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TRAINED ASSISTANCE DOGS FOR PEOPLE WITH DEMENTIA: A SYSTEMATIC REVIEW

Short running title: TRAINED ASSISTANCE DOGS IN DEMENTIA

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TRAINED ASSISTANCE DOGS FOR PEOPLE WITH DEMENTIA: A SYSTEMATIC REVIEW

Abstract

This systematic review investigated evidence for the effectiveness of trained assistance dogs as an intervention and support for people with dementia. Peer-reviewed articles were retrieved from multiple databases (SCOPUS, Web of Science, and Google Scholar). Reference lists of the articles retrieved were also screened to identify key authors for inclusion. Articles were subject to a quality review, and the results synthesised to address the research questions. Both qualitative and quantitative data were reported. There was evidence of the potential positive effects of dog-assisted interventions in relation to mood, prosocial behaviours, activities of daily living and/or quality of life, cognitive impairment and symptoms specific to dementia, and existential functions. However, the form and quality of the studies varied considerably. It was concluded that further research is needed, particularly for those with Younger Onset Dementia (YOD), for whom there were no specific studies available. Attention needs to be given to establishing adequate sized samples and designs incorporating control groups. Research would benefit from employing mixed-methods, allowing for the triangulation of qualitative and quantitative data. For deteriorating conditions such as the dementias, studies need to be conducted over time. Furthermore, given the important place family members play in the lives of those with dementia, the effects of dog-assisted interventions on the wider family should also be considered.

MeSH Keywords:

Animal assisted therapy

Dementia

Early onset Alzheimer disease

Introduction

Therapy animals

The use of therapy and assistance animals is generating considerable interest across the fields of health, education, and community services. This is in part built on research into interspecies emotional recognition, and quality of life.^{1,2} As documented by Filan and Llewellyn-Jones³: '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 communication, reaching those who show little response to other stimuli.' While they observe that dogs are a primary area of interest, evolving with humans for over 10,000 years,⁴ research has investigated a range of therapy, assistance and companion animals. These have included insects,⁵ fish,⁶ horses,⁷ pets in general^{8,9} and robotic animals including dogs, cats and seals¹⁰⁻¹⁴.

Assistance, therapy and companion dogs have been used with people with a broad range of disabilities and support needs, with the best known being in the areas of assistance dogs for people who are deaf, blind or vision-impaired. There is an emerging field of data on the use of assistance dogs for people with post-traumatic stress disorders (PTSD) and other areas of mental health, dogs that detect cancers, seizures and so forth, dogs that support people with autism spectrum disorders (ASD), those that work with children with intellectual disabilities, and so on. Particular note should be made here of the recent La Trobe University report (2016), *Reviewing Assistance Animal Effectiveness*, that reviewed the literature across the use of assistance animals (predominantly dogs), and across a broad spectrum of disabilities and health issues. This report also looked at training concerns and risks. It did not however, address the area of specific concern in this literature review, being that of the use of trained assistance dogs for people with Alzheimer's disease and more specifically younger onset dementia, and the effect of trained assistance dogs in intervention and support for this growing group in our community.

The primary focus of this review was on the use of trained assistance dogs, working on a regular one-to-one basis in residential settings. Here though it should be recognised that research into the use of assistance, companion and therapy dogs is a diverse field, and varies from case research about single therapy animals that are brought into various settings (e.g., as adjuncts to music-therapy in residential care), and single animals that are residents themselves in residential settings, through to trained assistance dogs that are placed with an individual for an extended period of time (i.e., similar to the placement of guide dogs). Subsequently, we sought to address the question of what if any effects these animals might have on the health, wellbeing and

quality of life of those living with dementia, and what was the quality of the evidence available. Furthermore, we sought to establish what might the need be for future research in this area, and if so what might be the key features of such research.

Dementia and Alzheimer's Disease

The term *dementia* is used very broadly to address a range of conditions. The most commonly known of these is Alzheimer's disease. Aetiology is variable, and often far from clear (if at all), except in cases such as vascular dementia, Korsakoff's Syndrome (which is alcohol related), dementia with Lewy bodies and genetic disorders such as Huntington's disease. Dementia is progressive, and is marked by ongoing deterioration in the cognitive and physical functional of the individual living with the disorder. Confusion and loss of memory may be early markers, along with declining rationality and intellect, loss of language skills, diminishing social skills and personality changes. Normal emotional reactions may decrease, and in some cases increased volatility of emotional reactions is evident. Loss of physical function can include bladder and bowel incontinence, and ultimately, inability to swallow.

It is notable that while the majority of people with dementia are diagnosed when they are over 65 years, people with younger onset dementia (YOD) (sometimes referred to as Early Onset Dementia – EOD) may be far younger, with diagnosis occurring among people as young as in their 30s. Estimating the prevalence of younger onset dementia is problematic, with some figures suggesting 156 people out of every 100,000 in the 60–64 age group,¹⁵ though this is probably an underestimation of the prevalence in the wider population, given many people do not present early for diagnosis.

The primary focus of contemporary intervention and support, given the current lack of cure, is to maintain, and ideally improve the quality of life for the person with dementia and family members who take on a primary care role. To these ends, diverse non-pharmaceutical interventions are practised, and a number of these was evident amongst the literature located during the current literature search.¹⁶⁻²¹ Such interventions include Cognitive Behavioural Therapy, occupational therapy, music-based activity, focussed memory training, physical activity such as walking and other exercise, behaviour modification, and psycho-education. Some of these interventions included carers and family members, as well as the person living with dementia.

This systematic literature review investigates the efficacy of trained assistance dogs as an intervention and support for people experiencing dementia. Here it is important to not only review what has been found, but also evaluate the strength of the current evidence base and to determine what needs to be done to address short-comings in the literature. It is concerns such as these, relating to the possible lack of rigour and

limited capacity to generalize findings, that have been expressed by policy makers and funding bodies. This review aims to determine the methodological strengths and validity of the extant literature on the use of trained assistance dogs with people with younger onset dementia and/or Alzheimer's disease, and to evaluate what needs to be done to address any potential limitations to the current evidence-base to better inform decisions by policy makers and agencies or organisations which are called upon to provide financial support for the provision of such assistance dogs.

Methods

A systematic review of peer-reviewed articles and international reports was conducted, informed by the *Social Care Institute of Excellence Guidelines (SCIE, 2016)*,²² and the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Guidelines*.²³ Both were referred to given the mix of qualitative and quantitative literature on this topic, and an integrated guideline²⁴ used when appraising the quality of articles for inclusion.

Design

The databases searched included Scopus, Web of Science and Google Scholar. Other databases were initially scanned, but failed to yield articles of interest. The database searches were supplemented by a review of the bibliographies and reference lists of the key and significant papers that were seen as adding to the understanding of the literature and the field. The grey literature (such as reports by government agencies, leading community advocacy and education organizations, service providers, and other Web-based information) was also searched.

Search strategy & quality review

The following search terms were used to identify relevant papers: dementia, Alzheimer's disease, younger onset dementia, early onset dementia, assistance dogs, therapy dogs, service dogs, therapy animals, animal assisted therapy, and companion animals. Where applicable in the databases, allowance was made for truncations/word stems, plurals, and phrases.

It is important to note that some authors²⁵ draw a distinction between animal-assisted therapy and animal-assisted activities. We acknowledge these differences exist in definition, but for the purposes of this review opted to include both varieties to provide a critical mass for analysis. We also acknowledge that trained assistance dogs or service dogs 'are specially trained to perform tasks for an individual with a disability. Service dogs may go where animals may not normally... but they must be with their

handler at all times.’²⁶ In contrast, a therapy dog ‘is animal employed by schools, nursing homes, hospitals and other areas to provide happiness and comfort for individuals.’²⁷ Given the dearth of replicable studies of trained assistance dogs for people living with Alzheimer’s/dementia, we chose to include therapy and companion dogs if the context was replicable drawing on acceptable quantitative or qualitative methodologies.

No exclusions were made to the parameters of the search, other than the need for the relevant key terms, and no date limitations were defined. No requirements were set for articles to be written in English only. A summary of the selection process is provided at Figure 1.

Results

Overall, we found the literature to provide valid and reliable data addressing the potential effects of dog-assisted interventions in relation to: mood, prosocial behaviours, activities of daily living and/or quality of life, cognitive impairment and symptoms specific to dementia, and existential functions. These outcomes are summarised in Table 1 . Each of the areas of outcome is summarised briefly below, and linked by citation to the associated researchers.

Effects of dog-assisted interventions in relation to measures of mood

Measures of mood consider dimensions such as stress, pride, depression, apathy laughter and general homeostatic well-being. These may be measured behaviourally, or indeed through biological functions, such as salivary CgA, blood pressure and so forth. Eleven of the studies²⁸⁻³⁸ investigated the value and efficacy of dog-assisted interventions in areas specially related to mood, although other studies also crossed into this area less specifically.

Effects of dog-assisted interventions in relation to prosocial behaviours

Increased emotional well-being and management of behavioural sequelae of dementia may include memory, social interactions and communication, the development of friendships. Ten studies³⁹⁻⁴⁸ in particular explored prosocial and antisocial behaviours, with varying outcomes.

Effects of dog-assisted interventions in relation to scales of daily activity and/or quality of life

Scales of daily activity and quality of life addresses such areas as renewed sense of purpose, change in exercise and physical activity, increases in mobility, enhanced bonding and development of friendships, and general feelings of well-being. Thirteen (13) studies⁴⁹⁻⁶¹ measured the value and efficacy of dog-assisted interventions on areas related to daily activity and quality of life, with differing methodologies and results.

Effects of dog-assisted interventions in relation to cognitive impairment and dementia

Six studies⁶²⁻⁶⁷ considered the value and efficacy of dog-assisted interventions on areas specifically related to cognitive impairment and dementia. Measures addressed increased cognitive awareness, such as enhanced skills in learning new things and completing new tasks, mental and physical stimulation, and enhanced memory.

Effects of dog-assisted interventions in relation to existential functions

This outcome included increased or sustained self-determination, ability to reflect and remember, and to place oneself in the world. Existential functions were largely explored by phenomenological hermeneutic approaches. Analyses were carried out to seek emerging themes, such as love and attachment, meaning of life, self-worth and other existential issues⁶⁸⁻⁷⁰.

Discussion and Conclusions

This review investigated the efficacy of trained assistance dogs as an intervention and support for people experiencing dementia. The search revealed no papers that specifically addressed the issue of assistance dogs for those with younger onset dementia. This was surprising as this is an emerging area of dementia that is generating considerable interest amongst medical and gerontological professionals. It is also an area of concern as people with younger onset dementia move into residential care facilities that are designed for an older client base. This absence of literature strongly suggests the need for research into the intervention and support needs of people with younger onset dementia generally, and the potential of assistance animals more specifically. There was also a dearth of literature exploring the efficacy of assistance dogs with people with dementia more generally.

What did the papers show overall?

To be included in the final analysis, the literature reviewed necessarily met several criteria: it explored the use of trained assistance dogs, therapy dogs or companion dogs; the participants in the study were people living with Alzheimer's/dementia; and the context was replicable drawing on acceptable quantitative or qualitative methodologies. Single case studies and narratives were excluded. While there was only a very limited number of papers that finally met all selection criteria, we did find the literature provided generally valid and reliable data that addressed the potential effects of dog-assisted interventions in relation to: mood, prosocial behaviours, activities of daily living and/or quality of life, cognitive impairment and symptoms specific to dementia, and existential functions.

Nine of the twenty-five papers finally selected reported on the effect of the varying use of dogs on mood, but outcomes were not consistent. Kanamori *et al's*⁷¹ data on salivary CgA and stress is very interesting piece of work as a quantitative/physiological measure, and one of the few of this type that was evident. This research measured mental stress and also utilised a control group. It reported that for the experimental group there was a significant decrease in behavioural pathology, which was not evident in the control group. Other studies utilised a variety of tools, including the Mini Mental State Exam, Cornell Depression in Dementia Scale, Geriatric Depression Scale, Multi-dimensional observational scale for elderly patients (MOSES). However, no really clear pattern of effect was evident across the various studies, although general interpretation is that there was improvement in mood related measures. Studies that focussed specifically on pro-social behaviours also showed inconsistent outcomes. Richeson⁷² used the Cohen-Mansfield Agitation Scale, and found a statistically significant decrease in agitated behaviours and an increase in pro-social behaviours. Here it must be noted that all studies had very limited timeframes, and it was not possible to document changing effects across time in a condition which is known to deteriorate over time.

Scales of daily activity/quality of life were used in seven studies, with variable methodologies and results. Mental State batteries, phenomenological observations (without baseline measures), and Quality of Life in Later Stage Dementia Scale (QUALID) were used in a several studies. Outcomes suggested that the dog assisted therapy was more effective in people with severe dementia, but that may also be a factor inherent in the nature of the assessment tool. Nursing diaries were used in one study for example. Studies that utilised phenomenological hermeneutic approaches to evaluate existential functions also showed limited outcomes. Overall, results were again inconsistent, and timeframes were limited.

Several studies measured the nature of cognitive impairment in relation to dementia. Bono *et al*⁷³ used the Alzheimer's Disease Assessment Scale (ADAS) in a controlled randomised study suggested a slowdown in cognitive impairment in the experimental group. Swall's several studies used phenomenological hermeneutic studies to document time with a dog shows the person with dementia recounting memories and feelings. Once again however, results appeared inconclusive and would have benefitted from matching with contemporaneous quantitative data. The work of Menna *et al*⁷⁴⁻⁷⁵ showed slight statistically significant improvement using AAT with formal ROT protocols.

What were the limitations of the available research?

The available literature showed very little consistency in the quality and training of the dogs, and how they were used within the research. Only three of the papers specifically addressed the use of trained assistance or service dogs. Two of these related to the use of technology, such as smart phones, with assistance dogs. The choice of dogs used in the various studies appeared to be extremely random, with some seemingly the pets of the therapists, some pound animals, and the occasional extensively trained dog of various varieties. None of the dogs were described as having been bred for therapy work (in the way guide dogs for the blind are), and degree of training varied from several years (which was the exception), through to minimal or none. Furthermore, where training was reported, there were insufficient details provided to allow for replication.

None of the papers addressed the allocation of an assistance dog to a particular participant, and certainly not on a full time basis. All the dogs were predominantly used in animal assisted therapy, or as companion animals assigned to a group of individuals on a part-time basis. The length of exposure time was inconsistent, but relatively short, or on an intermittent basis. Similarly, while some of the projects ran for a year on a part-time basis, most were for shorter periods, such as twelve weeks.

In general, the current evidence base could be described as inconsistent. Research rigour, either statistically or qualitatively, was absent in much of the literature reviewed, with a predominance of single case studies and narratives (all of which were eliminated from the final review). While these themselves contribute much to the general picture, they lack methodological power and rigour, and are seldom replicable. Of the remaining more methodologically rigorous studies, there was a wide diversity of sample sizes, and of measures of change. Most studies only used one or two measures, and on a number of occasions, did not start with a baseline measure against which to compare any potential change. As with other areas of research relating to the needs of those with Younger Onset Dementia, there is a need for further research employing

stronger research designs, conducted over time, and including the capacity to control for potentially confounding factors (cf Sansoni *et al* ⁷⁶).

The Need for further research

It must be argued that this review of the use of trained assistance dogs for people with dementia demonstrates a clear need for further research. Based on the current review, it is imperative that there is an adequate sized sample of participants, that the dogs are allocated to live with the participants on a full time basis, and that the program runs over an extended period of time, of at least a year. In order to provide a replicable project, data should consist of a wide battery of carefully selected psychometric tests that are repeated over the duration of the project to provide a baseline and ongoing outcomes. The research would be well served if these quantitative data could be triangulated with a consistent set of qualitative outcomes from an interview protocol. Considering that we initially aimed to review the literature relating to younger onset dementia but this was notably absent from the literature, it is recommended that such research should target this group, and their carers. Furthermore, given the important place family members play in the lives of those with dementia, the effects of dog-assisted interventions on the wider family should also be considered.

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Table 1. The outcomes reported in research papers selected for review

Authors (Ref Number)	Partici pants and dogs	Duratio n	Measures	Outcomes for Experimental Groups				
				Mood	Prosocial behaviors	Daily activity/ Quality of life	Cognitive impairment	Existential function
Bono, Benvenuti <i>et al.</i> <i>G GerontolPsychosocial Geriatrics</i> (53)	N=12 Control N=12 experimental MMSE 16-24 Outpatients in Alzheimer's Evaluation Unit Dogs trained 2-3 years to work with disabled people	8 months Biweekly 1-hour sessions	Pre & post Barthel Index of Daily Activities ADAS test (Alzheimer's Disease Assess Scale) Cornell Scale Controlled; randomised			Stat reduced Bartel Index therefore lower impairment of daily activities	Lower increase on ADAS> slowing down of cognitive impairment	
Friedmann, Galik <i>et al.</i> <i>Am J Alzheimers Dis Other Demen</i> (5827)	N=40 MMSE 8-23 Nursing home 55 years + Control group Experimental group (PAL) Pet dog with experience as visitor in nursing homes	12 weeks 60-90 mins, twice a week	Monthly Cornell Depression in Dementia Scale (CDDS) Apathy Evaluation Scale (AES) [shortened version] On CDDS pre-test no significant difference between the groups. (PAL at 62.5%; control 66.7%)	Depressive symptoms improved in experimental group. 36.8% PAL group met the depression criteria: control group still at 66.7%). Apathy scales also slightly improved for PAL and worsened for control.		Physical activity improved in experimental group		

			depression rating)					
Kanamori, Suzuki <i>et al.</i> <i>Am J Alzheimers Dis Other Dement</i> (7028)	N=7 experimental grp N=20 control Day care facility	6 biweekly sessions	Pre and post MMSE Behave-AD Salivary CgA (as mental stress index)	Improvement across all tests for experimental group, with decrease in salivary CgA. Control group indicated greater stress over time.	Experimental grp showed decrease in behavioural pathology 3 months later from an average baseline score of 11.14 ($\pm$ 4.85) to 7.29 ($\pm$ 7.11) ($p < 0.05$). No significant difference for control group.			
Kawamura, Niiyama <i>et al.</i> <i>Psychogeriatrics</i> (6738)	N=10 Residential 2 small pet dogs	One year Twice a month	GBS Scale-Japanese Mental Function Impairment Scale (MFIS) Tested 4 times over a year				Mental function decreased in first six months, then increased up to 12 months. May take a while for intervention to be effective on cognitive function.	

Kawamura, Niiyama <i>et al Journal of Psychosocial Nursing</i> (3851)	N=8 women Nursing home Mild to moderate dementia Lucid 2 small pet dogs	One year Twice a month	No baselines collected at start. Semi-structured interviews. Qualitative . Analysis using phenomenological procedures		Themes: Enhanced communication with volunteers; increased trust	Themes: confidence in self, break from daily routines, interaction with other residents		Theme s: Confidence in oneself, recalling fond memories about dogs; interacting with other residents and positive feelings towards dogs.
Kendzioriski & Treacy <i>Master's thesis Grand Valley State University</i> (52)	N=10 Long term care facility. Resident pet dog free to roam in facility		Qualitative Hermeneutic process Interviews of participants			Themes; enjoyment of companionship, pleasure in feeding and petting dogs; general improved quality of life		
Kongable, Buckwalter <i>et al Arch Psychiatr Nurs</i> (5939)	N=12 Special Care Unit for Veterans		Observations on 3 occasions Measured 8 social behaviours			Increased number of total social behaviours; no differences between permanent		

						nt & temporary residents		
Majic, Gutzmann <i>et al Am J Geriatr Psychiatry</i> (30)	27 matched pairs	10 weekly sessions	Randomised, controlled MMSE Cohen-Mansfield Agitation Inventory Dementia Mood Assessment Scale Baseline & 4 weeks post AAT intervention	Control group-agitation/aggression & depression significantly increase over 10 weeks. Experimental grp showed constant frequency and severity of symptoms of agitation/aggression and depression. Symptom amelioration did not occur in either grp				
McCabe, Baun <i>et al West J Nurs Res</i> (40)	N=22 Residential Dog resident ; obedience trained	Dog resident	Nursing Home Behaviour Problem Scale- days and evenings. 1 week prior to placement of dog; 4 weeks after placement of dog		Fewer problems on day shift; no significant change on evening shift			
Menna, Santaniello <i>et al</i> (2016) <i>Psychogeriatrics</i> (7335)	Control N=10 Reality Orientation Protocol (ROT) N=20	6 months	Pre and post tests MMSE Geriatric Depression Scale (GDS) Cortisol	ROT (GDS went from 11.6 to 10.5) & AAT (GDS went from 11.5 to 9.5) Both slight stat.			Control group no change on MMSE: ROT slight	

	ROT+AA T N=20 4 dogs obedien ce trained; used to pet therapy			improveme nt. No change in control group.			improv ement 19.9 to 20.0); more significa nt improv ement in AAT group (20.2 to 21.5)	
Menna, Santaniello <i>et al</i> (2019) <i>Psychogeriat rics</i> (7436)	N=22 (N=11 experim ental; N=11 control Reality Orientat ion Protocol (ROT)	12 meetings , once a week, for 3 months, experime ntal and control groups	Pre and post tests MMSE Geriatric Depression Scale (GDS) Cortisol	GDS decreased significantly for experiment al group; Control group GDS increased, but not significantly . Decrease in cortisol in Experiment al grp.			MMSE increas ed for experim ental group. Control group, MMSE decreas ed GDS increas ed, but not significa ntly.	
Moretti, De Ronchi <i>et al</i> <i>Psychogeriat rics</i> (31)	N=10 (experi mental grp) N=11 Control 4 dogs obedien ce trained; used to pet therapy	6 weeks 90 mins a week	MMSE Geriatric Depression Scale (GDS) Self- perceived quality of life Pre and post testing (4 weeks after interventio n ended)	With Pet group GDS symptoms decreased by 50%		No significan t differenc e quality of life	Mean MMSE increas ed statistic ally for experim ental group by 4.5 ($p=0.06$) and 2 points for control group ($p=0.09$ 41) Betwee n group compari son showed positive effect	

							of pet therapy on GDS (p=0.070)	
Motomura, Yagi <i>et al</i> Psychogeriatrics (32)	N=8 (4 Alzheimer's, 4 vascular dementia) 2 dogs from rescue facility	1 hour over 4 days	Mental State batteries- apathy scale, irritability scale, depression scale, activities of daily living MMSE	No significant difference on irritability, depression, activity of daily living or MMSE. Apathetic state improved in all participants.		No significant difference quality of life		
Nordgren & Engstrom <i>Clinical Nursing Research</i> (56)	N=20 4 nursing homes Qualified therapy dogs (240 hrs training)	10 training sessions 45-60 minutes Once-twice a week	Quality of Life in Later Dementia Scale (QUALID) Pre and post testing Results supported by nursing journal entries			4 died 4 withdrew 3 incomplete 9 left, one week after completion, median QoL improved from 23 to 18.		
Olsen, Pederson <i>et al Int J of Geriatr Psychiatry</i> (33)	N=58 Nursing home Dogs tested for attributes with qualified handler	12 weeks 30 min session with AAA twice weekly for 12 weeks with groups of 3-6 participants	Measured Norwegian versions of Cornell Scale for Depression in Dementia (CSDD), the Brief Agitation Rating Scale, and Quality of Life in Late-stage Dementia	Significant effect on depression in participants with severe dementia, but no significant change in those with mild-moderate dementia. Control group had continual	No effects on agitation	Significant effect on Quality of Life immediately after AAA		

			scale (QUALID) Randomised & controlled. Follow up measurement 3 months after end of intervention	increase in CSDD.				
Oshima, Yasuda <i>et al</i> International Journal of Computer Science and Applications (65)	N=8 Dog trained for task		Replicable Scientific model Development of application Control versus dog with phone strapped to their back Several tasks				People with dementia learned over 3 days to listen to messages from the dog	
Richeson <i>Am J Alzheimers Dis Other Dement</i> (7141)	N=15 Nursing home residents with dementia & agitated behaviours	Pilot study 3 weeks Mostly one/some times 2 therapy dogs working with group	Daily AAT for three weeks Cohen-Mansfield Agitation Inventory Anecdotal observations of nursing, medical staff & families.		Statistically significant decrease in agitated behaviours	Statistically significant increase in social interaction pretest to post-test		
Swall, Fagerberg <i>et al Clinical Nursing Studies</i> (50)	N=5	10 x 30 min visits per person 16 weeks	Registration of activity and sleep curves using an Actiwatch.			No clear pattern of effect on individual persons daytime activity and sleep Data analysed		

						using descriptive statistics		
Swall, Ebbeskog <i>et al</i> <i>Int J Older People Nurs</i> (66)	N=5 Dogs trained with handler 18 months and certified (Swedish Therapy Dog School)	10 x 30 min visits per person	Lifeworld Phenomenological hermeneutic Videotaped				Theme: time spent with dogs shows person recounting memories and feelings and enables a possibility to reach a person on a cognitive level	Theme: Awareness of one's past & present existence i.e. connect with one's senses and memories & reflect on these with the dog
Swall Thesis Karolinska Institute, Sweden (49)	N=5 Dogs trained with handler 18 months and certified (Swedish Therapy Dog School)	16 weeks One to one with participants	Videos of participants interacting with therapy dogs; Interviews with 9 dog handlers; Phenomenological, hermeneutic analysis Registration of activity and sleep for 16 weeks			Time spent with dog revealed memories & feelings resulting in existential thoughts of oneself & life No pattern of effect on daytime activity & sleep		Time spent with dog revealed memories and feelings resulting in existential thoughts of oneself & life
Walsh, Mertin <i>et al</i> <i>Aust Occup Ther J</i> (42)	Closed ward in hospital for	12 weeks	Matched group and control 12 weeks		Significant experimental group			

	dementia		Measured heart rate, blood pressure and ward noise level Global measures of daily functioning		changes in heart rate and substantial drop in noise levels during presence of dog			
Wesenberg, Mueller et al <i>Psychogeriatrics</i> (37)	N=19 Nursing home Moderate to severe dementia Trained dog handlers; dogs screened for suitability	Weekly group sessions with 5 participants and one dog team over 6 months; controlled interventions without dogs	Social interaction, emotional expression, behavioural & psychological symptoms Video recordings at baseline, 3 months & 6 months	Significant positive effects observed in experimental group; No significant difference in groups in relation to apathy	No significant changes shown	Significant positive effects observed in experimental group;		
Wordley Thesis, University of Adelaide, School of Psychology (4629)	N=30 experimental N=7 control Accredited therapy dogs		Baseline & at 6 weeks Measures of prosocial behaviour Blood pressure Heart rate Disruptive behaviour Depression Memory	Significantly decreased during intervention	Significant improvement during intervention, then slight insignificant decrease after. Disruption, negative behaviour and depression significantly decreased during intervention			
Zisselman <i>Am J Occup Ther</i> (4734)	N=58 Hospital geriatric		Randomised, parallel group		No significant			

	psychiatric unit		Pre and post measures Per therapy group vs exercise control group 1 hr a day for 5 days Multidimensional Observation Scale for Elderly Subjects (MOSES)		differences in scores. Non-significant tendency for experimental group to demonstrate less irritable behaviour after treatment			

Figure 1. The selection of articles for review

Table 1. The outcomes reported in research papers selected for review

Authors (Ref Number)	Participants and dogs	Duration	Measures	Outcomes for Experimental Groups				
				Mood	Prosocial behaviours	Daily activity/ Quality of life	Cognitive impairment	Existential function
Bono, Benvenuti <i>et al. G Gerontol</i> (53)	N=12 Control N=12 experimental MMSE 16-24 Outpatients in Alzheimer's Evaluation Unit Dogs trained 2-3 years to work with disabled people	8 months Biweekly 1-hour sessions	Pre & post Barthel Index of Daily Activities ADAS test (Alzheimer's Disease Assess Scale) Cornell Scale Controlled; randomised			Stat reduced Bartel Index therefore lower impairment of daily activities	Lower increase on ADAS> slowing down of cognitive impairment	
Friedmann, Galik <i>et al. Am J Alzheimers Dis Other Demen</i> (27)	N=40 MMSE 8-23 Nursing home 55 years + Control group Experimental group (PAL) Pet dog with experience as visitor in nursing homes	12 weeks 60-90 mins, twice a week	Monthly Cornell Depression in Dementia Scale (CDDS) Apathy Evaluation Scale (AES) [shortened version] On CDDS pre-test no significant difference between the groups. (PAL at 62.5%; control 66.7% depression rating)	Depressive symptoms improved in experimental group. 36.8% PAL group met the depression criteria: control group still at 66.7%). Apathy scales also slightly improved for PAL and worsened for control.		Physical activity improved in experimental group		
Kanamori, Suzuki <i>et al. Am J Alzheimers Dis Other Demen</i> (28)	N=7 experimental grp N=20 control Day care facility	6 biweekly sessions	Pre and post MMSE Behave-AD Salivary CgA (as mental stress index)	Improvement across all tests for experimental group, with decrease in salivary CgA. Control group indicated greater stress over time.	Experimental grp showed decrease in behavioural pathology 3 months later from an average baseline score of 11.14 ($\pm$ 4.85) to 7.29 ($\pm$ 7.11) ($p < 0.05$). No significant			

					difference for control group.			
Kawamura, Niiyama <i>et al Psychogeriatrics</i> (38)	N=10 Residential 2 small pet dogs	One year Twice a month	GBS Scale- Japanese Mental Function Impairment Scale (MFIS) Tested 4 times over a year				Mental function decreased in first six months, then increased up to 12 months. May take a while for intervention to be effective on cognitive function.	
Kawamura, Niiyama <i>et al Journal of Psychosocial Nursing</i> (51)	N=8 women Nursing home Mild to moderate dementia Lucid 2 small pet dogs	One year Twice a month	No baselines collected at start. Semi-structured interviews. Qualitative. Analysis using phenomenological procedures		Themes: Enhanced communication with volunteers; increased trust	Themes: confidence in self, break from daily routines, interaction with other residents		Themes: Confidence in oneself, recalling fond memories about dogs; interacting with other residents and positive feelings towards dogs.
Kendzioriski & Treacy <i>Master's thesis Grand Valley State University</i> (52)	N=10 Long term care facility. Resident pet dog free to roam in facility		Qualitative Hermeneutic process Interviews of participants			Themes; enjoyment of companionship, pleasure in feeding and petting dogs; general improved quality of life		
Kongable, Buckwalter <i>et al</i>	N=12		Observations on 3 occasions			Increased number of total		

<i>Arch Psychiatr Nurs</i> (39)	Special Care Unit for Veterans		Measured 8 social behaviours			social behaviours; no differences between permanent & temporary residents		
Majic, Gutzmann <i>et al Am J Geriatr Psychiatry</i> (30)	27 matched pairs	10 weekly sessions	Randomised, controlled MMSE Cohen-Mansfield Agitation Inventory Dementia Mood Assessment Scale Baseline & 4 weeks post AAT intervention	Control group- agitation/aggression & depression significantly increase over 10 weeks. Experimental grp showed constant frequency and severity of symptoms of agitation/aggression and depression. Symptom amelioration did not occur in either grp				
McCabe, Baun <i>et al West J Nurs Res</i> (40)	N=22 Residential Dog resident; obedience trained	Dog resident	Nursing Home Behaviour Problem Scale- days and evenings. 1 week prior to placement of dog; 4 weeks after placement of dog		Fewer problems on day shift; no significant change on evening shift			
Menna, Santaniello <i>et al (2016) Psychogeriatrics</i> (35)	Control N=10 Reality Orientation Protocol (ROT) N=20 ROT+AAT N=20 4 dogs obedience trained; used to pet therapy	6 months	Pre and post tests MMSE Geriatric Depression Scale (GDS) Cortisol	ROT (GDS went from 11.6 to 10.5) & AAT (GDS went from 11.5 to 9.5) Both slight stat. improvement. No change in control group.			Control group no change on MMSE: ROT slight improvement 19.9 to 20.0); more significant improvement in AAT group (20.2 to 21.5)	
Menna, Santaniello <i>et al (2019)</i>	N=22 (N=11 experimental; N=11 control)	12 meetings, once a week, for 3 months,	Pre and post tests MMSE	GDS decreased significantly for experimental group;			MMSE increased for experimental	

<i>Psychogeriatrics</i> (36)	Reality Orientation Protocol (ROT)	experimental and control groups	Geriatric Depression Scale (GDS) Cortisol	Control group GDS increased, but not significantly. Decrease in cortisol in Experimental grp.			group. Control group, MMSE decreased GDS increased, but not significantly.	
Moretti, De Ronchi <i>et al Psychogeriatrics</i> (31)	N=10 (experimental grp) N=11 Control 4 dogs obedience trained; used to pet therapy	6 weeks 90 mins a week	MMSE Geriatric Depression Scale (GDS) Self-perceived quality of life Pre and post testing (4 weeks after intervention ended)	With Pet group GDS symptoms decreased by 50%		No significant difference quality of life	Mean MMSE increased statistically for experimental group by 4.5 ($p=0.06$) and 2 points for control group ($p=0.0941$) Between group comparison showed positive effect of pet therapy on GDS ($p=0.070$)	
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Oshima, Yasuda <i>et al International Journal of Computer Science and Applications</i> (65)	N=8 Dog trained for task		Replicable Scientific model Development of application Control versus dog with phone strapped to their back Several tasks				People with dementia learned over 3 days to listen to messages from the dog	
Richeson <i>Am J Alzheimers Dis Other Demen</i> (41)	N=15 Nursing home residents with dementia & agitated behaviours	Pilot study 3 weeks Mostly one/sometimes 2 therapy dogs working with group	Daily AAT for three weeks Cohen-Mansfield Agitation Inventory Anecdotal observations of nursing, medical staff & families.		Statistically significant decrease in agitated behaviours	Statistically significant increase in social interaction pretest to post-test		
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Swall Thesis Karolinska Institute, Sweden (49)	N=5 Dogs trained with handler 18 months and certified (Swedish Therapy Dog School)	16 weeks One to one with participants	Videos of r participants interacting with therapy dogs; Interviews with 9 dog handlers; Phenomenological, hermeneutic analysis Registration of activity and sleep for 16 weeks			Time spent with dog revealed memories & feelings resulting in existential thoughts of oneself & life No pattern of effect on daytime activity & sleep		Time spent with dog revealed memories and feelings resulting in existential thoughts of oneself & life
Walsh, Mertin <i>et al</i> <i>Aust Occup Ther J</i> (42)	Closed ward in hospital for dementia	12 weeks	Matched group and control 12 weeks Measured heart rate, blood pressure and ward noise level Global measures of daily functioning		Significant experimental group changes in heart rate and substantial drop in noise levels during presence of dog			
Wesenberg, Mueller <i>et al</i> <i>Psychogeriatrics</i> (37)	N=19 Nursing home Moderate to severe dementia	Weekly group sessions with 5 participants and one dog team over 6 months; controlled	Social interaction, emotional expression, behavioural & psychological symptoms	Significant positive effects observed in experimental group; No significant difference in groups in relation to apathy	No significant changes shown	Significant positive effects observed in experimental group;		

	Trained dog handlers; dogs screened for suitability	interventions without dogs	Video recordings at baseline, 3 months & 6 months					
Wordley Thesis, <i>University of Adelaide, School of Psychology</i> (29)	N=30 experimental N=7 control Accredited therapy dogs		Baseline & at 6 weeks Measures of prosocial behaviour Blood pressure Heart rate Disruptive behaviour Depression Memory	Significantly decreased during intervention	Significant improvement during intervention, then slight insignificant. decrease after. Disruption, negative behaviour and depression significantly decreased during intervention			
Zisselman <i>Am J Occup Ther</i> (34)	N=58 Hospital geriatric psychiatric unit		Randomised, parallel group Pre and post measures Per therapy group vs exercise control group 1 hr a day for 5 days Multidimensional Observation Scale for Elderly Subjects (MOSES)		No significant differences in scores. Non-significant tendency for experimental group to demonstrate less irritable behaviour after treatment			

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