 2009). These guidelines consist of a 27-item checklist of minimum recommendations for reporting scientific studies. These internationally applied guidelines are employed frequently within clinical, epidemiological, and public health research (Fleming, Koletsi, & Pandis, 2014; Mannocci et al., 2015).

Searches of the literature took place primarily in early and mid-2016 and results were limited to those published during or after 2005 to encompass ten full years of research literature. The authors limited their search to English language publications because neither investigator is conversant outside of this language. Investigators carried out the searches in health, education, psychology, and social science information resources such as MEDLINE (EBSCOhost's Complete interface and the PubMed interface), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Database of Systematic Reviews, Education Source, ERIC, SocINDEX, and PsycINFO, as well as multidisciplinary resources including Academic Search

Complete, Google Scholar, Google Advanced Search, and USA.gov. Broader searches of the "grey literature" (information not emanating from commercial publications) were also conducted electronically with no additional relevant studies identified. Where possible, searches of the full text of articles and other publications were undertaken. An additional search took place in late 2016 to detect new, relevant publications. The authors explored relevant references from supporting literature as well. While the authors made extensive attempts to identify relevant studies, they do no assert that all possible studies meeting inclusion criteria were located, but that a best faith exploration, using the outlined searching methods, did not appear to yield qualifying studies other than those listed in this review.

Databases were searched using terms related to ASD, dogs, and therapy. Terminology relating to Asperger's was included as the diagnosis appeared frequently during the publication date range examined. Detailed phrases, advanced searching methods, tool-specific subject heading explorations, and targeted keyword tactics maximized searching potential within different tools. Multiple Boolean search logic-enriched phrases were used. As an example, the following phrase was used to mine standard database record information (article title, subject headings, abstract, keywords, journal title, etc.) and terms dealing with dogs and words applicable to ASD: *(dog or dogs or canine*)* and *(autis* or asperger*)*

Studies eligible for inclusion meet the following criteria:

- Described original quantitative, qualitative, or mixed-methods research
- Were conducted with individuals with ASD or caregivers of individuals with ASD
- Focused on the perceived therapeutic role of canines
- If other types of animals were included with canines in the study, results of canine interventions are separable
- Dealt in some way with the social interactions and/or restricted, repetitive activities of individuals with ASD
- Appeared in the literature during or after 2005 through the end of 2016 to encompass 10 years
- Were published in the English language
- Had a sample size of six or more participants
  - Sample size restriction to six or more participants should increase the likelihood of the emergence of unifying themes (Guest & Johnson, 2006). While optimum sample size varies by topic (Mason, 2010), Morse (1994) suggests a minimum of six study participants in qualitative research to begin to identify recurring themes.
- Published in an academic or professional journal or in a conference paper, dissertation, or U.S. governmental report discoverable through electronic health, education, social science, or multidisciplinary research databases and search engines.

The authors extracted and coded data from the selected studies. Variables included publication author(s), date, study design, sample size and demographics, intervention(s) employed, study duration, outcome(s), and limitations and biases. The authors drew limitations and biases from those listed within the publications themselves and from the authors' own critical examination of the studies. The authors used the "Newcastle-Ottawa Scale (NOS) for Assessing the Quality of Nonrandomised

Studies in Meta-analyses" (Wells et al., 2014) to detect additional biases. The *Cochrane Handbook for Systematic Reviews of Interventions* recommends this tool in evaluating nonrandomized studies' methodological quality (Higgins & Green, 2011).

Gough, Thomas, and Oliver (2012) note that there is as much variability in systematic review methods as there are variations in the conduct of primary research. The current review sought to incorporate as many aspects of the PRISMA guidelines as possible and modify only where needed as allowed within PRISMA. Synthesis of results presented a primary area of guideline modification. Included studies had qualitative study designs with quantitative methods mixed in. This mixed methodology, in many cases the most feasible and ethical approach to examine such topics, greatly limited inclusion of variables often recorded in systematic reviews of primarily quantitative research.

In addition to searches for studies meeting inclusion criteria, intensive literature searches were undertaken to identify relevant supporting literature, systematic review methodological guidance (in addition to the PRISMA guidelines), similar studies of animal-assisted therapies with individuals with ASD, and studies involving therapeutic canine interaction with humans independent of ASD diagnosis.

Results

Titles, abstracts, and/or similar information for more than 400 articles were screened for eligibility for inclusion in the present review. Of those, 24 articles were read, and 10 studies met inclusion criteria. An insufficient number of participants (fewer than six) presented a primary reason for exclusion of 14 studies from the final grouping. In the event multiple relevant publications emanated from one study group, multiple publications were included if those articles presented assessments of different variables (Wright et al., 2015a; Wright et al., 2015b). While 10 studies may at first seem a small number of studies for inclusion when compared to a general literature review, that number is sufficient to conduct a systematic review. Guidelines for the conduct of a systematic review do not set a minimum number of studies necessary for inclusion. The number of included studies is dependent upon whether relevant research has been conducted and whether that research has been disseminated. Cochrane's own systematic reviews may include no studies at all (Yaffe, Montgomery, Hopewell, & Shepard, 2012).

This review presents a qualitative synthesis of the studies' conduct, findings, and limitations rather than a meta-analysis because the selected studies differed by design, population, specific intervention, duration, and variables assessed. Studies employed (individually or in combination) observational, experimental, case-control, and cohort designs. Only one study used identifiable randomization methods (Fung & Leung, 2014). Table 1 provides further description of study designs, results, and limitations.

Children with ASD and/or their caregivers (often parents) comprised the most frequently studied groups, with adults with ASD living with caregivers included in one study (Grandgeorge et al., 2012). Studies from across the globe met inclusion criteria if those studies were accessible to the authors (English language and indexed in major English language research databases or web resources). Studies took place in Canada, France, Germany, Hong Kong, Ireland, the United Kingdom, and the United States. Study periods ranged from a single administration to more than one year of pre- and post-assessments.

Table 1

Selected Variables by Study

Study	Design	Sample	Duration	Methodology	Result(s)	Biases and Limitations
Burgoyne et al. (2014)	Observational study with survey of cohort of caregivers of children with ASD	Irish service dog study; 221 caregivers of children with ASD (134 with assist. dogs, 87 waiting list). Pilot study conducted.	Single admin.	Validated and study-specific scales measured caregivers' beliefs on safety, perception, and caregiver strain and confidence. Gathered open-ended responses on benefits and constraints of dogs.	Authors found significant positive view of assistance dogs' effects on safety, public perception, and decreased strain and increased feelings of competence for caregivers. Animal care = constraint.	Based on self-reports = possible recall bias and expectancy effects. Objective measures not provided to participants. Selection bias. Only caregivers interviewed.
Burrows, Adams, & Spiers (2008)	"Qualitative ethnology"; observational; interview of caregivers of children with ASD	Canadian service dog study of 10 caregivers of children with ASD	6 to 12 months, depending on date when dog assigned	Observation of video recordings of family and dog interaction and caregiver interviews	Dogs promoted safety, autonomy, social engagement. Caregivers felt presence of dogs increased awareness of ASD and status.	Interviews conducted only with caregivers; selection bias; small sample size; follow-up period limited.
Carlisle (2015)	Cross-sectional descriptive study	United States pet dog study of 70 children with ASD and caregivers	Single admin.	Service animals excluded. Telephone surveys of caregivers and children (commensurate with child's communication abilities). Caregivers received demographic survey and Social Skills Improvement System Rating Scale (SSiS-RS). Children received Companion Animal Bonding Scale (CABS).	Children with ASD with dogs had higher overall social skills scores than children with ASD without dogs. Having pets (dogs, other animals) associated with increased "assertion"-type social skills.	Selection bias, recall bias. Children with IQ <70 and children <8 years of age excluded. Children surveyed may have had difficulty with Likert scale. ASD factors may have influenced children's self-report on pet attachment, though child and caregiver reports were similar.
Fung & Leung (2014)	Experimental, pre–post design, quantitative	Hong Kong therapy dog study of 10 children with ASD	20 sessions including 14 therapy sessions	Experimental group received play therapy with dog. Comparison group received therapy with doll.	Verbal social behavior increased in therapy dog group compared with doll group.	Small sample size, brevity of intervention, no control group
Grandgeorge et al. (2012)	Cohort study using 2 questionnaires administered to caregivers of children and adults with ASD; partial "blinding" of administrators	French pet study of 260 individuals with ASD. 2 groups of 12 (dog after age 5 vs. no pet) and 2 groups of 8 (with pet vs. without).	Initial survey followed by second within year.	Social impairment assessed twice with ASD Diagnostic Interview-Revised (ADI-R) administered to caregivers; within year, telephone survey on child-pet relationships administered to caregivers. Intragroup analysis.	Pet group caregivers indicated positive behavior change (sharing, providing comfort). More interactions between children and pets noted in children with pet after age 5 than if pet present since child's birth.	Small sample size, no interview or direct observation of individuals with ASD.
Prothmann, Ettrich, & Prothmann (2009)	Prospective experimental study	German therapy dog study of 14 children with ASD.	20-min video. Tested once per week for 3 weeks	Participants offered 3 choices of entities with which to interact: person, certified therapy dog, or object like toy.	Most often chose and interacted longest with dog, then person, then object. Authors proposed dog communication > understandable.	Small sample size, no randomization of interventions, comparatively short duration.

Table 1 (cont.)

Smyth & Slevin (2010)	Qualitative, phenomenolog-ical study via in-person interview of caregivers of children with ASD	Irish assistance dog study of 7 caregivers of children with ASD.	Dogs' time with family varied from 3 months to 3 years. Single interview.	Individual, semi-structured, recorded interviews. Extracted significant perceived caregiver experiences, meanings clustered into themes, situation described. Data analysis concluded when data saturation reached.	Children had > safety, companionship, acknowledgement, motor skills. Caregivers had < anxiety. Concerns about dog training, care, death. Improved quality of life.	Small sample size; did not interview or directly observe individuals with ASD. Results subject to recall bias. Did not address changes in dog behavior over time, impact of death.
Viau et al. (2010)	Exploratory intervention study	Canadian assistance dog study of 42 children with ASD and their caregivers.	8 weeks 2 weeks prior to dog, 4 weeks with dog, and 2 weeks after dog	Caregivers measured children's salivary cortisol levels 3X each week prior to and during introduction of service dog and after dog removed. Caregivers completed questionnaire on child behavior.	Dog introduction tied to statistically significant diminished Cortisol Awakening Response (CAR). CAR increased when dog removed. Diurnal cortisol unaffected.	Comparatively short duration. Guide dog foundation helped fund and design study.
Wright et al. (2015a)	Case-control study	United Kingdom pet dog study. 62 caregivers of children with ASD. 38 dog group and 24 controls	17 weeks pre-dog, 3 to 10 weeks with dog, and follow-up at 25 to 40 weeks	Parenting Stress Index used to measure stress levels of 38 caregivers acquiring pet dog and 24 controls without dog.	Intervention group experienced improvements in total stress, parental distress, and difficult behavior. Significant number intervention caregivers moved from high to normal distress level.	Short duration. Did not interview or directly observe children. Groups not controlled for type of ASD diagnosis or child behavior. Lack of standardized measurements in linguistic abilities.
Wright et al. (2015b)	Case-control study	United Kingdom pet dog study of 70 caregivers of children with ASD	17 weeks pre-dog, 3-10 weeks during, follow-up at 25-40 weeks	Family Assessment Measure-III-Brief. 42 caregivers of children with ASD with dog, 28 without. 14 caregivers and 26 controls took Spence Children's Anxiety Scale.	Scores for family functioning improved and scores for anxiety decreased in dog group compared with non-dog group.	Comparatively short duration. Did not interview or directly observe individuals with ASD.

Selected studies primarily examined changes in social and repetitive behaviors in individuals with ASD. Most studies gathered input solely from caregivers, even in instances where researchers did not assess caregivers' own wellbeing as a variable. One study included responses from individuals with ASD commensurate with their assessed ability to communicate (Carlisle, 2015). Seven of the ten studies employed caregiver interview by phone, in person, or by paper-based survey (Table 1). In two studies, researchers observed video recordings of study participants interacting with dogs (Burrows, Adams, & Spiers, 2008; Prothmann, Ettrich, & Prothmann, 2009). One study drew upon biomarker measurements by using the salivary cortisol levels of individuals with ASD taken prior to and after canine interaction (Viau et al., 2010).

Use of terminology regarding service animals, animal-assisted therapy, and companion animals varied widely in the selected articles. While variances exist in the literature, in the United States it is more commonly understood that service animals are specifically trained for, and reside with, the individual who requires assistance. In the context of the Americans with Disabilities Act (ADA), a service dog "is defined as a dog that has been individually trained to do work or perform tasks for an individual with a disability. The task(s) performed by the dog must be directly related to the person's

disability" (United States Department of Justice, 2015). Animal-assisted activities tend to include an animal (often trained, but not always) and may be recreational in nature. Animal-assisted therapy intentionally uses a trained animal for therapeutic outcomes varying in nature (Pet Partners, 2014).

Internationally, these terms are not as consistently used. As selected studies originated from several countries, inconsistencies exist with these recently United States-standardized terms. Selected studies included trained service dogs (Burgoyne et al., 2014; Burrows, Adams, & Spiers, 2008; Smyth & Slevin, 2010; Viau et al., 2010), dogs acting primarily as companion animals (Carlisle, 2015; Grandgeorge et al., 2012; Wright et al., 2015a; Wright et al., 2015b), and dogs trained or certified for short-term therapeutic interactions (Fung & Leung, 2014; Prothmann, Ettrich, & Prothmann, 2009).

Limitations of Included Studies

A number of limitations likely affected study outcomes. Drawing information solely from researcher and/or caregiver observations presented major limitations for most studies. The accuracy of these observations in relation to the actual thoughts and feelings of individuals with ASD could not be assessed fully. In the case of the 2015 Carlisle study that includes responses taken directly from individuals with ASD, the study's author notes concern over those individuals' ability to process the Likert scale used in the research. Bias may have also affected findings of the study that used arguably the most objective measurement tool, salivary biomarkers (Viau et al., 2010). Caregivers in that study collected saliva samples from individuals with ASD, presenting the possibility that caregivers may have behaved in ways that would increase or decrease stress hormone levels in the individuals with ASD. Comparatively small sample sizes for most studies also limited applicability of study findings.

Biases may play additional roles in the outcomes of included studies. Recall bias may have affected outcomes of three studies due to their single administration format that relied upon individuals' memories of behaviors and feelings prior to dogs' arrival (Burgoyne et al., 2014; Carlisle, 2015; Smyth & Slevin, 2010). Only one study employed a nonselective alternate intervention to control for possible placebo effect (Fung & Leung, 2014). Selection bias may have affected all studies because, across studies, participants volunteered to take part or gave consent when recruited, indicating they may have already felt greater openness to interventions.

Table 1 further notes limitations and biases for the individual studies. The table summarizes variables including design, methodology and name of formal scale or questionnaire used (if applicable), sample composition and size, results, and issues of bias and limitation.

The authors of this systematic review did not mathematically assess risk of bias across studies due to the non-randomized methodology used in all but one study. Heterogeneity across study variables further complicated standard analysis.

Instead, the authors assessed methodological quality of studies using the previously discussed "Newcastle-Ottawa Scale (NOS) for Assessing the Quality of Nonrandomised Studies in Meta-analyses" (Wells et al., 2014). Table 2 shows an application of the NOS' unique star rating system to the 10 studies. The NOS awards a maximum of four stars in relation to the quality of selection criteria applied to recruitment of study participants. The scale gives a maximum of two stars pertaining to

adequacy of controlling for differences between cases and controls or exposure groups and control groups. The NOS may then award a maximum of three stars for exposures or outcomes, depending upon completeness of follow-up and quality of researchers' assessment of study findings. The authors applied the NOS to the lone study employing randomization (Fung & Leung, 2014) to provide a unified view of study analysis.

Table 2

Newcastle-Ottawa Scale (NOS) for Assessing the Quality of Nonrandomised Studies in Meta-analyses (Wells et al., 2014)

Study	Closest Match NOS Study Questions	Selection (0-4 stars)	Comparability (0-2 stars)	Exposure/Outcome (0-3 stars)
Burgoyne et al. (2014)	Cohort	***	*	**
Burrows, Adams, & Spiers (2008)	Cohort	***		**
Carlisle (2015)	Cohort	***	*	*
Fung & Leung (2014)	Case-Control	***	**	***
Grandgeorge et al. (2012)	Cohort	****	*	*
Prothmann, Ettrich, & Prothmann (2009)	Cohort	*	*	***
Smyth & Slevin (2010)	Cohort	*		*
Viau et al. (2010)	Cohort	***		***
Wright et al. (2015a)	Case-Control	****	*	**
Wright et al. (2015b)	Case-Control	****	**	***

By further analyzing results of the ten studies, the reader may identify additional reasons recreational therapists may choose to use dogs in animal-assisted interventions or therapy sessions with individuals with ASD. There also may be reason to consider recommending dog ownership to families or residences.

Three studies indicate increased positive social behaviors (Carlisle, 2015; Fung & Leung, 2014; Grandgeorge et al., 2012). These behaviors include verbal social behaviors, companionship, sharing, and providing comfort. As "persistent deficits in social communication and social interaction across multiple contexts…" are primary diagnostic criteria for individuals with ASD (American Psychiatric Association, 2013), these findings offer indication of potential clinical benefits from the use of dogs in therapy sessions or in therapeutic milieus.

Restricted, repetitive behaviors present the second diagnostic criteria for ASD (American Psychiatric Association, 2013). These behaviors may help create greater levels of anxiety as restrictive symptoms and behaviors become more severe for some individuals with ASD. Changing focus or action can cause stress and create anxiety when an individual with ASD experiences disruptions in routines or patterns of behavior. Several articles discuss reduction of stress-related behaviors, including decreased "difficult" behavior (Wright et al., 2015a), decreased cortisol awakening response (Viau et al., 2010), and decreased total stress and anxiety (Wright et al., 2015a; Wright et al., 2015b) in relation to canine-assisted interventions.

Severity levels of Autism also indicate that even the most high-functioning individuals (Level 1) have difficulty with independence due to challenges in organizing and planning (American Psychiatric Association, 2013). Four articles describe increased safety or autonomy with dogs for individuals with ASD (Burgoyne et al., 2014; Burrows, Adams, & Spiers, 2008; Carlisle, 2015; Smyth & Slevin, 2010). Recreational

therapists, whose focus is on community integration and independence, may find this aspect of canine-assisted therapy especially useful for planning and treatment.

The use of dogs within family systems may seem separate from the recreational therapist's role, but the authors of this review believe recreational therapists should understand potential animal options so that they may better advocate for individuals with ASD. Several articles note positive effects on caregivers, including decreased strain and anxiety (Burgoyne et al., 2014; Smyth & Slevin, 2010; Wright et al., 2015a; Wright et al., 2015b), and increased perceptions of competence (Burgoyne et al., 2014). One article cites improved family functioning as a benefit of dogs in the home (Wright et al., 2015b). Article authors also note that dogs increased public acknowledgement of individuals with ASD and increased public awareness and perception of ASD (Burgoyne et al., 2014). Negative factors related to dogs joining families also existed, however. Notably, caregivers had concerns over responsibilities for dog care and training as well as negative outcomes at the death of the dog (Smyth & Slevin, 2010). While financial and care burdens became apparent when dogs were added into treatment or residences, the articles indicate benefits as well. Some of those benefits relate directly to primary diagnostic criteria for ASD while other benefits align more closely with family and community systems.

Discussion and Recommendations for Future Study

All studies indicate positive outcomes from the various types of interactions dogs had with individuals with ASD. While results in one study showed no change in nonsocial variables, measures of sharing and comforting behaviors performed by individuals with ASD showed positive change within that study (Grandgeorge et al., 2012). Positive effects from dog interaction were noted in individuals' observed anxiety levels, autonomous actions, behaviors termed "difficult" by others, feelings of safety and confidence, and social engagement. In studies assessing caregivers' own feelings (Burgoyne et al., 2014; Wright et al., 2015a; Wright et al., 2015b), benefits of dog interaction were observed. Study authors note positive outcomes across dog types (companion, service, and therapy), methods of assessment (biological measurement, interview, paper survey, and video), intervention length or duration of animal relationships, and observer types (caregiver, researcher). These findings appear to support the partnering of recreational therapists with dogs as the recreational therapists would primarily employ dogs within a short-term therapeutic context. Research studies that focus specifically on individuals with ASD, their recreational therapists, and canines used in the therapeutic milieu are needed to provide a more accurate assessment of intervention efficacy within recreational therapy.

A number of limitations likely affected this review. Searches were limited to English language publications, an action which may have excluded possibly relevant studies published in other languages. While a total of 20 databases and search engines were used to identify relevant publications, and then references from those publications were explored to find additional resources, the large, more internationally focused database EMBASE was not searched due to its lack of availability at the authors' institution. EMBASE's close crossover with information found in MEDLINE and other tools that were used in the search likely controls for this limitation, however. Further, EMBASE

has as a primary strength a focus on pharmacological information, an issue not directly related to the topic of this research.

Reporting and publication biases may also have affected the review. Researchers whose studies had negative outcomes may have chosen not to report these findings in their eventual publications, or even to seek publication at all. Journal editors themselves may find research touting negative outcomes less appealing to their readership and thereby limit publication.

Individual study design further limited the review as only one study employed randomization, a strategy widely considered one of the strongest types of study design (Fung & Leung, 2014). A more traditional meta-analysis across studies may have increased the accessibility of this review's findings to individuals unfamiliar with the NOS assessment.

Regarding yet to come research on the topic, the authors recommend future teams also include, if not be led by, recreational therapists. Recreational therapists have unique and highly relevant expertise valuable in research of this type. The review authors also recommend that research on canine-assisted therapies for individuals with ASD include greater diversity in participants' age, living circumstances, and levels of function.

When possible, research should incorporate additional hallmarks of rigorous health care inquiry. While randomized controlled trials are widely considered the "gold standard" of therapeutic evidence (Bothwell, Greene, Podolsky, & Jones, 2016), there are settings and topics of inquiry in which that methodology is inappropriate or unethical. Randomization can be quite appropriate in areas relevant to recreational therapy, though, and randomization of study participants is possible even when study groups are small (for example, Fung & Leung, 2014).

Qualitative, quantitative, and mixed-methods research designs all provide important avenues in the conduct of research for recreational therapists. Relevant study method recommendations, guidelines for study conduct, and validated assessment tools are available in the literature of therapeutic recreation as well as other disciplines. Recreational therapists working within medical centers, academia, and a myriad of other settings may also draw from the expertise of colleagues. Recreational therapists can seek out collaboration across LISTSERVs, at professional conferences, and around the coffee pot.

Applications for Recreational Therapy/ Therapeutic Recreation Practice

Recreational therapists may glean several potential applications from the ten articles in this systematic review. Perhaps foremost is the need to acknowledge previously discussed selection bias. It is imperative as recreational therapists to consider participants' desire for the therapeutic modality. In the case of canine-assisted therapies, understanding participants' possible fear of dogs (or certain types of dogs), allergies, or religious restrictions, as well as their desires to participate in this type of interaction, are foundational for person-centered care. Canine-assisted therapy, regardless of support from the research, is not appropriate for everyone. In the assessment process,

if canine-assisted therapy offers a potential modality, the recreational therapist should assess clients' willingness to interact with dogs and any restrictions they may have in these interactions.

Much goes into the planning process with canine-assisted therapies. As noted in the diversity of definitions, it is imperative that recreational therapists conscientiously consider the many factors regarding the use of animals in the treatment process. The following offers a non-comprehensive listing of considerations for using dogs in animal-assisted therapy in a treatment (non-home-based) setting. The therapist should consistently follow the standards of practice for the profession (American Therapeutic Recreation Association, 2013) and incorporate evidence when implementing all recreation therapy programs.

Program Planning

- Is this a needed service at your agency? Would the addition of a therapy dog program add therapeutic benefits not already addressed?
- In what format will you provide the service? Is the use of the dog for general recreational purposes (animal-assisted activities) or treatment-oriented (animal-assisted interventions/ treatment/therapy)?
- Have you adopted risk management policies in line with respected animal-assisted therapy agencies (e.g., Pet Partners) to minimize risks for dogs, participants, and staff?
- Does the dog have certification from a reputable organization?
- Does the handler have certification from a reputable organization?

Assessment

- According to the RT program assessment protocol, are canine-assisted interventions indicated or contraindicated for a particular individual?

Treatment Planning

- Do written functional outcome goals for each participant connect assessed needs to the planned canine-assisted therapy session? Based on evidence provided in the 10 reviewed articles, potential functional outcomes to consider for participants with ASD include:
  - increased safety
  - increased autonomy
  - decreased anxiety
  - decreased overall stress levels
  - increased empathetic responses (sharing, providing comfort)
  - increased motor skills
  - decreased behaviors viewed as negative (repetitive behaviors, tantrums)
  - and increased social behaviors including: verbalizations or time spent in conversation, assertiveness, social engagement, and general social skills

Implementation

- Is there a clear protocol and/or specific program designed for the use of the dog to increase the likelihood of the expected participant outcomes? This program should incorporate current evidence on animal-assisted therapy with the preferences of the client to facilitate the most effective intervention.

Evaluation

- Are evaluation criteria in place to measure expected functional outcomes?
- Are measurements of the intervention drawn from the view of participants with ASD themselves, or only from the perspectives of their caretakers and therapists?
- Are evaluation measures in place to address the efficacy of the overall therapy program?

Documentation

- Are documentation strategies employed that will allow accurate recording of participant and program outcomes?

The role of the dog in family interactions provides another area for consideration. Several of the reviewed studies discussed the use of dogs in home-based settings. The presence of the dogs added a number of positive factors for caregivers and family members in addition to benefits for individuals with ASD. The use of canine-assisted therapy in a traditional recreational therapy group setting with caregivers and family members is a unique application. Recreational therapists often incorporate families into their sessions. This modality may provide a unique opportunity to reap benefits (decreased stress, strain, and anxiety; increased family functioning) for all members of the family. Whether or not short-term treatment sessions with a dog that does not reside with the family might address these areas is yet unknown.

Conclusion

Understanding of the role of canines in therapeutic interactions with ASD, as well as best practices within those therapies, should increase over time. This systematic review aims to add to that growing body of research. More importantly, though, the authors hope the review provides support and direction to recreational therapists who are exploring options for expanding or improving services to their clients with ASD. If a bit of dog's breath accompanies those services, all the better.

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