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REVIEW

Animal-assisted therapy for dementia: a review of the literature

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ABSTRACT

Background: Animal-assisted therapy (AAT) is gaining popularity as part of therapy programs in residential aged care facilities. Humans and pet dogs respond to quiet interaction with a lowering of blood pressure and an increase in neurochemicals associated with relaxation and bonding. These effects may be of benefit in ameliorating behavioral and psychological symptoms of dementia (BPSD).

Methods: Medline, PsychInfo and CINAHL databases (1960–2005) were searched for papers on AAT or pets and dementia. Publications of controlled trials that measured the effect of AAT for dementia were reviewed.

Results: Several small studies suggest that the presence of a dog reduces aggression and agitation, as well as promoting social behavior in people with dementia. One study has shown that aquaria in dining rooms of dementia care units stimulate residents to eat more of their meals and to gain weight but is limited by the small number of facilities studied. There is preliminary evidence that robotic pets may provide pleasure and interest to people with dementia.

Conclusions: Current literature suggests that AAT may ameliorate BPSD, but the duration of the beneficial effect has not been explored. The relative benefits of "resident" *versus* "visiting" pet dogs are unclear and are confounded by the positive effect of pet interaction on staff or caregivers. Further research on the potential benefits of AAT is recommended.

Key words: AAT, pet therapy, dementia, challenging behaviors, BPSD

Introduction

Human–animal interactions are becoming a focus of research in an attempt to document claims that animals make humans feel better and serve as aids to

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communication, reaching those who show little response to other stimuli. Dogs have evolved with humans for more than 10,000 years (Lange, 2002) and feature prominently in animal-assisted therapy (AAT) practice and research. Humans and pet dogs respond to quiet interaction with a lowering of blood pressure and an increase in neurochemicals associated with relaxation and bonding (Odendaal and Meintjes, 2003). This physiological reaction may contribute to effective pet therapy.

AAT most commonly involves interaction between a client and a trained animal, facilitated by a human handler, with a therapeutic goal such as providing relaxation and pleasure, or incorporating activities into physical therapy or rehabilitation (e.g. brushing a dog with a stroke-affected limb). The therapeutic effect may depend on the interaction with the animal as well as with the handler. The therapeutic possibilities of companion animals have been described by Baun and McCabe (2003) with reference to the stage of dementia and the positive effect on caregivers. However, research documenting therapeutic effect is difficult to design and perform (Wilson and Barker, 2003).

Behavioral and psychological symptoms of dementia (BPSD) are common (Patterson and Bolger, 1994), are a major source of informal caregiver ill health (Burns and Rabins, 2000) and cause significant distress to residential care staff (Wood *et al.*, 1999). These problems are likely to become more common with the predicted exponential increase in the prevalence of dementia (Henderson and Jorm, 1998). While medication has a role in the management of more severe behavior problems, there has been a growing call to focus on psychosocial methods as alternative or supplemental interventions, particularly given the potential for adverse medication effects. Despite a burgeoning literature on psychosocial interventions in dementia, the number of rigorously-controlled studies is limited (Bird *et al.*, 2002).

Methods

This paper reviews studies that have investigated whether AAT has a measurable beneficial effect for people with dementia and specifically upon BPSD. Medline, PsychInfo and CINAHL databases (1960–2005) were searched using a combination of "animal-assisted therapy" or "pet and dementia" as key words. The bibliography of Barker *et al.* (2003) was used to identify papers published between 1996 and 2001. References cited in relevant publications were used to identify further studies. General descriptions (e.g. Laun, 2003), reports of uncontrolled and/or informal observations (Katsinas, 2000) and studies of residents without dementia (e.g. Fick, 1993; Winkler *et al.*, 1989) were excluded.

The settings, design outcome measures and findings of reviewed studies are presented in Tables 1 and 2.

Results

Reducing agitation and/or aggression

Several studies have evaluated the impact of AAT on agitation and aggression in Special Care Units (SCUs), which are designed to manage the challenging behaviors of individuals with dementia. Churchill *et al.* (1999) introduced pet therapy visits during the difficult "sundown" time (1700–1730 hours) in three SCUs to examine the effect on residents with a history of agitated "sundowning" behavior. Residents exhibited significantly less agitated/aggressive behavior when interacting with an investigator and a dog compared to interacting with the investigator when a dog was not present. This effect was not related to the severity of dementia. The researchers also documented more social behaviors in the presence of a dog (see below). This study controlled for human-interaction effects by using the handler without a dog for control sessions. However, its observations were limited by only being made on two 30-minute occasions. The duration of the calming effect after the dog's departure and the variability in resident response over time were not explored. The authors do not mention whether residents were regularly visited by dogs and handlers or if their exposure to AAT was a novel experience.

The impact of introducing a resident dog into an SCU was documented by McCabe *et al.* (2002). Data were collected 1 week before and for the first 4 weeks after placement of the dog. There was a significant reduction in daytime behavioral disturbances among residents, but no difference in the regular use of mood-altering medications. The instrument used, the Nursing Home Behavior Problem Scale (NHBPS; Ray *et al.*, 1992) (see Table 1), reflected residents' behavior over 3 days rather than just during interaction with the dog and thus better reflected the global effects of the intervention compared to measures taken only during the presence of the dog. It was limited by being administered by facility staff who may have been influenced by their own reactions to the dog. The investigators do not mention whether residents' medication was reviewed during the study period. If not reviewed, no change in scheduled medication would be expected. The facility studied routinely used environmental features such as an aquarium, caged birds, non-toxic plants and frequent visits from non-resident dogs. The study did not examine the longer-term effect of the resident dog.

Walsh *et al.* (1995) investigated the effect of a visiting therapy dog on the behavior of patients in a psychiatric ward. Behavioral rating scale scores did not

Table 1. Summary of studies showing effects of AAT for dementia

STUDY	COUNTRY; SETTING	PARTICIPANTS	DESIGN	OUTCOME MEASURES	FINDING
Impact on anxiety and aggression					
Churchill *et al.*, 1999	U.S.A.; SCUs of three extended care facilities	28 (seven men, 21 women), BDBRS 22.2 (3–37), agitated behavior in evening	Videotape of two 30-minute sessions of researcher alone or researcher + dog in common area	ABMI	Agitated behaviors significantly lower when dog present. No *p*-values given
Fritz *et al.*, 1995	U.S.A.; private homes	146 surveys distributed by Alzheimer's disease referral center. 64 completed (26 men, 38 women); 34 pet exposed	Caregiver survey + medical records of dementia severity Control group comprised survey respondents without pets	Caregiver report of noncognitive symptoms	Those with pets have less verbal aggression ($p < 0.005$)
Kanamori *et al.*, 2001	Japan; dementia day program at psychiatric hospital	Seven subjects (two men, five women), 20 controls (four men, 16 women) with dementia diagnosed by DSM-IV criteria	AAT sessions with either a dog or cat every 2 weeks or normal activities, over 3 months	BEHAVE-AD	Scores on BEHAVE-AD significantly improved ($p = 0.029$) for the AAT group, but were unchanged for controls. Groups not well matched at baseline. Mean baseline control group BEHAVE-AD score 5.45 *vs.* 11.14 for AAT group, no *p*-value given
McCabe *et al.*, 2002	U.S.A.; SCU of extended health-care facility	22 (seven men, 15 women) resident in Alzheimer's SCU	Data collection 1 week before and weekly for 4 weeks after introduction of resident dog	NHBPS, medication review form	Problem behaviors were significantly decreased after introduction of a resident dog ($p < 0.05$). No medication change
Richeson, 2003	U.S.A.; SCUs of two nursing homes	15 (one man, 14 women) with MMSE $\leq$ 15 and diagnosis of dementia in medical record	Small group 1 hour AAT sessions with a visiting dog daily for 3 weeks, data collection at baseline, after 3 weeks of AAT and 2 weeks washout after the end of AAT	CMAI	A significant decrease in agitation after 3 weeks of AAT ($p = 0.001$) and a significant increase after AAT ceased ($p = 0.000$)
Walsh *et al.*, 1995	Australia; two closed wards of a psychiatric hospital	Seven subjects (four men, three women), six with dementia, one with schizophrenia; seven matched controls	LPRS and BCABS before and after 12-week study period. Dog visit for 3 hours twice per week during study. Blood pressure, heart rate and noise measurements prior to AAT and at end of session	LPRS, BCABS, blood pressure, heart rate, ward noise level	No difference in LPRS or BCABS. Slight drop is diastolic blood pressure within experimental group over 12 weeks. Reduced heart rate after AAT session in experimental group ($p = 0.021$). Reduced noise on experimental ward ($p = 0.001$)

Table 1. (Continued)

Impact on social behavior					
Churchill *et al.*, 1999	U.S.A.; SCUs of three extended care facilities	28 (seven men, 21 women), BDBRS 22.2 (3–37)	Videotape of two 30-minute sessions of researcher alone or researcher + dog in common area	Frequency and duration of social behaviors	Significant increase in frequency of touch, leans, smiles, verbalization and looks. Significant increase in duration of smiles, verbalization and looks
Greer *et al.*, 2001	U.S.A.; nursing home	Six women with moderate dementia based on MMSE and FAST	ABACA withdrawal design. Three 10-minute sessions each for baseline, withdrawal and intervention phases (toy or real cat). Half of the subjects received toy cat first; half had real cat first	Count of total number of words, MIU and verbal initiations per minute from videotape recording	Live cat resulted in greater number of total words, MIU and initiations. Each group responded more favorably to the first intervention. There was an increase in meaningful communication in the presence of real cats
Kongable *et al.*, 1989	U.S.A.; SCU of Veteran's nursing home	12 (10 men, two women) diagnosed with Alzheimer's disease	Six observation periods in sets of two (group and individual) pre-treatment, during weekly pet visits and 2 weeks after permanent placement of dog	Observational checklist	Significantly more social behaviors when dog present ($p < 0.001$). No difference between weekly visit and permanent placement or between group and individual settings
Richeson, 2003	U.S.A.; SCUs of two nursing homes	15 (one man, 14 women) with MMSE $\leq$ 15 and diagnosis of dementia in medical record	Small group 1 hour AAT sessions daily with visiting dog for 3 weeks, data collection at baseline, after 3 weeks of AAT and 2 weeks after the end of AAT	AAT flow sheet	Significantly more interaction in final week of AAT when compared with first week ($p = 0.009$)
Impact on nutrition					
Edwards and Beck, 2002	U.S.A.; SCUs of three nursing homes	62 (24 men, 38 women), 17 controls crossover to treatment	Treatment group has fish tank in dining area. Control has picture for 2 weeks, 2 weeks washout, then fish tank introduced to dining area	Resident weight, weight of food consumed at meals	No difference in food intake during exposure to picture or washout period for control group. Experimental group has significant increase in food intake ($p < 0.001$) and in monthly resident weight ($p < 0.000$)

ABMI, Agitated Behaviors Mapping Instrument (Cohen-Mansfield, 1986b); BCABS, Brighton Clinic Adaptive Behaviour Scale (Wood and Britton, 1984); BDBRS, Burke Dementia Behavioral Rating Scale (Haycox, 1984); BEHAVE-AD, Behavioral Pathology in Alzheimer's Disease (Reisberg *et al.*, 1987); CMAI, Cohen-Mansfield Agitation Inventory (Cohen-Mansfield, 1986a); FAST, Functional Assessment Tool for Alzheimer's Type Dementia (Reisberg *et al.*, 1985); LPRS, London Psycho-Geriatric Rating Scale (Hersch *et al.*, 1978); MIU, Meaningful Information Units; MMSE, Mini-mental Status Examination (Folstein *et al.*, 1975); NHBPS, Nursing Home Behavior Problem Scale (Ray *et al.*, 1992); SCU, Special Care Unit.

Table 2. Studies of the response to robotic pet substitutes

STUDY	COUNTRY; SETTING	PARTICIPANTS	PET SUBSTITUTE	DESIGN	OUTCOME MEASURES	FINDING
Tamura *et al.*, 2004	Japan; nursing home	13 (one man, 12 women) residents with severe dementia Mean GBS = 66	AIBO® dog robot and battery-powered toy dog	Videotape scoring of 5-minute sessions with four groups of three subjects. *Experiment* 1: 4 days. Toy dog presented first, then AIBO. *Experiment* 2: 3 days. AIBO daily, but in plush clothes on day 2	Patient and OT activity changes counted during session	*Experiment* 1: 985 reactions to toy dog; 608 to AIBO. 374 and 749 OT interventions for toy and AIBO, respectively. *Experiment* 2: No effect if AIBO in plush clothes. Most interest on first day
Libin and Cohen-Mansfield, 2004	U.S.A.; nursing home	Nine women with moderate to severe dementia GDS 5.4 (4–7)	NeCoRo® cat robot and plush toy cat	Two 10-minute interactive sessions on different days – one with NeCoRo and one with plush cat. Six NeCoRo first, three plush first	ABMI, affect via LMBS, Engagement (duration, attitude, attention, intensity)	Significantly lower agitation ($p = 0.036$ physical, $p = 0.046$ overall) with plush cat; $p = 0.078$ overall with NeCoRo. Increased pleasure ($p = 0.007$) and interest ($p = 0.028$) with NeCoRo; $p = 0.111$ and $p = 0.052$, respectively, for plush cat. No difference in engagement, but 78% held plush cat, 22% held robot

ABMI, Agitated Behaviors Mapping Instrument (Cohen-Mansfield, 1986b); GBS, Gottfries–Bråne–Steen score; GDS, Global Deterioration Scale (Reisberg *et al.*, 1982); LMBS, Lawton's Modified Behavior Stream (Lawton *et al.*, 1996); OT, occupational therapist.

change after the 12-week experimental period. However, there were effects on blood pressure and heart rate, which were measured immediately before and after AAT sessions or at the same times of day in controls. Heart rate was significantly reduced ($p = 0.021$) in the AAT group, suggesting a calming effect of AAT. The general noise level on the experimental ward was lowered owing to a decrease in loud and/or aggressive outbursts while the dog visited. It is not clear why the findings using the behavior scale did not reflect this result. Staff and investigators noted more social interactions among patients and between patients and staff during the dog visits. These positive effects were not long-lasting and patients reverted to their former behavior after the dog was removed.

Kanamori *et al.* (2001) documented the impact of AAT using either a dog or a cat in a dementia day-program. Cognitive function, measured by the Mini-mental Status Examination (MMSE; Folstein *et al.*, 1975) and Nishimura's activities of daily living (N-ADL; Yamashita *et al.*, 1988), remained unchanged for AAT and control groups, but participants in the AAT program made significant improvements in behavior after 3 months when compared to those in the normal day program. Decreases in subscales of the Behavioral Pathology in Alzheimer's Disease (BEHAVE-AD) rating scale for aggressiveness ($p = 0.045$), anxieties ($p = 0.004$) and caregiving burden ($p = 0.047$) accounted for the improvement in overall behavior scores. Limitations of this study included subscale scores being based upon interviews with family members, who may have been biased towards perceiving improvements. In addition, the control and intervention groups were not well matched at baseline.

The effect of a resident pet in private homes was investigated by Fritz *et al.* (1995). On the basis of caregivers' reports, patients with Alzheimer's disease who had pets in the home displayed significantly less verbal aggression when compared to those not exposed to pets. Greater attachment to pets was associated with significantly fewer mood disorders, but other measures of psychiatric morbidity were unchanged. Findings were unchanged when adjusted for severity of dementia. The study's limitations included being a postal survey with a 46.8% response rate.

Richeson (2003) performed a small pilot study of nursing home residents with agitated behavior who participated in daily AAT sessions with visiting therapy dogs for 3 weeks. Agitated behaviors decreased significantly immediately after the AAT intervention, but increased when sessions were discontinued. There was no significant correlation between MMSE scores and the measure of agitated behaviors.

Promoting social behavior

One of the earliest and most widely-cited studies of social behavior during AAT is that of Kongable *et al.* (1989), who used an observational checklist

to document social behavior among SCU residents. When the dog was present, either visiting or living on the SCU, residents displayed significantly more social behaviors: smiles, laughs, looks, leans, touches and verbalization. Observations of interactions between residents and the dog were made soon after the dog's introduction to the unit. The investigators noted that two residents expressed aggression toward the dog, which occurred more frequently upon the animal's permanent placement.

Churchill *et al.* (1999) used criteria similar to those of Kongable *et al.* (1989), but also measured the duration of the social behaviors using video footage of their study participants. Both duration and frequency of social behavior significantly increased in the presence of a visiting "therapy dog".

Greer *et al.* (2001) documented the effect of toy *versus* live cats on communication in a small group of elderly women with dementia. Live cats stimulated more communication both during their presence and immediately afterwards, but numbers were small and the order of presentation of the live and toy cats may have been a confounding factor.

In the study by Richeson (2003), a recreational therapist completed an AAT flow sheet (Richeson and McCullough, 2002) daily for each participant during a 3-week intervention of daily group AAT with a "therapy dog". This validated instrument rated nine behaviors using a four-point Likert response format. Responses from the first and last weeks of the intervention were compared to determine whether residents were more responsive over time. Significantly greater resident responsivity was observed in the last week.

Improving nutrition

Edwards and Beck (2002) introduced specially-designed aquaria into the dining areas of three SCUs. Two facilities were treatment facilities and one was the control, later crossing over to the treatment condition. In all facilities, food intake in residents with Alzheimer's disease was measured by weighing the food consumed in meals and weighing residents. Baseline measurements were made daily for 2 weeks in all facilities. In the treatment facilities, a fish tank was introduced, while the control facility received a "scenic ocean picture." For the next 2 weeks, the food consumed in each meal was weighed, while residents were weighed weekly throughout the study. After the first 2 weeks of the intervention, food intake was measured one day each week for the subsequent 6 weeks. In the control group, the picture was removed after 2 weeks and a 2-week washout period was allowed before crossover into the treatment group with introduction of an aquarium into the dining room.

The scenic picture had no effect upon food intake or resident weight in the control group. When fish aquaria were present in the dining room of treatment facilities, residents ate more of their meals and gained weight. Staff reported

that agitated residents were calmer when contemplating the aquaria, while those who were usually lethargic remained more alert and attentive. These effects were maintained throughout the 8-week study period. Nutritional intake in treatment facilities increased throughout the study and was significantly greater in the 6-week period of weekly measures than during the initial 2-week treatment. The authors report that the aquaria also served as a focal point for social interactions between residents and visitors. Increased food intake at mealtimes not only improved the health of residents but also saved the facilities money as there was less need for nutritional supplements.

The role of pet substitutes

While recognizing the health benefits of pets, robots have been proposed as reasonable substitutes for animals without the responsibility and space requirements of a dog or cat. Eachus (2001) suggests that robots may be the pets of the future, with sensors allowing the robot to respond to emotional changes and also to monitor the health status of the owner. Commercially available robots are not yet this sophisticated, but they have been investigated as alternatives to AAT for individuals with dementia, as summarized in Table 2.

Tamura *et al.* (2004) used AIBO® (Sony Corporation, Japan) and a battery-powered toy dog for occupational therapy sessions. AIBO is a robot pet simulator that can walk, respond to commands, and sense its environment through touch, sight and hearing. The battery-powered dog was covered in a plush fabric, could wag its tail and sit, but did not respond to commands. The residents with dementia responded with interest to AIBO but they responded more readily to the battery-powered toy dog, and did so with less encouragement from the occupational therapist. Residents were reluctant to touch AIBO, even when it was dressed in furry "clothes" that made it feel and look more like the toy dog. Neither AIBO nor the toy dog stimulated patients to reminisce about the past or about pets.

In a small study, Libin and Cohen-Mansfield (2004) compared the responses of nursing home residents to a robotic cat (NeCoRo®, made by Omron Corporation, Japan) and a plush toy cat. Both cats showed a significant effect on some behaviors. The robotic cat evoked a significant increase in pleasure and interest. However, few residents held the robot cat, although it had a furry outer covering, while most held the plush cat. There was a correlation (significant for some parameters) between increasing dementia and decreasing engagement with both cat substitutes. The results of this study require confirmation.

Severity of dementia and response to AAT

Several studies that have controlled for the severity of dementia have found that the positive response to AAT is independent of dementia severity (Churchill *et al.*,

1999; Fritz *et al.*, 1995; Richeson, 2003). However, Libin and Cohen-Mansfield (2004) found a correlation between increasing severity of dementia and decreasing engagement with cat-substitutes. The failure of certain studies to detect a correlation between dementia severity and AAT response may either reflect a real lack of relationship or the studies may have included an inadequate range of cognitive impairment or have been insufficiently powered.

Discussion

The current body of literature describing AAT interventions for dementia indicates possible benefit, but many factors make it difficult to make generalizations and recommendations on the basis of these results.

The mode of AAT

AAT can be divided into individual therapy (see Banks and Banks, 2002), the more common group AAT and resident pets. Current literature suggests that AAT using dogs has a calming and socializing effect. The presence of a dog is a powerful social catalyst among unimpaired people in the community (McNicholas and Collis, 2000) as well as among nursing-home residents generally (Fick, 1993), so it is not surprising that this is the case among those with dementia. There is also evidence that a pet stimulates positive reminiscence among residents or between residents and visitors or caregivers (Churchill *et al.*, 1999; Fick, 1993; Katsinas, 2000; Richeson, 2003; Walsh *et al.*, 1995).

However, the relative efficacy of each mode of AAT, their applicability to different dementia populations and sources of confounding bias have not been well studied. In addition, the percentage of people with dementia who would or would not benefit from contact with a dog has yet to be determined. Most visiting pet-study participants have a prior history of positive interaction with animals and their results are restricted to such individuals. Selection bias on the part of the dog and handler occurs: if the dog or resident hesitate to interact, this is not forced. The interaction with the handler may be an important component of the beneficial effect of AAT, although the results of Crowley-Robinson *et al.* (1996) and Churchill *et al.* (1999) suggest otherwise.

The differential impact of visiting *versus* resident dogs is unknown. Visiting dogs are encouraged by a handler to interact with all interested clients. Both McCabe *et al.* (2002) and Winkler *et al.* (1989) report that a resident dog spends much of its time with staff or with only a few residents. While Fritz *et al.* (1995) suggest that regular contact with a pet may improve the behavior of those with dementia, the caregivers surveyed may have been affected by their own positive response to the pet, thus biasing their reports. Winkler *et al.* (1989) similarly

suggest that staff ratings of resident behavior following AAT are likely to be biased.

The characteristics of those residents who benefit from AAT, the most effective mode of AAT, the differential impact of the dog and the handler, the consistency of response and bias from differences in interactions (e.g. resident *versus* visiting dogs) deserve further study using "blind" raters.

In practice, residents with dog fur allergy, fear of dogs, or aggression when in the presence of dogs should not be exposed to dogs. Aggressive residents present a danger to the animal, the handler, facility staff and other residents and should generally be excluded from AAT. Individual differences (e.g. certain residents may react adversely to seeing a dog in the distance) and cultural differences in the acceptance of pets must be considered. The extra responsibility placed on caregivers, residents' role, if any, in caring for a dog and the impact of the dog on caregivers (positive or negative) also require consideration.

Sample size

Studies of AAT for dementia to date have been limited by small sample sizes (Table 1). The largest AAT study reviewed (Edwards and Beck, 2002) provides support for further research into the impact of introducing aquaria into dining rooms of aged care facilities. Such research needs to control for potential bias introduced by differences between facilities and ideally should study a large number of facilities using the facility as the unit of randomization. The results to date suggest that the introduction of aquaria, while requiring an initial investment, may save money in the longer term while improving the physical health of residents with dementia.

Duration of the AAT effect

The duration of the impact of AAT is unclear. Churchill *et al.* (1999), Kongable *et al.* (1989), Richeson (2003) and Walsh *et al.* (1995) showed significant improvements in resident behavior during interaction with a "therapy dog". Walsh *et al.* (1995) noted that the behavior of residents and noise level on the psychiatric ward studied returned to normal levels immediately after the "therapy dog" was removed. More longer-term effects were shown by Fritz *et al.* (1995), Kanamori *et al.* (2001), McCabe *et al.* (2002) and Richeson (2003) using instruments reflecting general behavior as distinct from behavior only measured during the pet therapy interaction. Only Richeson (2003) repeated measurements after a post-intervention washout period, finding that behavior returned to baseline 2 weeks after regular therapy sessions were discontinued.

The studies of Kongable *et al.* (1989) and McCabe *et al.* (2002) do not fully assess the effect of a resident dog, as final data collection was less than 6 weeks after introduction of the dog. Winkler *et al.* (1989) studied perceptions and

social interactions among staff and residents without significant dementia. Both staff and residents had an increase in interaction 6 weeks after introduction of a resident dog. At 22 weeks, however, the interaction of residents had returned to baseline levels, while interaction among staff remained higher. Future research should include measures during the interaction with the therapy dog as well as medium- , long-term and post-intervention follow-up measures.

Dose response

Dose response has not been studied for AAT in dementia but was examined by Banks and Banks (2002), who investigated whether AAT reduced loneliness among cognitively intact elderly residents of long-term care facilities. Participants were randomized to three groups: no AAT (control), AAT once a week or AAT three times a week. At the end of the 6-week study, both AAT groups experienced significantly less loneliness than controls, but there was no difference between the two AAT groups. Further research is needed to determine the optimal frequency of AAT visits for residents of aged care facilities in general and whether this differs for those with dementia.

Cumulative effect

Some evidence suggests that residents respond more to AAT over time. Subjects in the study by Richeson (2003) were more responsive in their third week of AAT than during the first week. Crowley-Robinson *et al.* (1996) studied the effects of visiting or resident dogs in nursing homes at approximately 3-month intervals for more than a year and found a gradual reduction in negative aspects of mood among residents receiving AAT over the course of the study. The authors did not measure the cognitive status of study participants.

The role of pet substitutes

There is preliminary evidence that robotic pets may provide pleasure and interest to people with dementia. However, real pets look and feel very different to currently available robots and toys. They are adept at reading human body language, initiate interactions and respond appropriately to subtleties of body language. Real pets also show genuine affection and pleasure during interactions, which, in turn, bring pleasure to the human involved. The small study of Greer *et al.* (2001) suggests that real animals may stimulate more communication than plush toys. Larger studies are needed, as are studies comparing live animals with more sophisticated robots. It is important to determine whether the impact of robotic pets is like that of an electronic game or like that of a real animal.

Conclusion

AAT appears to offer promise as a psychosocial intervention for people with dementia. The optimal frequencies and duration of AAT sessions, as well as the optimal format of such sessions, need systematic study. The possibilities for reducing or eliminating scheduled psychotropic medication among residents with BPSD by introducing AAT should be investigated. The potential for robotic pets to assist people with dementia deserves further investigation. Overall, the quality of current studies is limited. Future research needs to use "blind" raters larger, and well-designed studies, that are randomized when possible.

Conflict of interest

None.

Description of authors' roles

This review grew from R. Llewellyn-Jones' long-term interest in psychosocial interventions for dementia and S. Filan's experience as a pet therapy volunteer for Velma's Pets As Therapy in Sydney, Australia. S. Filan reviewed the literature, drafted the paper and contributed to editing and revising. R. Llewellyn-Jones evaluated the literature, assisted by writing, editing and revising, and placed the AAT studies in the context of literature on interventions for dementia.

References

Banks, M. R. and Banks, W. A. (2002). The effects of animal-assisted therapy on loneliness in an elderly population in long-term care facilities. *Journal of Gerontology. Series A, Biological Sciences and Medical Sciences*, 57, M428–M432.

Barker, S. A., Rogers, R. S., Turner, J. W., Karpf, A. S. and Suthers-McCabe, H. M. (2003). Benefits of interacting with companion animals. *American Behavioral Scientist*, 47, 94–99.

Baun, M. M. and McCabe, B. W. (2003). Companion animals and persons with dementia of the Alzheimer's type: therapeutic possibilities. *American Behavioral Scientist*, 47, 42–51.

Bird, M., Llewellyn-Jones, R. H., Smithers, H. and Korten, A. (2002). *Psychosocial approaches to challenging behaviours in dementia: a controlled trial*. Report for the Commonwealth Department of Health and Ageing: Office for Older Australians. Canberra: Commonwealth Department of Health and Ageing.

Burns, A. and Rabins, P. (2000). Carer burden in dementia. *International Journal of Geriatric Psychiatry*, 15 (Suppl. 1), S9–S13.

Churchill, M., Safaoui, J., McCabe, B. W. and Baun, M. M. (1999). Using a therapy dog to alleviate the agitation and desocialization of people with Alzheimer's disease. *Journal of Psychosocial Nursing*, 37, 16–22.

Cohen-Mansfield, J. (1986a). Agitated behaviors in the elderly: II. Preliminary results in the cognitively deteriorated. *Journal of the American Geriatrics Society*, 34, 722–727.

Cohen-Mansfield, J. (1986b). *Guidelines and Suggestions for Administering the Agitation Behavior Mapping Instrument.* Rockville, MD: Research Institute of the Hebrew Home of Greater Washington.

Crowley-Robinson, P., Fenwick, D. C. and Blackshaw, J. K. (1996). A long-term study of elderly people in nursing homes with visiting and resident dogs. *Applied Animal Behavior Science*, 47, 137–148.

Eachus, P. (2001). Pets, people and robots: the role of companion animals and robopets in the promotion of health and well-being. *International Journal of Health Promotion and Education*, 39, 7–13.

Edwards, N. E. and Beck, A. M. (2002). Animal-assisted therapy and nutrition in Alzheimer's disease. *Western Journal of Nursing Research*, 24, 697–712.

Fick, K. M. (1993). The influence of an animal on social interactions of nursing home residents in a group setting. *American Journal of Occupational Therapy*, 47, 529–534.

Folstein, M. F., Folstein, S. E. and McHugh, P. R. (1975). "Mini-mental state." A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12, 189–198.

Fritz, C. L., Farver, T. B., Kass, P. H. and Hart, L. A. (1995). Association with companion animals and the expression of noncognitive symptoms in Alzheimer's patients. *Journal of Nervous and Mental Disease*, 183, 459–463.

Greer, K. L., Pustay, K. A., Zaun, T. C. and Coppens, P. (2001). A comparison of the effects of toys versus live animals on the communication of patients with dementia of the Alzheimer's type. *Clinical Gerontologist*, 24, 157–182.

Haycox, J. (1984). A simple reliable clinical behavioral scale for assessing demented patients. *Journal of Clinical Psychiatry*, 45, 23–24.

Henderson, A. and Jorm, A. (1998). *Dementia in Australia*. Canberra: Australian Government Publishing Service.

Hersch, D. L., Kral, V. A. and Palmer, R. B. (1978). Clinical value of the London Psycho-Geriatric Rating Scale. *Journal of the American Geriatrics Society*, 26, 348–354.

Kanamori, M. *et al.* (2001). A day care program and evaluation of animal-assisted therapy (AAT) for the elderly with senile dementia. *American Journal of Alzheimer's Disease and Other Dementias*, 16, 234–239.

Katsinas, R. P. (2000). The use and implications of a canine companion in a therapeutic day program for nursing home residents with dementia. *Activities, Adaptation and Aging*, 25, 13–30.

Kongable, L. G., Buckwalter, K. C. and Stolley, J. M. (1989). The effects of pet therapy on the social behavior of institutionalized Alzheimer's clients. *Archives of Psychiatric Nursing*, 3, 191–198.

Lange, K. E. (2002). Wolf to woof. *National Geographic*, 2–11.

Laun, L. (2003). Benefits of pet therapy in dementia. *Home Healthcare Nurse*, 21, 49–52.

Lawton, M. P., Van Haitsman, K. and Klapper, J. (1996). Observed affect in nursing home residents with Alzheimer's disease. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 51, P3–P14.

Libin, A. and Cohen-Mansfield, J. (2004). Therapeutic robocat for nursing home residents with dementia: preliminary inquiry. *American Journal of Alzheimer's Disease and Other Dementias*, 19, 111–116.

McCabe, B. W., Baun, M. M., Speich, D. and Agrawal, S. (2002). Resident dog in the Alzheimer's special care unit. *Western Journal of Nursing Research*, 24, 684–696.

McNicholas, J. and Collis, G. M. (2000). Dogs as catalysts for social interactions: robustness of the effect. *British Journal of Psychology*, 91, 61–70.

Odendaal, J. S. J. and Meintjes, R. A. (2003). Neurophysiological correlates of affiliative behaviour between humans and dogs. *The Veterinary Journal*, 165, 296–301.

Patterson, M. and Bolger, J. (1994). Assessment of behavioral symptoms in Alzheimer disease. *Alzheimer's Disease and Associated Disorders*, 8 (Suppl. 3), 4–20.

Ray, W. A., Taylor, J. A., Lichenstein, M. J. and Meador, K. G. (1992). The Nursing Home Behavior Problem Scale. *Journal of Gerontology: Medical Sciences*, 47, M9–M16.

Reisberg, B., Borenstein, J. B., Salob, S. P., Ferris, S. H., Franssen, E. and Georgotas, A. (1987). Behavioral symptoms in Alzheimer's disease: phenomenology and treatment. *Journal of Clinical Psychiatry*, 48 (supplement), 9–15.

Reisberg, B., Ferris, S. H., de Leon, M. J. and Crook, T. (1982). The Global Deterioration Scale (GDS): an instrument for the assessment of primary degenerative dementia. *American Journal of Psychiatry*, 139, 1136–1139.

Reisberg, B., Ferris, S. and Franssen, E. (1985). An ordinal functional assessment tool for Alzheimer's-type dementia. *Hospital and Community Psychiatry*, 36, 593–595.

Richeson, N. E. (2003). Effects of animal-assisted therapy on agitated behaviors and social interactions of older adults with dementia. *American Journal of Alzheimer's Disease and Other Dementias*, 18, 353–358.

Richeson, N. E. and McCullough, W. T. (2002). An evidence-based animal-assisted therapy protocol and flow sheet for the geriatric recreational therapy practice. *American Journal of Recreational Therapy*, 1, 25–31.

Tamura, T. *et al.* (2004). Is an entertainment robot useful in the care of elderly people with severe dementia? *Journals of Gerontology. Series A: Biological Sciences and Medical Sciences*, 59A, 83–85.

Walsh, P. G., Mertin, P. G., Verlander, D. F. and Pollard, C. F. (1995). The effects of a 'pets as therapy' dog on persons with dementia in a psychiatric ward. *Australian Occupational Therapy Journal*, 42, 161–166.

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

Winkler, A., Fairnie, H., Gericevich, F. and Long, M. L. (1989). The impact of a resident dog on an institution for the elderly: effects on perceptions and social interactions. *The Gerontologist*, 29, 216–223.

Wood, R. T. and Britton, P. G. (1984). *Clinical Psychology with the Elderly*. Beckenham: Croom Helm.

Wood, S., Cummings, J., Barclay, T., Hsu, M., Allahyar, M. and Schnelle, J. (1999). Assessing the impact of neuropsychiatric symptoms on distress in professional caregivers. *Aging and Mental Health*, 3, 241–245.

Yamashita, M. *et al.* (1988). A new clinical scale for rating of mental states and activities of daily living of the elderly (NM scale and N-ADL). *Japanese Journal of Clinical Psychiatry*, 17, 1653–1668.