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Animal-Assisted Intervention and Dementia: A Systematic Review

Michelle L. Yakimicki, MS, AGPCNP[1], Nancy E. Edwards, PhD, ANP-BC[1], Elizabeth Richards, PhD, RN[1], and Alan M. Beck, ScD[1]

Abstract

This review discusses the relationship between animal-assisted interventions (AAI) and behavioral and psychological symptoms of dementia (BPSD). A systematic search was conducted within CINAHL, Web of Science CAB Abstracts, PubMed, Abstracts in Social Gerontology, Google Scholar, and PsycINFO for primary research articles. A total of 32 studies were included in the final review. Variation was noted in study designs and in study setting. Twenty-seven of 32 studies used dogs as the intervention. Agitation/aggression showed a significant decrease in nine of 15 studies. Eleven of 12 studies demonstrated increased social interaction with AAI. Mood had mixed results in nine studies. Quality of life was increased in three of four studies. Resident activity and nutritional intake were each increased in two studies. Animal assisted activities/interventions showed a strong positive effect on social behaviors, physical activity, and dietary intake in dementia patients and a positive effect on agitation/aggression and quality of life.

Keywords

dementia, animal-assisted therapy, systematic review

[1]Purdue University, West Lafayette, IN, USA

Corresponding Author:
Nancy E. Edwards, Associate Professor, School of Nursing, Purdue University, Johnson Hall, 502 N. University Street, West Lafayette, IN 47907, USA.
Email: edwardsn@purdue.edu

Background

Animal-assisted activities and therapy (AAA/T) have been utilized as a complementary therapy for a variety of medical and psychological conditions since the 1980s (Hines & Fredrickson, 1998). The terms *animal-assisted activities* and *animal-assisted therapy* are used differently in the health care arena. Animal-assisted therapy (AAT) refers to goal-directed therapy individually tailored to assist a patient in meeting criteria and outcomes. It is generally implemented under the direction of a health care professional working under their scope of practice and is revised on a regular basis as the patient's goals change (American Veterinary Medicine Association [AVMA], 2016). The AVMA (2016) defines animal-assisted activities (AAA) as an informal recreational or motivational activity where an animal is introduced by a licensed, unlicensed, or volunteer person for recreation, education, quality, and/or enjoyment to a person's life. One use for AAA/T is in the treatment of dementia.

Dementia is a major cause of disability among people over 65 years of age, and the incidence is increasing (Alzheimer's Association, 2016). In 2016, Alzheimer's dementia alone was estimated to affect 5.4 million Americans (Alzheimer's Association, 2016). It has been estimated that by the year 2050, 13.8 million Americans will have Alzheimer's dementia (Alzheimer's Association, 2016). Currently, there are no treatments that can cure or completely eliminate the behavioral and psychological symptoms of dementia (BPSD), which include aggression, agitation, depression, anorexia, and decreased physical activity (Cerejeira, Lagarto, & Mukaetova-Ladinska, 2012). At least 90% of dementia patients display BPSD (Columbo et al., 2007). These symptoms are difficult for both the patient and the caregiver and are the primary reason for the institutionalization of dementia patients. Researchers have investigated the use of complementary therapies such as music therapy, exercise therapy, AAA/T, aromatherapy, and reminiscence therapy to help reduce the negative aspects of BPSD (Hulme, Wright, Crocker, Oluboyede, & House, 2010). Some research has shown that AAA/T has been helpful in moderating some of the symptoms associated with dementia. AAA/T has been shown to increase social behavior, decrease behavior problems including agitation, decrease depressive symptoms, and decrease impairment of activities of daily living (Bono et al., 2015; Churchill, Safaoui, McCabe, & Baun, 1999; Dabelko-Schoeny et al., 2014; Edwards, Beck, & Lim, 2014; Friedmann et al., 2015). The purpose of this literature review is to identify and discuss the current available evidence surrounding the relationship between AAA/T and BPSD.

Method

Search Strategy

A systematic literature search was conducted using CINAHL, Web of Science CAB Abstracts, PubMed, Abstracts in Social Gerontology, Google Scholar, and PsycINFO for all primary research articles published through October 2016 related to the effects of AAA/T on dementia. Results were filtered to show only peer-reviewed articles. Search terms used included "animal-assisted therapy" OR "pet therapy" OR "animal-assisted intervention" OR "animal-assisted activities" AND *dementia.* In addition, PubMed was searched using MeSH terms "bonding, human-pet" AND *dementia*. The database search resulted in 204 articles, from which two additional articles were found using the ancestry search. A total of 39 duplicates were removed. Six non-English articles were excluded, and 95 non-research articles were excluded, leaving a total of 66 primary research articles.

Primary research articles were analyzed, and articles were excluded that utilized a robotic pet exclusively (17 articles), focused on dementias related to schizophrenia (four articles), included a cognitively unimpaired geriatric population (eight articles), focused on the caregiver rather than the patient (three articles), or were case-study articles (two articles; see Figure 1). Articles describing qualitative or quantitative research designs were eligible for inclusion. There was a resultant 32 articles for inclusion in this review.

Data extraction. Identified studies were examined by selected variables (if available), using the following data collection categories: (a) study design, location, setting; (b) participant characteristics: sample size, mean age, and gender; (c) intervention characteristics: animal involved, duration, intervention deliverer; (d) description of control condition; (e) outcome measures; and (f) key findings (see Table 1).

Results

Study Location, Design, and Setting

Studies included in this review were conducted in eight different countries: the United States (15 studies), Japan (four studies), Italy (three studies), Norway (three studies), Sweden (three studies), Australia (two studies), Denmark (one study), and Germany (one study). While all studies reviewed in this article investigated the effects of AAA/T on elderly patients with dementia, there were few similarities between study designs (see Table 1). Eight studies utilized a randomized controlled design (Bono et al., 2015; Friedmann et al.,

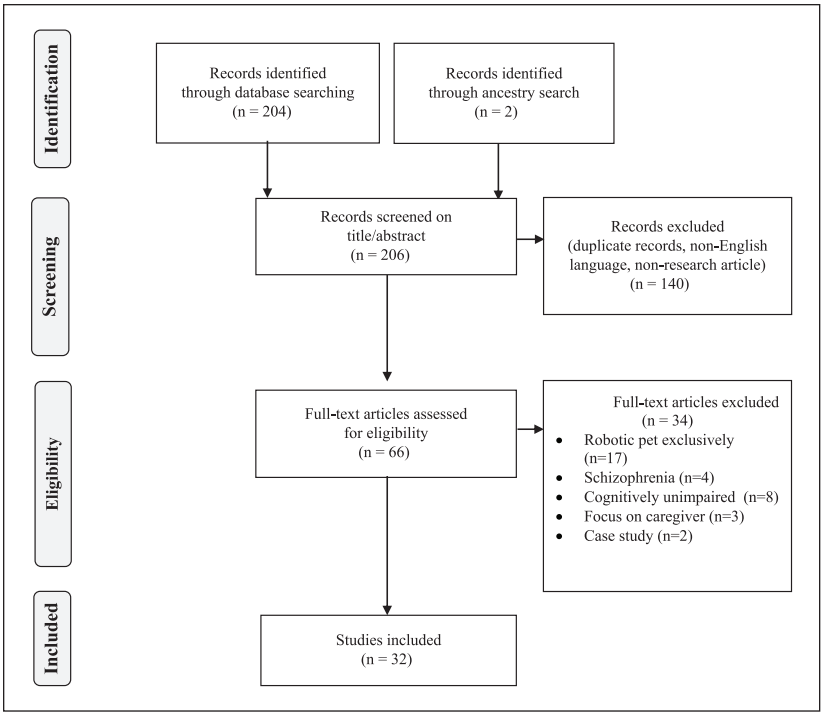

Figure 1. Flowchart of selection of studies.

2015; Nordgren & Engström, 2014b; Olsen, Pedersen, Bergland, Enders-Slegers, & Ihlebaek, 2016a; Olsen, Pedersen, Bergland, Enders-Slegers, Patil, & Ihlebaek, 2016; Pope, Hunt, & Ellison, 2016; Thodberg et al., 2016; Travers, Perkins, Rand, Bartlett, & Morton, 2013); 20 studies utilized quasi-experimental designs with multiple variations including within-subjects, randomized pretest-posttest crossover, time-series design with nonequivalent control group, within group pretest-posttest, matched pairs, test–retest non-controlled, within-participants repeated measures, nonrandomized controlled trial, and non-randomized controlled repeated measures (Batson, McCabe, Baun, & Wilson, 1998; Churchill et al., 1999; Dabelko-Schoeny et al., 2014; Edwards & Beck, 2002; Edwards et al., 2014; Greer, Pustay, Zaun, & Coppens, 2002; Kanamori et al., 2001; Kawamura, Niiyama, & Niiyama, 2007; Kongable, Buckwalter, & Stolley, 1989; Lutwack-Bloom, Wijewickrama, & Smith, 2005; Majić, Gutzmann, Heinz, Lang, & Rapp, 2013; McCabe, Baun, Speich, & Agrawal, 2002; Menna, Santaniello, Gerardi, Di Maggio, & Milan, 2016;

Table 1. Summary of Studies Utilizing Animal-Assisted Interventions and Dementia Patients.

Authors (date) Location	Study design setting	Participants: –*n*, characteristic Mean age % male	Animal Intervention description: –duration Deliverer	Control condition	Outcome measure	Results
Batson, McCabe, Baun, and Wilson (1998) United States	Within-subjects quasi-experimental ECF memory care ward	*n* = 22 patients with severe dementia 77.9 years 45% male	Dog. Six observation periods with weekly pet visits	Six observation periods without presence of animal	Burke Dementia Behavioral Rating Scale, Social behavior, blood pressure/ heart rate/skin temperature	Increase in frequency of smiles (t = 2.33*), leaning toward (t = 2.08*), duration of looks (t = 4.42**)
Bono et al. (2015) Italy	Randomized control trial AAT sessions completed at Memory Clinic	*n* = 24 patients with dementia AAT: 82.1 years Control: 78.3 years 33.3% male	Dog. Biweekly 1-hr AAT sessions for 8 months Animal trainer	Biweekly 1-hr home visits	Alzheimer Disease Assessment Scale, Barthel Index, Cornell Scale for Depression in Dementia	Lower impairment of activities of daily living**, slowing of cognitive impairment**, absence of depressive symptoms
Churchill, Safaoui, McCabe, and Baun (1999) The United States	Within-subjects quasi-experimental ECFs in memory care wards and agitated evening behavior	*n* = 28 patients with dementia (severity unspecified) 83.8 years 33.3% male	Dog. Researcher plus dog Certified therapy dog trainer	Researcher alone	Burke Dementia Behavioral Rating Scale, Agitation Behavior Mapping Instrument, medication use, social behavior	Statistically significant increase in social behavior, statistically significant decrease in agitated behavior in evening (statistics not given)
Dabelko-Schoeny et al. (2014) The United States	Randomized pretest–posttest crossover (quasi-experimental) Adult day care center	*n* = 16 patients with dementia in early or moderate stage 78.1 years 43.7% male	Horse. Petting, leading, and painting horses for 15 min each for 4 weeks Research and center staff	Activity as usual	Philadelphia Geriatric Center Affect Rating Scale, salivary cortisol levels, Nursing Home Behavior Problem Scale	Decreased behavior problems***, increased cortisol in patients with higher Mini-Mental State Exam scores***, increased self-initiated physical activity (anecdotal)
Edwards and Beck (2002) The United States	Time-series design with nonequivalent control group ECF Memory care wards	*n* = 62 patients with dementia, severity unspecified 80.1 years 38.7% male	Fish. Fish tank in dining area Available continually	Dining area with ocean scene picture	Patient weight, weight of food consumed	Intervention group has increase in food intake (t = −7.276***) and patient weight***
Edwards, Beck, and Lim (2014) The United States	Within-group pretest–posttest quasi-experimental ECF Memory care wards	*n* = 71 patients with dementia, severity unspecified 80.3 years 29.2% male	Fish. Fish tank in dining area Available continually	No fish tank in dining area	Nursing Home Disruptive Behavior Scale	Improvement in behavior with aquarium presence (F = 15.60***)

(continued)

Table 1. (continued)

Authors (date) Location	Study design setting	Participants: –*n*, characteristic Mean age % male	Animal Intervention description: –duration Deliverer	Control condition	Outcome measure	Results
Friedmann et al. (2015) The United States	RCT Assisted-living communities	*n* = 40 patients with mild to moderate dementia 80.7 years 27.5% male	Dog. 3 months of PAL (60-90 min group interventions twice per week for 12 weeks Geriatric nurse practitioner	Reminiscing activities	Apathy Evaluation Scale, Cornell Scale for Depression in Dementia, Cohen-Mansfield Agitation Inventory, Barthel Index, Actigraph Activity Monitor	Physical activity increased and depressive symptoms decreased in PAL group***.
Greer, Pustay, Zaun, and Coppens (2002) The United States	Within-subjects quasi-experimental ECF	*n* = 6 women with moderate dementia 87.8 years 0% male	Cat. Videotaped sessions with real cat, three 10-min sessions Research staff	Toy cat	Count of number of words, MIUs, verbal initiations per minute	Increase of number of words, MIU, and initiations in real cat, increase in meaningful communication (no statistics given)
Kanamori et al. (2001) Japan	Matched pairs study. Adult day care center	*n* = 27 patients with dementia, severity unspecified 79.4 years 22.2% male	Dog and cat. Six biweekly AAT sessions for seven patients over 3 months Veterinarians	Activities as usual	Mini-Mental State Exam, Nishimura's Activities of Daily Living, Salivary Chromogranin A levels, Behavioral Pathology of Alzheimer's Disease	Aggression*, phobias**, caregiving burden* significantly decreased
Katsinas (2001) The United States	Observational Adult day care program	*n* = 12 patients with moderate to severe dementia 84.0 years % male not available	Dog. Group exposure to companion dog for 6 hr 2 days per week Center staff	None	Specific goals related to social interaction and safe "wandering"	All goals met plus unintended goals of bringing out withdrawn patients and assisting in reorientation with time (day of the week). No statistics given.
Kawamura, Niiyama, and Niiyama (2007) Japan	Test–retest, noncontrolled. ECF	*n* = 10 patients with dementia, severity unspecified. Age range 75-95 years 10% male	Dog. 2-hr visits from one to four small dogs twice per month. Each participant had 30 min to interact with a dog. 12-month study duration ECF staff and therapy dog volunteers	None	Gottfries-Bråne-Steen Scale–Japanese Version, Mental Function Impairment Scale	Continual improvement in emotional comfort*. Initial improvement of mental functions* and decrease in motor functions*. Improvements stagnated at 6-month mark

(continued)

Table 1. (continued)

Authors (date) Location	Study design setting	Participants: –*n*, characteristic Mean age % male	Animal Intervention description: –duration Deliverer	Control condition	Outcome measure	Results
Kawamura, Niiyama, and Niiyama (2009) Japan	Qualitative ECF	*n* = 8 female patients with very mild to mild dementia Age range 67-94 years 0% male	Dog. AAA sessions twice monthly for 2 years Research staff and volunteers	None	Themes extracted from participant interviews	Participants were more in touch with themselves, AAA enabled self-expression, AAA was welcomed change from usual routine, visits from outsiders were found to be refreshing (no statistics given)
Kongable, Buckwalter, and Stolley (1989) The United States	Within-subjects test–retest quasi-experimental. Veteran's home memory care ward	*n* = 12 patients with dementia, severity unspecified Age range 68-88 years 83% male	Dog. Three conditions: absence of dog, temporary presence of dog, permanent placement of dog Research staff	Absence of dog	8 Pro-Social behaviors	Increase in pro-social behaviors*** in groups with temporary placement and permanent placement
Lutwack-Bloom, Wijewickrama, and Smith (2005) The United States	Randomized matched pairs design ECF	*n* = 68 patients with dementia, severity unspecified 69.9 years 41.8% male	Dog. Visits from volunteer with dog for 15-20 min 3 times per week Trained volunteers	Visits from volunteer without dog	Geriatric Depression Scale and Profile of Mood Disorders	Significant improvement in mood* in intervention group
Majić, Gutzmann, Heinz, Lang, and Rapp (2013) Germany	Matched case-control design ECF	*n* = 54 patients with moderate to severe dementia. 81.8 years 27.7% male	Dog. Treatment as usual combined w/AAT in 10 weekly 45-min individual sessions Dog therapy guides	Treatment as usual	Cohen-Mansfield Agitation Inventory	Agitation, aggression, depression remained constant*** in intervention group but increased in control group

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Table 1. (continued)

Authors (date) Location	Study design setting	Participants: –*n*, characteristic Mean age % male	Animal Intervention description: –duration Deliverer	Control condition	Outcome measure	Results
Marx et al. (2010) The United States	Observational ECF	*n* = 56 patients with dementia, severity unspecified 87.0 years 21% male	Dog. Individual engagement with a small, medium, or large dog or a dog-related activity (puppy video, robotic dog, plush dog, or dog coloring task for 3-15 min) Research staff	None	Mini-Mental State Exam, observational measures of engagement	Mean engagement duration was lower for the small dog**. Highest engagement for puppy video, followed by real dog, then dog coloring activity (*ns*).
McCabe, Baun, Speich, and Agrawal (2002) The United States	Within-participants repeated-measures design quasi-experimental ECF memory care ward	*n* = 22 patients with dementia, severity unspecified 83.7 years 31.8% male	Dog. Exposure to resident dog allowed to roam freely through the unit Staff nurse	None	Medication use, Nursing Home Behavior Problem Scale	Decrease in problem behavior after AAA during day shift ($F = 9.24$**)
Menna, Santaniello, Gerardi, Di Maggio, and Milan (2016) Italy	Non-RCT Adult day care center	*n* = 50 patients with mild to moderate Alzheimer's disease 75.0 years 26% male	Dog. AAT using ROT protocol with a dog for 45 min once weekly for 6 months Veterinarian	Same activities but with a plush dog	Mini-Mental State Exam, Geriatric Depression Scale	Improvement in depressive symptoms and improvement in Mini-Mental State Exam scores in the AAT+ROT group***
Mossello et al. (2011) Italy	Controlled repeated-measures design, nonrandomized Adult day care center	*n* = 10 patients with dementia, severity unspecified 79.0 years 60% male	Dog. 3 weeks of AAAs with live dog 3 times per week, 100 min per session AAT professional	None	Mini-Mental State Exam, Severe Impairment Battery, Activities of Daily Living, Neuropsychiatric Inventory, Cornell Scale for Depression in Dementia, Cohen-Mansfield Agitation Inventory, Observed Emotion Rating Scale, Agitation Behavior Mapping Index, Motor Behavior Observation Form	Reduced anxiety*, sadness, improved**, increased positive emotions*, increased alertness** with AAA intervention

(continued)

Table 1. (continued)

Authors (date) Location	Study design setting	Participants: –*n*, characteristic Mean age % male	Animal Intervention description: –duration Deliverer	Control condition	Outcome measure	Results
Motomura, Yagi, and Ohyama (2004) Japan	Test–retest, noncontrolled quasi-experimental ECF	*n* = 8 patients with mild dementia 84.8 years 0% male	Dog. AAT for 1 hr over 4 consecutive days Research staff	None	Apathy scale, irritability scale, Geriatric Depression Scale, Physical Self-Maintenance Scale, Mini-Mental State Exam	No significant change in irritability scale, depression scale, activities of daily living, or Mini-Mental State Exam. Significant change in apathy score* and patient enjoyment*
Nordgren and Engström (2014a) Sweden	Pretest–Posttest noncontrolled quasi-experimental ECF	*n* = 20 patients with dementia, severity unspecified 83.0 years 40% male	Dog. 10 individually tailored AAI sessions 45-60 min once or twice per week Certified therapy dog team	None	Quality of Life in Late Stage Dementia questionnaire	Improvement in total quality of life score*
Nordgren and Engström (2014b) Sweden	RCT ECF	*n* = 33 patients with dementia, severity unspecified 82.0 years 40% male	Dog. 10 individually tailored AAI sessions 45-60 min once or twice per week Certified therapy dog team	Comparable activity interventions not utilizing animals	Cohen-Mansfield Agitation Inventory, Multi-Dimensional Dementia Assessment Scale	Increase in verbal agitation in intervention group*. No other significant findings
Olsen, Pedersen, Bergland, Enders-Slegers, and Ihlebaek (2016a) Norway	RCT Adult day care centers	*n* = 80 patients with dementia or cognitive deficit Mini-Mental State Exam <25 Control: 81.7 years AAT: 84 years Control: 34.6% male AAT: 40% male	Dog. Twice weekly AAA 30-min sessions for 12 weeks Center staff		Quality of Life in Late Stage Dementia questionnaire, Brief Agitation Rating Scale	Increase in balance (p = .03) but no effect on quality of life
Olsen, Pedersen, Bergland, Enders-Slegers, and Ihlebaek (2016b) Norway	Quasi-experimental ECFs and adult day care centers	*n* = 49 patients with dementia, Mini-Mental State Exam score <25 84.0 years 46.9% male	Dog. Two 30-min AAA sessions per week for 12 weeks Certified dog handlers	Treatment as usual	Ethogram with pro-social behaviors	Increase in pro-social behaviors during activity in both groups

(continued)

Table 1. (continued)

Authors (date) Location	Study design setting	Participants: –*n*, characteristic Mean age % male	Animal Intervention description: –duration Deliverer	Control condition	Outcome measure	Results
Olsen, Pedersen, Bergland, Enders-Slegers, Patil, and Ihlebaek (2016) Norway	RCT ECF	*n* = 51 patients with dementia or cognitive deficit Mini-Mental State Exam <25 Control: 84.1 years AAT: 82.9 years Control: 34.6% male AAT: 40% male	Dog. 30-min AAA sessions twice weekly for 12 weeks Certified dog handlers	Treatment as usual	Cornell Scale for Depression in Dementia, Brief Agitation Rating Scale, Quality of Life in Late Stage Dementia questionnaire, Clinical Dementia Rating	AAA Improved depression*** and quality of life (p = .003) in patients with severe dementia
Richeson (2003) The United States	Pilot study: quasi-experimental time-series design. ECF	*n* = 15 patients with dementia, Mini-Mental State Exam score <15 86.9 years 7% male	Dog. Daily AAT for 3 weeks Recreational therapy staff	None	Cohen-Mansfield Agitation inventory and animal-assisted therapy flow sheet	No significant effect on social interactions or engagement, lower score on screaming and verbal aggression (p = .02)
Pope, Hunt, and Ellison (2016) The United States	RCT ECF	*n* = 56 patients with dementia, severity not specified 79.8 years 45.5% male	Dog. Two weekly AAT visits for 2 weeks, 10 min in length Animal handler	One-to-one human interaction	Demographic and Pet History Questionnaire, Social Behaviors checklist, Menorah Park Engagement Scale, Cohen-Mansfield Agitation Inventory	Decrease in agitated behaviors** and increase in social interactions***
Sellers (2006) The United States	Within groups quasi-experimental ECF	*n* = 4 patients with dementia, severity unspecified 87.0 years 25.0% male	Dog. Participants videotaped for 15 min per day for 4 days in AAT interventions Recreation therapy staff and animal therapist	None	Mini-Mental State Exam, Agitation Behavior Mapping Index, Social Behavior Observation Checklist	Decreased agitated behavior during AAT***, increased social behavior during AAT***
Swall, Ebbeskog, Lundh Hagelin, and Fagerberg (2015) Sweden	Qualitative ECF	*n* = 5 patients with moderate to severe dementia Age range 89-95 years 20% male	Dog. 10 videotaped AAT individual sessions per participant, 30 min in length Research staff	None	Themes and subthemes extracted and compared from 25 hr of videotaped interactions	Dog visits increased awareness of past and present experiences, feelings, and senses (no statistics available)

(continued)

Table 1. (continued)

Authors (date) Location	Study design setting	Participants: –*n*, characteristic Mean age % male	Animal Intervention description: –duration Deliverer	Control condition	Outcome measure	Results
Thodberg et al. (2016) Denmark	RCT block design ECF	*n* = 100 patients with mild to severe dementia 85.5 years 31% male	Dog. 6 weeks to twice-weekly AAA sessions, 10 min in length Research staff	Soft toy cat	Ethogram with pro-social behaviors: physical contact, talking, eye contact	Dog increased eye contact*, talking*, and physical contact***
Travers, Perkins, Rand, Bartlett, and Morton (2013) Australia	RCT ECF	*n* = 55 patients with mild to moderate dementia Control: 85.1 years AAT: 84.9 years Control: 14.3% male AAT: 29.6%	Dog. 11 weeks of dog-assisted group therapy lasting 40-50 min 2 or 3 times per week Veterinarian and psychiatric nurse	Same duration/ frequency of interaction with human therapist (no animal)	Modified Mini-Mental State Exam, Medical Outcomes Study, 36-Item Short Form Health Survey, Geriatric Depression Scale–Short Form, Multidimensional Observational Scale for Elderly Subjects, and Quality of Life–Alzheimer's Disease	Increase in quality of life score in two facilities*, improved MOSES depression scores in participants with higher (worse) baseline scores**
Walsh, Mertin, Verlander, and Pollard (1995) Australia	Matched case-control design Geriatric Psych ward of hospital	*n* = 13 patients with dementia, identified as "difficult" to manage Age not available 57.1% male	Dog. Dog visit 3 hr twice per week Animal handler	Activities as usual	London Psycho-Geriatric Rating Scale, Brighton Clinic Adaptive Behavior Scale, diastolic blood pressure, heart rate, ward noise levels (in decibels)	In presence of dog, there was a significant drop in blood pressure and ward noise levels

Note. ECF = extended-care facilities; AAA = animal-assisted activities; AAT = animal-assisted therapy; AAI = animal-assisted intervention; RCT = randomized controlled trial; PAL = pet-assisted living; MIU = meaningful information units; ROT = reality orientation therapy; MOSES = Multidimensional Observation Scale for Elderly Subjects. *$p < .05$. **$p < .01$. ***$p < .001$.

Mossello et al., 2011; Motomura, Yagi, & Ohyama, 2004; Nordgren & Engström, 2014a; Olsen, Pedersen, Bergland, Enders-Slegers, & Ihlebaek, 2016b; Richeson, 2003; Sellers, 2006; Walsh, Mertin, Verlander, & Pollard, 1995). In addition, two studies utilized a qualitative design method (Kawamura, Niiyama, & Niiyama, 2009; Swall, Ebbeskog, Lundh Hagelin, & Fagerberg, 2015), and two studies utilized an observational design method (Katsinas, 2001; Marx et al., 2010).

Extended-care facilities (ECF) provided the setting for 22 of the 32 studies, six of which were conducted in memory care wards. Of the studies not conducted in an ECF, one study was conducted in an assisted-living community (Friedmann et al., 2015), one in a geriatric psychiatric ward of a hospital (Walsh et al., 1995), six were conducted in an adult day care setting (Dabelko-Schoeny et al., 2014; Kanamori et al., 2001; Katsinas, 2001; Menna et al., 2016; Mossello et al., 2011; Olsen et al., 2016a), one at a memory clinic for community dwelling patients (Bono et al., 2015), and one study was conducted in both ECFs and adult day care centers (Olsen et al., 2016b).

Participant Characteristics

The participants were all elderly patients with dementia of varying stages. Thirteen studies controlled for severity of dementia (Batson et al., 1998; Bono et al., 2015; Dabelko-Schoeny et al., 2014; Friedmann et al., 2015; Greer et al., 2002; Kawamura et al., 2009; Majić et al., 2013; Menna et al., 2016; Motomura et al., 2004; Olsen et al., 2016b; Richeson, 2003; Swall et al., 2015; Travers et al., 2013), and the remaining 19 studies did not.

The range of mean age for the studies varied from 69.9 years (Lutwack-Bloom et al., 2005) to 87.8 years (Greer et al., 2002). A common thread between all included studies was the small number of participants. The largest conducted study included 100 participants (Thodberg et al., 2016) while the smallest study included only four (Sellers, 2006). As would be expected from the age group studied, the majority of studies included a higher percentage of female participants than men, with some conducted exclusively on women (Table 1).

Intervention Characteristics

All but five of the included studies utilized one or more dogs as the intervention animal. Of the five non-dog studies, two used fish (Edwards & Beck, 2002; Edwards et al., 2014), one used horses (Dabelko-Schoeny et al., 2014), one used cats (Greer et al., 2002), and one used both a cat and a dog (Kanamori et al., 2001). Duration of contact with the utilized animals varied widely between studies. The shortest duration of contact consisted of three 10-min videotaped human-cat interaction sessions conducted by Greer et al. (2002).

Kawamura et al. (2009) conducted the longest study in the group, consisting of two bimonthly human-dog interaction sessions over a span of 2 years.

Study Outcomes: Agitation and Aggression

Agitation in dementia can include physical or verbal outbursts, pacing, obsessive behaviors (such as shredding tissues), restlessness, and emotional distress (Alzheimer's Association, 2017). Agitation can be distressing to both the patient and the caregiver. Perhaps even more distressing to the caregiver is aggressive behavior. Aggressive behavior is that which threatens or directs assault toward another being or the environment and is said to occur in up to 50% of dementia patients (Cipriani, Vedovello, Nuti, & Di Fiorino, 2011). AAA and AAA/T were investigated to determine their effect on the behavioral symptoms of agitation and aggression in the dementia population.

Fifteen studies measured outcomes related to agitation and/or aggression, making it the most frequently occurring dementia symptom studied (Churchill et al., 1999; Dabelko-Schoeny et al., 2014; Edwards & Beck, 2014; Friedmann et al., 2015; Kanamori et al., 2001; Majić et al., 2013; McCabe et al., 2002; Motomura et al., 2004; Nordgren & Engström, 2014b; Olsen, Pedersen, Bergland, Enders-Slegers, Patil, & Ihlebaek, 2016; Pope et al., 2016; Richeson, 2003; Sellers, 2006; Travers et al., 2013; Walsh et al., 1995). Nine of these 15 studies found statistically significant decreases in agitation and aggression with the implementation of an AAA/T program (Churchill et al., 1999; Dabelko-Schoeny et al., 2014; Edwards, Beck & Lim 2014; Friedmann et al., 2015; Kanamori et al., 2001; McCabe et al., 2002; Pope et al., 2016; Richeson, 2003; Sellers, 2006). One study specifically targeted "sundowning" behaviors (Churchill et al., 1999) and found a statistically significant decrease ($p < .05$) in the evening-time agitated behaviors exhibited by the participants. Two studies (Motomura et al., 2004; Olsen, Pedersen, Bergland, Enders-Slegers, Patil, & Ihlebaek, 2016) found no significant change in agitation with the AAA/T interventions. Majić et al. (2013) did not find a significant change in agitation or aggression in their study of 54 German nursing home patients with moderate-to-severe dementia; however, the control group, which received treatment as usual, was found to have a significant increase in agitation and aggression over the course of the 10-week study. Increased aggression in the AAA/T intervention group was found in only one study, conducted by Nordgren and Engström (2014b; $p = .035$).

Study Outcomes: Social Behavior

Social behaviors show engagement with another person or animal and include physical contact, eye contact, or talking to a person or animal (Kongable

et al., 1989). Twelve studies examined the impact of AAA/T on social behavior in elderly patients with dementia (Batson et al., 1998; Churchill et al., 1999; Greer et al., 2002; Katsinas, 2001; Kawamura et al., 2009; Kongable et al., 1989; Olsen et al., 2016b; Pope et al., 2016; Richeson, 2003; Sellers, 2006; Swall et al., 2015; Thodberg et al., 2016). Only one study (Pope et al., 2016) found no significant change in pro-social behaviors between the intervention and control groups, although anecdotal observations during this study suggested a positive influence of the dog on the social interaction of the participants. The remaining studies found significant increases in social behaviors in the AAA/T intervention groups. Batson et al. (1998) found all measured social interaction factors to increase significantly in the presence of a dog. The measured social interactions included duration of leaning forward ($p < .5$), frequency of smiling ($p < .05$), frequency of tactile contact ($p < .01$), frequency of looking ($p < .05$), and praise frequency ($p < .01$).

Thodberg et al. (2016) compared pro-social behaviors in cognitively impaired nursing home patients when exposed to a person with a dog versus a stuffed cat or robot seal ("PARO"). While the dog and robot seal both increased physical contact, talking, and eye contact initially, only the dog intervention sustained continued pro-social behaviors over time. This was theorized to be related to the limited set of interactive features of the robot compared with a live dog and the loss of novelty over time.

In addition to the basic indicators of social activity, several studies noted that patients were reoriented by the presence of an animal (Katsinas, 2001), were better able to express themselves (Kawamura et al., 2009; Greer et al., 2002; Swall et al., 2015), became more aware of their surroundings (Marx et al., 2010), and more oriented to present time (Katsinas, 2001; Swall et al., 2015).

Study Outcomes: Mood

Depression or mood was specifically measured in nine studies (Bono et al., 2015; Friedmann et al., 2015; Lutwack-Bloom et al., 2005; Majić et al., 2013; Menna et al., 2016; Mossello et al., 2011; Motomura et al., 2004; Olsen, Pedersen, Bergland, Enders-Slegers, Patil, & Ihlebaek, 2016; Travers et al., 2013). Mood outcomes were found to be more heterogeneous between studies than social behaviors were. Friedmann et al. (2015) found a significant reduction in depressive symptoms in the AAA/T intervention group ($p = .000$). Lutwack-Bloom et al. (2005) found a significant increase in the Profiles of Mood State (POMS) score of patient mood in their animal intervention group ($p = .02$) but no significant decrease in the Geriatric Depression Scale (GDS) scores of the intervention group. Another study found no significant change in mood with the implementation of AAA/T (Motomura et al., 2004). Two studies

(Bono et al., 2015; Majić et al., 2013) found a steady increase in depressive symptoms in the control group while the AAA/T intervention group's depression level remained stable. Travers et al. (2013) found statistically significantly decreased depressive symptoms only for those with advanced dementia ($p < .01$). A pilot study by Menna et al. (2016) showed improved GDS scores in Alzheimer's patients when AAA/T was combined with reality orientation therapy. One study found significant decreases in depression only among their AAA/T participants with severe depression (Olsen, Pedersen, Bergland, Enders-Slegers, Patil, & Ihlebaek, 2016).

Study Outcomes: Quality of Life

The impact of animal interventions on quality of life indicators were included in four studies (Nordgren & Engström, 2014a; Olsen et al., 2016a; Olsen, Pedersen, Bergland, Enders-Slegers, Patil, & Ihlebaek, 2016; Travers et al., 2013). Nordgren and Engström (2014a) found a statistically significant increase in quality of life for elderly patients with dementia who received AAA/T sessions when compared with a control group ($p = .035$). In another study, dementia patients in two of the three participating Australian nursing homes experienced a statistically significant increase in quality of life score after participating in AAA/T compared with a control group ($p = .02$; Travers et al., 2013). One study found increase in quality of life scores only for patients with severe dementia who participated in an AAA/T trial (Olsen, Pedersen, Bergland, Enders-Slegers, Patil, & Ihlebaek, 2016) while another found no statistical change in quality of life with the AAA/T intervention (Olsen et al., 2016a).

Study Outcomes: Activity and Diet

Two studies targeted physical activity levels (Dabelko-Schoeny et al., 2014; Friedmann et al., 2015), and both showed increases in physical activity during AAA/T interventions. Dabelko-Schoeny et al. (2014) engaged dementia patients from an adult day care center in equine activities including leading, brushing, and painting on horses during day trips to a farm. The physical activity level of the intervention group was compared with the same group participating in similar enriching activities (i.e., songs, crafts) at the adult day care center. The participants in the horse interventions were found to be more physically engaged during the activities than they were during the normal activities at the day care center. Friedmann et al. (2015) compared the activity level of dementia patients in an assisted-living facility when they were involved in dog-related activities (grooming, dog-assisted range

of motion, playing) with reminiscence activities. Activity levels were measured based on calorie expenditure over basal metabolic rate. The intervention group increased their calorie expenditure compared with the control group.

One study investigated food intake in the presence of fish aquariums (Edwards & Beck, 2002) and found significant increase in quantity consumed at mealtimes as well as increase in patient weight when the patients were seated in view of aquariums compared with a control dining area without an aquarium.

Discussion

In reviewing the benefits of utilizing AAA/T to alleviate some of the BPSD, there is general consensus as to its efficacy in improving social functioning. Batson et al. (1998) suggested that a dog may activate a basic form of socialization in humans that is still within reach to those affected by all levels of dementia. While most studies included a dog as the intervention animal, the increased level of socialization behaviors was seen in all studies, regardless of the species used.

The outcomes of agitation/aggression, depression, and quality of life were more heterogeneous. Continued research examining the effects of AAA/T on these topics should help clarify which interventions are found to be most effective. Further studies will be necessary to determine whether patients with an affinity toward animals respond more favorably to AAA/T, as well as what duration and frequency of exposure to animals will generate the best outcomes.

Whether or not the participants in the studies were screened or categorized as being someone who currently or previously had strong relationships with a companion animal may be an important consideration for practice settings. All studies noted that participants were screened out if they were allergic to the animal being used in the study or if animal-averse. However, no studies exist that compare the effectiveness of AAA/T on animal lovers versus individuals who are indifferent or who never owned a pet. Another challenge for future research is to examine effective methods for administering AAA/T interventions. This may vary depending on the setting. A patient living at home with a spouse or caregiver may benefit from time spent with a house pet. Due to limitations in caring for an animal, potential for allergic reactions in some patients, and health code violations, a nursing home patient with dementia may have to utilize the services of a visiting animal. There are no studies examining the differences between the effectiveness of group versus individual therapy or the differences between trained therapy animals versus

untrained "lay" animals. There were not obvious differences between studies using goal-directed individualized AAT sessions and studies using more unstructured free time with animals (AAA), as such, this would be another beneficial area of investigation. Finally, as mentioned previously, more studies with more rigorous methods are needed to determine what baseline frequency and duration of animal exposure is the most beneficial to alleviating the BPSD patients. For example, studies with a longer follow-up period would extend knowledge on the duration of the impact of AAA/T interventions. In addition, the more consistent use of standardized measures would allow generalizability across studies.

Implications for Clinical Practice and Policy

A case can be clearly made that the benefits of implementing some form of animal interaction for dementia patients far outweighs the risks, if any. Facilities that may be hesitant to bring a trained animal therapist on staff might be well served to invite volunteers or staff members to bring healthy, vaccinated, well-behaved pets for scheduled visits to the milieu. Patients could self-select to interact with the animals and in essence create an unofficial trial. This would determine which patients appear to benefit the most from animal interactions. Facilities or individuals with access to a comprehensive therapy department would benefit from hiring a recreational therapist with experience in animal therapies. Primary care providers can advocate for animal interactions to benefit the behavioral and psychological symptoms suffered by dementia patients. Animal therapy may not be appropriate for every patient, but the evidence strongly suggests that for some patients, animal interactions can provide an enriching activity with documented results. Decreasing BPSD increases dementia patients' quality of life.

Long-term care staff can also be positively impacted by the implementation of AAA/T in their facility. Decreasing disruptive behaviors in residents would likely contribute to increased job satisfaction of staff and could potentially decrease turnover. This would be an area for future study.

Limitations

The wide array of symptoms measured across the included articles is a limiting factor in this systematic review. Study designs and statistical methods also varied widely, making it difficult to compare studies. The small number of participants in all of the included studies is problematic to the strength of the evidence.

Conclusion

The majority of studies have found that animal-assisted interventions (AAI) are effective in reducing the BPSD. This review has identified multiple areas for continued research and intervention refinement. The relatively small number of randomized controlled trials (RCTs), wide array of study designs, and small sample sizes continue to pose problems in building a strong case for practice implementation. AAIs will undoubtedly continue to be investigated as an alternative to medication administration for the reduction of BPSD, to the benefit of many dementia patients.

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ORCID iDs

Nancy E. Edwards https://orcid.org/0000-0002-3477-8094
Alan M. Beck https://orcid.org/0000-0002-0661-7672

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Author Biographies

Michelle L. Yakimicki, MS, AGPCNP, is a nurse practitioner in internal medicine at Indiana University Health Arnett, West Lafayette, Indiana.

Nancy E. Edwards, PhD, ANP-BC, is an associate professor at Purdue School of Nursing, West Lafayette, Indiana.

Elizabeth Richards, PhD, AN, is an assistant professor at Purdue School of Nursing, West Lafayette, Indiana.

Alan M. Beck, ScD, is the director, Center of the Human-Animal Bond, and a professor in the Department of Comparative Pathobiology, College of Veterinary Medicine, Purdue University, West Lafayette, Indiana.