

**A scoping review of AHP
interventions
for people living with dementia,
their families, partners and
carers**



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LIST OF ABBREVIATIONS, ACRONYMS AND SYMBOLS

AAC	Augmentative and Alternative Communications - an umbrella term for communication methods used to supplement or replace speech or writing for those with impairments in the production or comprehension of spoken or written language.
AAT/AAI	Animal Assisted Therapy/Animal Assisted Interventions – treatment in which interaction with animals is used to improve elements of a persons functioning (social, emotional, behavioural, physical etc.).
AD	Alzheimer’s Disease – the most common form of dementia, a progressive mental deterioration due to generalized degeneration of the brain.
ADL	Activities of daily living - refers to basic tasks of everyday life, such as eating, bathing, dressing, toileting, and transferring (see also PADL and IADL).
ADRD	Alzheimer’s Disease and Related Dementias - umbrella term for AD and a range of other dementias.
AI	Artificial intelligence – intelligence exhibited by machines or software. In dementia care AI is often intended to be a simulation of human intelligence to help improve some aspect of function.
AlzSoc	The Alzheimer’s Society
AT	Assistive Technology – broad term which includes assistive, adaptive, and rehabilitative devices for people.
CVA	Cerebrovascular Accident; Stroke.
Dyad	Two individuals or units regarded as a pair – typically a person with dementia and their relative or caregiver.
GPS	Global Positioning Satellite - space-based navigation system that provides location and time information.
GT	Grounded theory – an inductive research methodology in the social sciences which involves the construction of theory through the analysis of data
HD	Huntington’s Disease - neurodegenerative genetic disorder that affects muscle coordination and leads to mental decline and behavioural symptoms
IADL	Instrumental activities of daily living – several different definition are available for IADL but they typically include the characteristics of being activities and tasks beyond basic self-care that are necessary for living independently and may include more complex tasks such as such as managing money, shopping, telephone use, travel in community, housekeeping, preparing meals, and taking medications correctly
ICT	Information and Communications Technology typically refers to telecommunications technology including telephone and computer networks
Likert Scale	A pre-coded ordinal scale that measures levels of agreement or disagreement
MCI	Mild Cognitive Impairment is a term which is used to describe a condition involving problems with cognitive function (their mental abilities such as thinking, knowing and remembering) which impact on daily function, but are not severe enough to be defined as dementia.
MRI	Magnetic Resonance Imaging - a non-invasive medical imaging procedure which produces detailed pictures internal body structures
OT	Occupational Therapy
PADL	Personal activities of daily living – sometimes used to refer to a narrow range of ADL dealing with personal elements of self-care.
PDA	Personal Digital Assistant - small mobile hand-held device that provides computing and information storage and retrieval capabilities for personal or

	business use, often for keeping schedule calendars and address book information handy.
PIR sensor	Passive Infra Red - is an electronic device that measures infrared light radiating from objects in its field of view, most commonly used in motion detectors.
Pro re nata	Latin for <i>as the circumstance arises</i> and typically used in reference to dosage of prescribed medication that is not scheduled
PWD	Person/people living with dementia
QoL	Quality of Life
n	Number of units (e.g. participants, carers, study sites) in a subgroup of the sample under study
\bar{x}	Sample mean – the arithmetic average of a specified value
\tilde{x}	Median value - number separating the higher half of a data sample or population from the lower half, the middle value in a range of numbers.
<	Less than
>	Greater than
\leq	Less than or equal to
\geq	Greater than or equal to

1. INTRODUCTION

1.1. PURPOSE

This report contains the findings from a scoping review undertaken to provide an overview of available research into the effectiveness of interventions delivered by allied health professions for people living with dementia, their families and carers. It is intended to support readers engaging with literature about treatment options for dementia by presenting a broad summation of available research findings.

This work was produced in support of Commitment 4 of Scotland's National Dementia Strategy 2013-16 (Scottish Government, 2013, p.9):

We will commission Alzheimer Scotland to produce an evidence based policy document outlining the contributions of AHPs to ensuring implementation of the 8-Pillar model.

The work reported in this review will support Alzheimer's Scotland as it continues to provide strategic direction and support for allied health professionals who work with people living with dementia and their carers.

1.2. APPROACH

The review is divided into fifteen different sections, each of which deals with a specific topic. These topics include both particular approaches to dementia and collections of studies arranged by outcomes of interest. For each category, information is ordered by design type to reflect the level of confidence with which any evidence for effectiveness of interventions is reported.

Where high quality systematic reviews have been reported (Cochrane Collaboration or equivalent), only relevant papers not addressed in these reviews have been included in the subsequent commentary.

Each topic section contains:

- a) Brief definitions related to the topic
- b) A summation of available systematic reviews (where available)
- c) Details of the types of evidence identified
- d) A brief conclusion explaining the current nature and quality of available evidence
- e) Tables including summary information for relevant studies

1.3. METHODS

1.3.1. SEARCH STRATEGY

Searching for literature was completed in three phases (for an overview see Figure 1, p.3).

Phase 1

To identify systematic review evidence four specialist collections (the Cochrane Library, TRIP Database, OT Seeker, PEDro) were searched for relevant reviews relating to the term “dementia”.

Phase 2

Initially it had been anticipated that searches would be run combining terms for dementia with different AHP groups. However, after completion of the first set of searches (in Medline, CINAHL, PsycINFO and Embase) to identify papers relating to occupational therapy for dementia, it was clear that there is a high degree of cross over in the studies found. For instance, screening of this initial round of results indicated that many studies were focussed on specific outcomes, and the interventions they reported could either involve a range of different professionals, or use techniques common to different AHPs group.

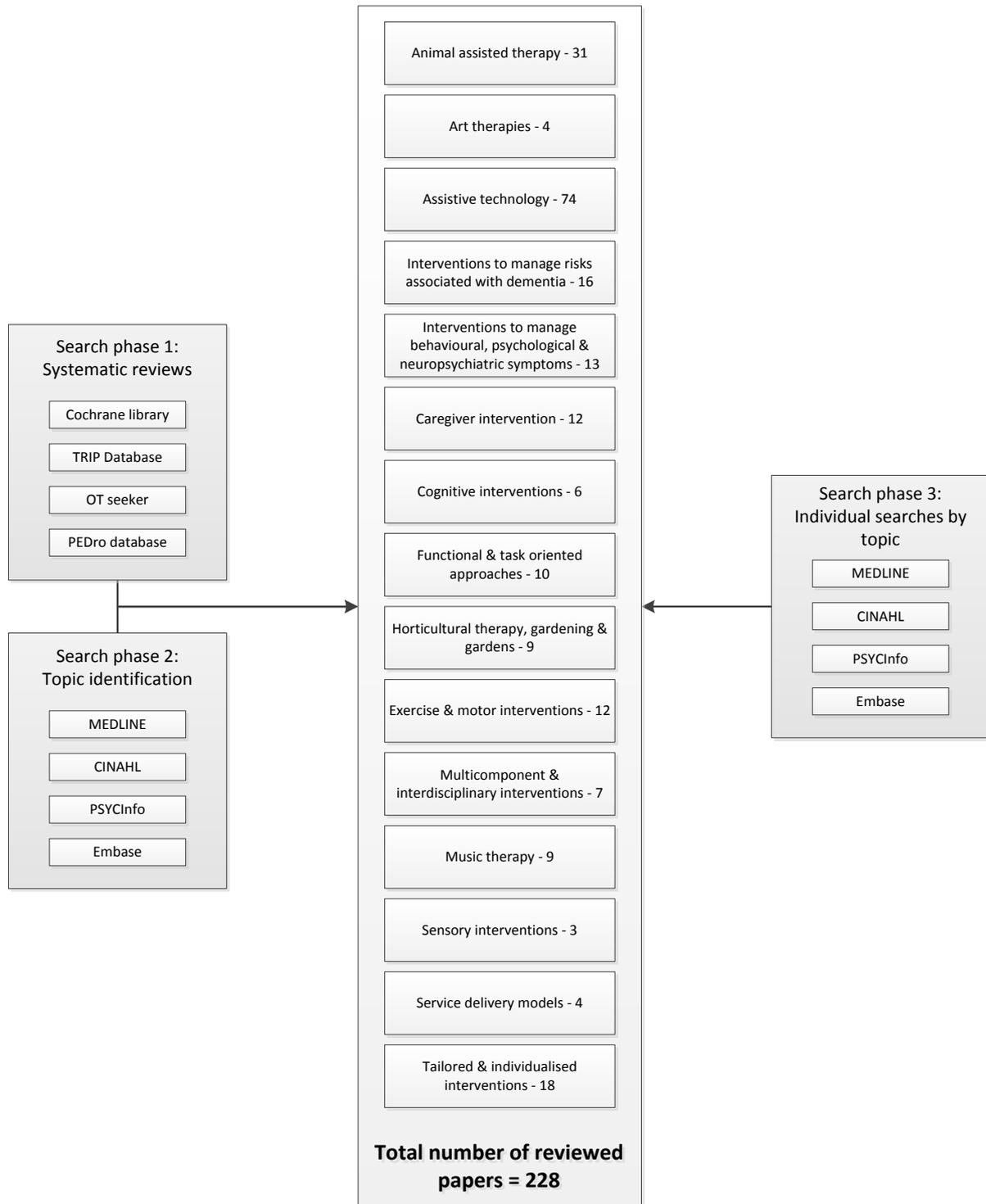
Consequently, the results of the Phase 2 searches were used to form topic categories which guided further, more specific searches in Phase 3.

Phase 3

Once the results from the phase 2 searches had been allocated to different categories a number of smaller more specific searches were run to ensure most key papers had been included.

Details of the search terms used are presented in Appendix A.

Figure 1: Overview of search strategy



1.3.2. INCLUSION AND EXCLUSION CRITERIA

Papers were included if they reported on the effects of any form of non-medical intervention or therapy delivered to people living with dementia or their carers. No limitation by date of publication was used.

Papers were excluded if:

- a) An English language version could not be located
- b) They reported letters to the editor, opinion pieces, brief reports from magazines, non-peer reviewed papers such as book chapters and dissertations
- c) No outcome data was presented

1.3.3. DATA EXTRACTION

Information and results from systematic reviews has been included in detail within each topic section.

Information from additional papers not addressed in systematic reviews has been presented in tabulated form and includes; author information, study design, brief sample information (sample size, mean age and mean Mini-mental state examination (Folstein, Folstein, & McHugh, 1975) (MMSE) scores where available to indicate severity of condition), aims of the study and details of interventions, data collected or outcomes measured, results reported and country of origin.

1.3.4. APPRAISAL AND SYNTHESIS

To help establish the potential merits of each identified paper, the standards of evidence recommended by the American Occupational Therapy Association for use during systematic literature reviewing were applied (Arbesman & Lieberman, 2011).

These standards are based on those used in evidence-based medicine and are presented in [Table 1, p.4](#). While these are not as exhaustive or detailed as those currently used in evidence based medicine reviews (for instance they do not differentiate between high and low quality experimental designs) they have been used as a structure to help categorise and order the large volume of AHP related outcomes research.

Key elements of study design have been included in the summary tables to help with further consideration of each paper's methodological qualities.

Table 1: Levels of evidence for outcomes research

Evidence Level	Definition
Level I	Systematic reviews, meta-analyses, randomized controlled trials
Level II	Two groups, nonrandomized studies (e.g., cohort, case control)
Level III	One group, nonrandomized studies (e.g., before and after, pre-test and post-test)
Level IV	Descriptive studies that include analysis of outcomes (e.g., single-subject design, case series)
Level V	Case reports and expert opinion that include narrative literature reviews and consensus statements

Data synthesis is based on providing a brief overview of the literature addressed for each topic. Statements have been made about if and how AHPs could consider using different

interventions in their practice. A brief summary of these statements are provided in [Table 2](#), [p.6](#).

Table 2: Brief summary of synthesis by topic

Topic	Number of reviewed papers by Evidence Level							Synthesis summary
	Sys. Revs ¹	Level I	Level II	Level III	Level IV	Level V	Lit Rev (Level V)	
Cognitive Interventions	6 (53)	-	-	-	-	-	-	The results of six systematic reviews of 53 studies, including high quality Cochrane reviews indicate there is good evidence in favour of cognitive stimulation to improve communication and social functioning, promising evidence for the use of cognitive stimulation to improve quality of life, initial but not definitive evidence for reminiscence therapy and limited inconclusive evidence for other cognitive approaches.
Sensory Interventions	3 (4)	-	-	-	-	-	-	There is no consistently convincing evidence derived from experimental studies for a range of sensory interventions. Massage and touch therapies may have some potential benefit in reducing some behavioural symptoms of dementia.
Exercise and motor interventions	3 (32)	3	4	1	-	-	1 (23)	There is some good evidence in favour of these approaches as away of improving ADL and functional capacities such as mobility and balance. Positive impact of exercise and motor interventions on cognitive performance is not supported by meta-analyses but is reported to have some benefits from mixed results of quasi-experimental studies.
Interventions aimed at carers	5 (214)	1	-	-	3	3	-	There is no consistent and convincing evidence in favour of specific caregiver focused interventions although a number of areas show potential positive outcomes.
Individualised or personalised interventions	1 (40)	10	1	1	1	2	2 (45)	There is good evidence in favour of individualised and tailored approaches to care as a means on improving a number of outcomes such as reductions in behavioural symptoms and their impact, improvements in functional performance, reduced carer burden and improved quality of life.
Functional and task oriented approaches	-	2	1	4	-	3	-	There is no consistent evidence in favour of functional and task oriented approaches although there are repeated positive results from a number of non-experimental studies which examine different interventions.
Assistive technologies	2 (14)	2	-	18	30	16	6 (182)	There is no clear or consistent evidence in favour of specific AT interventions for people living with dementia or their carers. This is partly due to the vast number of different devices that that have been examined and the wide range of lower level methods used to do so.
Interventions to manage risks	4 (41)	2	-	-	3	5	2 (19)	There is no conclusive evidence in favour of interventions to manage driving related risks. There is limited and inconclusive evidence to support the use of both exercise interventions

¹ Numbers in brackets indicate the total number of papers included in the identified systematic reviews or literature reviews.

associated with dementia								and the provision of caregiver training to help manage and prevent falls. There is some very limited and inconclusive evidence suggesting multisensory environments can help prevent wandering.
Interventions for behavioural, psychological and neuropsychiatric symptoms	2 (46)	2	1	1	-	1	6 (164)	There is good evidence in favour of a range of interventions including; providing skills training, problem solving strategies, education, self-management techniques, and access to support for carers; activity based interventions; environmental changes; and exercise-based interventions.
Multicomponent and interdisciplinary interventions	-	4	-	2	1	-	-	The studies examining multicomponent or interdisciplinary interventions that could not be included in a more specific section are inconclusive.
Service delivery studies	-	2	-	2	-	-	-	The reviewed studies are inconclusive and do not report consistent evidence in favour of the service delivery approaches studied.
Horticultural therapy, gardening and gardens	-	1	-	7	-	-	1 (16)	Horticultural therapy appears effective at improving engagement. While there is no consistent experimental evidence for other outcomes there are repeated reports from lower level studies of a positive impact on depression, agitation and quality of life.
Animal assisted interventions and pet therapy	-	4	5	-	14	4	4 (40)	There is repeated favourable evidence from a number of quasi-experimental studies but recent contradictions from experimental designs mean that the evidence for animal assisted therapies is inconclusive.
Music therapies	6 (67)	3	-	-	-	-	-	There is repeated favourable evidence from a number of experimental and quasi-experimental studies indicating short term benefits for music therapies on a number of dementia related outcomes. Meta-analysis indicates some inconsistency in these outcomes and as such the evidence should be considered promising but preliminary. Long term benefits from music interventions have not been demonstrated.
Art therapies	2 (32)	-	-	-	1	1	-	There is some inconsistent evidence from a range of differently designed studies which indicates some potential benefit for art therapy. At present these are inconclusive.
Total	34	36	12	36	53	35	22	

2. COGNITIVE INTERVENTIONS

2.1. DEFINITIONS RELATED TO COGNITIVE INTERVENTIONS FOR PEOPLE LIVING WITH DEMENTIA

Cognitive training interventions usually involve engaging the person with dementia in guided practice on standardised tasks. These tasks may be designed to reflect specific cognitive functions such as memory, attention or problem-solving, or may involve practicing typical occupations, such as ADL tasks, or suitable analogues of these. Common synonyms; cognitive retraining, cognitive remediation, brain training, memory training.

Cognitive rehabilitation is differently defined from cognitive training in that more emphasis is placed on individualising the intervention. Typically this involves focussing on improving functioning in daily life following a review of performance with the person and their families/carers, rather than improving performance on cognitive tasks. Interventions are often located within the person's home environment.

Cognitive stimulation interventions typically use a range of activities or occupations to stimulate thinking, concentration and memory. This often takes place in social settings and small groups though the mechanism of therapy tends to be inconsistent and provided in many different ways. Common synonyms; reality orientation, memory therapy, memory groups, memory support, memory stimulation, global stimulation, cognitive psycho-stimulation.

Reminiscence therapy is often termed as a psychosocial intervention but due to its strong cognitive rationale has been included in this section for categorisation purposes. There is also a strong psychotherapeutic rationale for this approach with different populations; however, the focus on its use with people living with dementia tend to emphasise improving distinct aspects related to cognition, such as communication, memory, social/interpersonal behaviours and mood. Reminiscence therapy can take many different forms but typically involves discussing relevant and meaningful past activities, experiences and life events. More specific aspects of reminiscence therapy may include using life histories, both written and oral, or both - to improve psychological well-being. A range of prompts may also be used to facilitate reminiscence such as visual, audio and text materials.

2.2. SYSTEMATIC REVIEWS OF STUDIES INTO COGNITIVE INTERVENTIONS

2.2.1. COGNITIVE TRAINING AND COGNITIVE REHABILITATION FOR MILD TO MODERATE ALZHEIMER'S DISEASE AND VASCULAR DEMENTIA (BAHAR-FUCHS, CLARE & WOODS, 2013)

11 RCTs of cognitive training and 1 RCT of cognitive rehabilitation. The overall quality of reviewed trials was considered to be low or moderate.

Cognitive training was not associated with positive or negative effects in relation to any reported outcomes which included cognitive function, mood and ADL.

A single, fairly high quality, RCT examined cognitive rehabilitation finding promising (but preliminary) results in relation to a number of participant and caregiver outcomes.

Available evidence regarding cognitive training is limited and suffers from a number of methodological flaws affecting quality.

There is currently no indication of any significant benefit derived from cognitive training, although some trial authors indicate that potential gains may not be captured adequately by available standardised outcome measures.

2.2.2. COGNITIVE STIMULATION TO IMPROVE COGNITIVE FUNCTIONING IN PEOPLE LIVING WITH DEMENTIA (B. WOODS, AGUIRRE, SPECTOR, & ORRELL, 2012)

15 RCTs reviewed. The overall quality of the trials was judged to be low.

Meta-analysis (n = 718) indicated that clear and consistent benefits of cognitive function were detected, and remained present at follow-ups of one to three months after the end of treatment.

Secondary analyses with smaller total sample sizes, identified benefits on self-reported quality of life and well-being (n = 209), and staff ratings of communication and social interaction (n = 223).

No differences were detected in relation to mood (n = 201; n = 239), activities of daily living (n = 260), general behavioural function (n = 416) or problem behaviours (n = 166).

The authors conclude that the evidence for cognitive stimulation as an intervention for improving cognitive functioning is consistently demonstrated.

Evidence for the intervention as a means of improving quality of life and communication is present but remains inconclusive due to the low number of studies.

2.2.3. REALITY ORIENTATION FOR DEMENTIA (SPECTOR, ORRELL & WOODS, 2000)

Withdrawn as superseded by (B. Woods et al., 2012)

2.2.4. REMINISCENCE THERAPY FOR DEMENTIA (WOODS ET AL., 2005)

Systematic review and meta-analysis of 4 RCTs.

When compared with no treatment, reminiscence was associated with significant improvements in caregiver strain, staff knowledge regarding residents with dementia and improved behavioural function.

Statistically significant results were also detected at 4-6 week follow up for mood, and cognition, which also demonstrated an improvement over a social-contact control group.

No effects were detected for differences in communication or interaction or for specific problem behaviours either at the end of treatment or follow up.

No harmful effects were identified on the outcome measures reported.

The four included studies were of relatively low quality, used fairly small sample sizes and examined different types of reminiscence therapy. The findings of the review should be interpreted as showing promising indications for this effect of this type of intervention but the conclusions are not definitive and further research is needed in this area.

2.2.5. COGNITIVE AND MEMORY TRAINING IN ADULTS AT RISK OF DEMENTIA: A SYSTEMATIC REVIEW (GATES ET AL., 2011)

Review of ten studies into the effectiveness of cognitive exercises; (three RCTs, two uncontrolled trials and one non-randomised controlled trial), and memory training strategies (two RCTs and two non-randomised controlled trials). Specifically this review sought to determine if these interventions benefitted people identified as at risk of developing dementia. Benefits were identified as changes in measures of domain-specific cognitive function (memory, attention, executive function, and speed), global cognitive measures, and secondary measures of function and emotional and behavioural status.

Study quality as determined by CONSORT rating was generally graded as average or poor with only two papers scoring well. Most included studies had limitations associated with poor methodological reporting, unclear or poor randomisation processes, and insufficient sample sizes.

The review indicates that the evidence for the benefits of cognitive exercises is inconclusive.

The authors note challenges due to heterogeneity in the design and application of cognitive training interventions.

2.2.6. A SYSTEMATIC REVIEW OF COGNITIVE STIMULATION THERAPY FOR OLDER ADULTS WITH MILD TO MODERATE DEMENTIA: AN OCCUPATIONAL THERAPY PERSPECTIVE (YUILL & HOLLIS, 2011)

Review of seven RCTs, three quasi-experimental cohort designs, one retrospective cohort design and one retrospective outcomes study.

The seven RCTs were judged to be of moderate to high quality. Methodological concerns in the RCTs were noted regarding insufficient information about randomisation and a lack of double blinding. Methodological flaws in the other studies included underpowered and/or unjustified sample sizes, a lack of suitable placebo controls, unequal amounts of attention across groups, and limited descriptions of the interventions.

The authors identified a common trend for CST interventions to potentially enhance cognitive function or at least slow the rate of decline. Small changes on the cognitive outcome measures used in the studies were interpreted as clinically meaningful because of typical disease progression.

Lack of meta-analysis of study results prevents general conclusions being made about cognitive stimulation. Results from the studies included are suggestive of small beneficial changes in cognitive function but methodological shortcomings do not allow for these results to be interpreted as irrefutable or conclusive due to the chance of error.

2.3. CONCLUSIONS

The available meta-analytic and descriptive systematic reviews of cognitive interventions indicate that the most compelling evidence is for the use of cognitive stimulation for people living with dementia. These approaches appear to improve cognitive function and may contribute to improvements in communication and social skills. There is some promising but not yet definitive evidence to indicate that cognitive stimulation may contribute to improved quality of life for people living with dementia.

Evidence for the use of reminiscence therapy is promising but not definitive.

Evidence for other cognitive training interventions is limited and inconclusive.

AHPs may want to consider including advice and training about cognitive stimulation strategies, including reminiscence therapy, for formal and informal carers but should note that the effects are limited to cognitive function and do not as yet appear to benefit those aspects of occupational performance that have been measured (primarily activities of daily living or other elements of functional performance).

Given the number, high quality and recent publication of systematic reviews into cognitive interventions for dementia, no further studies were considered for inclusion.

3. SENSORY INTERVENTIONS

3.1. DEFINITION OF SENSORY INTERVENTIONS REVIEWED

Multisensory stimulation and Snoezelen interventions typically provided stimulation targeting the primary senses via environmental media, such as lighting effects, tactile surfaces, meditative music and the odour of essential oils.

Massage and touch interventions typically vary somewhat in terms of type of interaction, but may include professional massage therapy, various types of therapeutic touch including tender touch with large strokes, slow strokes, expressive touch, rubbing, kneading, effleurage (skimming or light touch, usually with an open palm in a circular motion as a prelude to tissue massage) and touch as part of therapeutic communication.

Acupuncture refers to the Chinese method of inserting fine needles at certain sites in the body. More specific terms include body acupuncture (which is the generalised term), scalp acupuncture which refers to the insertion of needles in the surface of the head, and electroacupuncture in which electrical stimulation is combined with the acupuncture technique.

3.2. SYSTEMATIC REVIEWS OF EFFECTIVENESS STUDIES FOR SENSORY INTERVENTIONS

3.2.1. SNOEZELLEN FOR DEMENTIA (CHUNG AND LAI, 2002)

Systematic review of two RCTs and one quasi-experimental pre-post test study. No meta-analysis was possible due to differences in methodology (session based intervention versus 24hour integrated Snoezelen care).

Both RCTs were judged to be of inadequate methodological quality due to poor sampling strategies and research protocols, issues in recruitment and randomisation, and selective reporting of subscales rather than total outcome measure scores focussed on assessing overall performance in the domains of behaviour and mood.

The quasi-experimental study also suffered from inadequacies in methodology, notably additional recruitment during the study leading to non-equivalent groups and no the intention to treat analysis.

Nine other studies failed to reach the minimal level of methodological quality required for inclusion in the review.

The authors conclude that there is no evidence of the efficacy of Snoezelen or multi-sensory stimulation programmes for people living with dementia. Recommendations are also made for future research in this area notably efforts to achieve; greater rigour in randomisation processes, increased homogeneity of intervention design to allow comparison/meta-analysis with existing studies, adoption of standard protocols at different sites included in trials, greater attention to levels of impairment in the study samples and expanded outcome measurement including potential effects on therapeutic relationship and perceived quality of care.

3.2.2. MASSAGE AND TOUCH FOR DEMENTIA (HANSEN ET AL., 2006)

Systematic review of two RCTs. Meta-analysis was not possible due to differences between the nature of the massage interventions; hand massage for the immediate or short-term reduction of agitated behaviour, and the addition of touch to verbal encouragement to eat for the normalization of nutritional intake.

Both studies used small sample sizes. The study examining touch for normalising nutritional intake was criticised for being unclear in the randomisation and concealment allocation methods used.

The authors conclude that the evidence regarding the efficacy of massage or touch interventions for people living with dementia is not sufficient to allow for meaningful meta-analysis.

There is some evidence to support the efficacy of two specific applications.

Hand massage was found to be effective in achieving short-term reduction in agitated behaviour for people living with dementia at a level comparable with other pharmacological and non-pharmacological treatments.

Adding touch to verbal encouragement for eating to normalize nutritional intake was found to result in a statistically and practically significant increase in calorific and protein intake.

Further well-designed research into this area is recommended by the authors.

3.2.3. ACUPUNCTURE FOR VASCULAR DEMENTIA (PENG ET AL., 2007)

Systematic review which identified no studies of suitable methodological quality.

The authors conclude that there is currently no evidence from suitably designed trials to determine whether acupuncture provides any effect when treating people with vascular dementia.

There is a need for randomized placebo-controlled trials of acupuncture for people with vascular dementia.

3.3. CONCLUSIONS

The available systematic reviews examining several different approaches to sensory interventions indicate that there is no consistent or convincing evidence at present for their use with people living with dementia. There appears to be some potential benefit to the use of massage and touch at reducing some behavioural symptoms but further well designed research is required. Similarly, despite Snoezelen and sensory interventions being common to dementia care, at present there is no convincing experimental evidence to indicate their effectiveness at reducing the symptoms of dementia.

4. EXERCISE AND MOTOR INTERVENTIONS

4.1. DEFINITIONS OF EXERCISE AND MOTOR INTERVENTIONS

Exercise and motor interventions typically refer to programmes in which planned movements or physical activities are undertaken as a way of maintaining or improving elements of physical fitness. Intervention strategies tend to include activities designed to improve balance, agility, flexibility and joint mobility, motor coordination, strength, and aerobic endurance. Walking, working with weights or resistance, simple ball games (throwing, catching, passing) and dancing are all typical examples of exercise interventions used with people living with dementia.

4.2. SYSTEMATIC REVIEWS OF EFFECTIVENESS STUDIES FOR EXERCISE/MOTOR INTERVENTIONS

4.2.1. EXERCISE PROGRAMMES FOR PEOPLE LIVING WITH DEMENTIA (FORBES ET AL., 2013; FORBES ET AL., 2015)

Meta-analytic systematic review of 17 randomised controlled trials examining the effect of exercise interventions for people living with dementia on improving cognition, ADLs, neuropsychiatric symptoms, depression, and mortality.

The authors' meta-analysis indicate that there was no clear evidence of benefit from exercise on cognitive functioning (9 low quality studies, n = 409).

Exercise programs improved the ability of people living with dementia to perform ADLs (6 low quality trials, n = 289).

One well designed trial found caregiver burden may be reduced when they supervise the participation of the family member with dementia in an exercise program. This trial also reported no clear evidence of benefit from exercise on neuropsychiatric symptoms or depression.

Quality of life, mortality, and healthcare cost outcomes could not be analysed as either the appropriate data were not reported, or the trials that examined these outcomes were not retrieved.

The authors conclude that the evidence for exercise as an intervention to improve the ability to perform ADLs in people living with dementia is promising but should be interpreted with caution.

4.2.2. SYSTEMATIC REVIEW OF THE EFFECTS OF EXERCISE ON ACTIVITIES OF DAILY LIVING IN PEOPLE WITH ALZHEIMER'S DISEASE (RAO, CHOU, BURSLEY, SMULOFKY, & JEZEQUEL, 2014)

Meta-analytic review of 6 randomised controlled trials.

Of the six trials reviewed, four were included in the more recent Cochrane review (Forbes et al., 2015). One trial had been identified but excluded from the Cochrane review because

its outcomes were related to ADL. One further article was included which did not appear in the Cochrane review, possibly because it did not examine exercise in isolation but rather as part of an intervention which also included teaching carers how to manage behavioural problems. This study did not include measures of ADL and consequently its inclusion in this review seems invalid.

The results from Forbes et al., (2015) should be considered in the first instance.

4.2.3. SYSTEMATIC REVIEW OF THE EFFECTS OF PHYSICAL ACTIVITY ON PHYSICAL FUNCTIONING, QUALITY OF LIFE AND DEPRESSION IN OLDER PEOPLE LIVING WITH DEMENTIA (POTTER ET AL., 2011)

Systematic review of 13 RCTs (total n = 896) including partial meta-analysis.

Most interventions studied included elements of strength, flexibility or balance training. Two studies were exclusively walking interventions and one study included Tai Chi and Qigong classes.

Meta-analysis results:

Analysis of 3 papers (n = 60) favoured intervention for improving performance on the Timed-Up-and-Go Test; 95% CI = -1.39 [-2.59, -0.19].

Analysis of 2 papers (n = 83) did not support intervention as a means of improving performance on the 6-minute walk test; (95% CI = 47.10 [-19.78, 113.97]).

Analysis of 4 papers (n = 335) supported intervention for improving walking speed; 95% CI = 0.06 [0.01, 0.10].

Analysis of 2 papers (n = 234) supported intervention for improving performance on the Berg Balance Scale; 95% CI = 3.40 [1.08, 5.72].

Narrative results:

- 3/6 trials that reported walking as an outcome found an improvement.
- 4/5 trials reporting timed get up and go tests found an improvement.
- 1/4 trials that reported reduction of depressive symptoms as an outcome found positive effects.
- 2/2 trials that reported quality of life outcomes found an improvement.

4.3. EVIDENCE FOR EXERCISE AND MOTOR INTERVENTIONS NOT INCLUDED IN PRECEDING SYSTEMATIC REVIEWS

Nine studies and papers were identified which focused on exercise and motor interventions which had not been included in the systematic reviews noted above. The outcomes these studies examined did not fall within the scope or aims of the previously noted systematic reviews typically focusing on functional or discreet aspects of motor performance not rather than cognition, ADL, neuropsychiatric symptoms and mortality.

These included (summary information can be found in [Table 3, p.17](#)):

- Three Level I studies; two RCTs and a maintenance study of one further RCT cited in the above systematic reviews.
- Four Level II studies; three non-randomised controlled trials and one cohort study.
- One Level III study; a single group pre-post study
- No Level IV studies
- One Level V study; a narrative review

4.4. CONCLUSIONS

Systematic review evidence for exercise and motor intervention in dementia are promising. Two separate meta-analyses reported positive results for these interventions in terms of ADL performance and a number of functional areas including mobility and balance. Several RCTs and controlled trials not included in these reviews report corresponding results in terms of improvements to functional strength, balance and mobility but these were not consistently observed across studies.

A positive impact of exercise and motor interventions on cognitive performance is not supported by the meta-analyses but again mixed results from the quasi-experimental studies additionally considered suggest that further studies into the effect of exercise and motor intervention on cognitive and executive function would be worthwhile.

Allied health professionals should consider using exercise and motor interventions during efforts to improve the functional performance of people living with dementia. There is also some evidence that providing exercise interventions for people living with dementia may help to decrease caregiver burden.

Table 3: Summary of studies relating to exercise and motor interventions

Study	Design	Population	Intervention or aim	Outcomes/data used	Results	Country
(Hauer et al., 2012) and (Zieschang et al., 2013) (follow up study)	RCT	122 PWD \bar{x} age = 82y \bar{x} MMSE = 21.8/30 (approx.)	Examines the effects of a standardised exercise training regimen on muscle strength and physical functioning in PWD. 2 group randomized controlled trial. Double blinded. Intervention group received progressive resistance and functional training. Resistance training targeted at functionally relevant muscle group, provided as group therapy (4-6 participants). Functional training comprised training for basic ADL-related motor functions (walking, climbing stairs, sitting down and standing up), with progression to more advanced functional tasks. Intervention duration = 2 hours, twice a week for three months. Control group met two times per week for 1 hour of supervised motor placebo group training (flexibility exercise, calisthenics, low-intensity training with hand-	Cumulative Illness Rating Scale (CIRS) Functional status (ADL) Social status (independent vs institutionalized) Falls during the previous year Geriatric Depression Scale (GDS) Falls Efficacy Scale International (FES-I) Medical Outcomes Study 12-item Short Form Health Survey Attitudes to Falls Related Intervention Scale (AFRIS) Short Physical Performance Battery (SPPB) including five chair stands and gait performance (maximum walking speed, step frequency, cadence) Stair-climbing	Attrition: 12% at T2, 19% at T3. Participants in the training group demonstrated significant improvements for both primary outcomes; maximal strength and functional performance. Significant improvements in all strength and functional parameters related to trained muscle groups were also observed in the intervention group. No differences between groups were noted for the control parameter (handgrip strength). Training gains decreased in the follow-up, but effects were sustained for performance on motor tasks. Follow up study for maintenance effects at 9 months post-intervention completion: Gains in functional performance sustained with significant group differences in the primary endpoint (five-chair-rise) Secondary functional measures (Walking speed and POMA (Tinetti) confirmed this result. Strength, as measured by the primary endpoint 1-Repetition Maximum was still elevated but between-group differences disappeared.	Germany

			held weights, and ball games while seated). Measurements performed before randomization (T1), at the end of a 3-month training (T2), and after a 3-month follow-up period without training (T3).	performance Performance Oriented Motor Assessment (POMA) Timed-Up-and-Go Test (TUG) Maximum strength of muscle groups Physical Activity Questionnaire for the Elderly (PAQE) CERAD test battery Handgrip strength (control parameter)	
(Dorner et al., 2007)	RCT	42 older people (13 with dementia) \bar{x} age = 86.8y \bar{x} MMSE = 20.9/30	Examines the effect of structured strength and balance training on cognitive function (and additional functional, physical and psychological parameters) in frail, geriatric, long-term care facility residents, aged 75 years or older. 2 group randomised trial. No blinding reported. Intervention consisted of physical training (strength and balance training) delivered in group sessions three times a week for 10 weeks provided by a sports scientist. Duration	Muscle function (5 point Likert scale) German version of MMSE Body Mass Index (BMI) Barthel-Index Functional Independence Measure (FIM) Tinetti score Geriatric Depression Scale (GDS)	12 (6 from each group) dropped out Mean attendance to intervention = 91% At 10 weeks in the intervention group: - Muscle strength had increased significantly - Mean MMSE score increased from 20.9 to 23.9 points - BMI increased significantly - No significant changes occurred in the control group At 10 week, when compared to the controls, the intervention group displayed significant differences in: - Mean muscle strength score - Mean BMI - Mean lean body mass

Austria

			<p>of each session was 50 minutes.</p> <p>Control received usual care.</p> <p>All patients continued to receive pre-existing therapies (including OT, PT, SLT, Psychotherapy and medical management)</p>		<p>At 10 weeks, when compared to controls the intervention group displayed no significant changes in:</p> <ul style="list-style-type: none"> - Mean MMSE score - Proportion of lean body mass - Tinetti score (neither gait, nor balance test) - Barthel index - Functional independence measure (FIM) - Geriatric depression scale (GDS) <p>Change in cognitive function in the intervention group correlated significantly with the change in muscle function, the greater the gain in muscle strength, the greater the improvement in the MMSE score. This correlation was not observed in the control group.</p>	
(Pomeroy et al., 1999)	RCT	<p>81 PWD</p> <p>\bar{x} age = 81.9y</p>	<p>Examines the effects of providing physiotherapy during hospital respite admissions for PWD on mobility compared to non-physical activities intervention.</p> <p>Multi-center RCT.</p> <p>Blinded assessment.</p> <p>Participants individually received a maximum of 10 half-hour sessions of either physiotherapy treatment or non-physical activities.</p> <p>Physiotherapy comprised of</p>	<p>Southampton Mobility Assessment (mobility score)</p> <p>Two Minute Walking Test (distance walked)</p>	<p>The authors report:</p> <ul style="list-style-type: none"> - A non-significant trend for lower reductions in mobility score in the group receiving physiotherapy. - A non-significant trend for greater decrease in distance walked in the activities group 	UK

			<p>passive and active exercises to increase joint range of movement and muscle strength, interventions to re-educate bed mobility, balance in sitting or standing, standing up and sitting down and gait activities.</p> <p>Non-physical activities comprised one-to-one interaction with the aim of stimulating interest in the environment through touch, verbal communication and social contact.</p>			
(Schwenk et al., 2014)	Non-randomised controlled trial	148 PWD	<p>Examines the effects of a progressive resistance and functional training program on motor performance in PWD in a geriatric inpatient setting.</p> <p>Non-randomised groups (2 ward units)</p> <p>Intervention group received an intensive exercise programme. 2 sessions per day, of 1 hour maximum each were offered, one for strength training and one for functional training.</p> <p>Strength training targeted functionally relevant lower-extremity muscle groups/ Functional training targeted</p>	<p>Number of medication in use</p> <p>Cumulative Illness Rating Scale (CIRS)</p> <p>Barthel Index</p> <p>Geriatric Depression Scale (GDS)</p> <p>Short Falls Efficacy Scale International (Short-FES-I)</p> <p>12-Item Short Form Health Survey (SF-12)</p> <p>Percentage of available training sessions attended</p> <p>Muscle strength</p>	<p>18/148 (12.1%) dropped out</p> <p>\bar{x} attendance to intervention = 64.1±25.2% (strength sessions) and 60.4±24.8% (functional sessions).</p> <p>\bar{x} intervention duration = 18.1±6.8 days</p> <p>The intervention group compared to the control showed significant improvements to maximal strength (as measured by leg press) and functional performance (as measured by 5-chair-stand)</p> <p>The intervention group compared to controls showed significant improvements to abductor strength and balance performance.</p> <p>No significant between-group differences were found for any gait parameters and the HABAM.</p>	<p>USA</p> <p>Germany</p>

			<p>basic functions required during ADL such as chair transfer and postural control while standing.</p> <p>Intervention ceased when subject reached maximal lower extremity strength measured by a leg-press device and duration of the 5-chair-stand test for functional performance.</p> <p>The control group received care as usual.</p>	<p>5 Chair Stand</p> <p>Hierarchical Assessment of Balance and Mobility (HABAM)</p> <p>GAITRite-system</p> <p>Balance (sway area as measured by inertial sensor)</p>		
(Canonici et al., 2012)	Non-randomised controlled trial	<p>32 PWD-carer dyads</p> <p>\bar{x} age = 77.8 (PWD); 54.2 (carers)</p> <p>\bar{x} MMSE = 15.4/30</p>	<p>Examines the effects of a 6-month motor intervention programme on functionality in people with Alzheimer's Disease and carers' burden.</p> <p>No blinding.</p> <p>The motor intervention group received exercises during a 6-month period, three times per week for 60 min on non-consecutive days. Each session consisted of initial warm up, initial stretching, flexibility, strength, agility and balance; return to physical calm; and final stretching. Phases were aimed at emphasizing the functional capacity of the upper and lower limbs. Carers followed group procedures (motor</p>	<p>Mini-Mental State Examination (MMSE)</p> <p>Neuropsychiatric Inventory (NPI)</p> <p>Cornell Scale for Depression in Dementia (CSDD)</p> <p>Functional Independence Measure (FIM)</p> <p>Berg Functional Balance Scale (BFBS – Brazilian Version)</p> <p>Pfeffer Questionnaire</p> <p>Zarit Carer Burden Scale</p>	<p>Participants who received the motor intervention:</p> <ul style="list-style-type: none"> - Preserved their functionality (as measured by the FIM) while controls suffered a relative decline - Had better scores than the controls on functional balance assessed by Berg scale <p>Carers in the motor intervention group:</p> <ul style="list-style-type: none"> - Had reduced burden (as measured by the NPI and Zarit scale) <p>Results indicate that participation in the motor programme attenuated functional decline in PWD with an associated decrease in carers' burden.</p>	Brazil

			<p>intervention programme and/or medical routines) with their respective patients during the 6-month period.</p> <p>Controls received treatment as usual.</p>			
(Pedroso et al., 2012)	Non-randomised controlled trial	<p>21 people with probable AD</p> <p>\bar{x} age = 77y</p> <p>\bar{x} MMSE = 19,20/30</p>	<p>Examines the effects of a program of dual task physical activity on falls, executive functions and balance of elderly individuals with AD.</p> <p>Intervention consisted of physical exercise with cognitive tasks (exercises of coordination, aerobic resistance, flexibility, balance and agility and, at the same time, the performance of a cognitive task).</p> <p>Sessions took place three times a week on non-consecutive days, for 60 minutes for four months.</p> <p>Control group received no intervention.</p>	<p>Clock Drawing Test (CDT)</p> <p>Frontal Assessment Battery (FAB)</p> <p>Berg Balance Scale (BBS)</p> <p>Timed Up-and-Go (TUG)-test</p> <p>Number of falls (subject reported)</p>	<p>At outcome the intervention group presented:</p> <ul style="list-style-type: none"> - Significantly better performance in the MMSE - Better performance on the FAB and CDTs - No significant findings related to frequency of falls was observed 	Brazil
(Verdote-Robertson & Reddon, 2000)	Non-comparative study – pre-post	<p>44 older people (32 with dementia)</p> <p>\bar{x} age = 75.9y</p>	<p>Examines the effects of a daily walking programme on walking status, coordination of legs, posture, and gait pattern.</p> <p>Programme carried out by</p>	<p>Non-validated author developed scales of:</p> <ul style="list-style-type: none"> - Walking status - Coordination of legs - Posture 	<p>Statistically significant improvements in walking status, coordination of legs, and posture were obtained.</p> <p>Gait pattern did not improve significantly</p>	Canada

			<p>two PTs and two PTAs. Patients who could follow instructions participated in daily walking and strengthening exercises, while those who could not follow instructions due to cognitive impairment or aggressive or resistive behaviour participated only in daily walking exercises on the units.</p> <p>Walking activities occurred once daily for up to an hour. Intervention ceased when participants became independent in walking with or without a walking aid.</p>	- Gait pattern		
(Manckoundia et al., 2014)	Cohort study	<p>70 PWD</p> <p>\bar{x} age = 81.76</p> <p>\bar{x} MMSE = 22/30 (approx.)</p>	<p>Examines the effects of ambulatory physiotherapy (AP) on motor abilities in elderly subjects with AD.</p> <p>Data collected at baseline and 15-36 months post-inclusion from two groups; a physiotherapy group (PG), and a no physiotherapy group (NPG), depending on whether they received AP.</p> <p>PG received three sessions of 30 minutes per week and included musculo-articular analytical rehabilitation of the lower limbs with a focus on the ankles, muscular training</p>	<p>Mini-Mental State Examination (MMSE)</p> <p>Tinetti Test (TT)</p> <p>Mini Motor Test (MMT),</p> <p>Timed Up and Go test (TUG)</p> <p>Measurement of gait speed (GC)</p> <p>One-leg balance test (OLB)</p> <p>Ability to rise from the floor (RFF)</p> <p>Use of Walking aids</p>	<p>Motor physiotherapy had no impact on cognitive function.</p> <p>Significant differences between the two groups were observed for the evolution of postural and motor abilities between T0 and T1.</p> <p>Postural and motor abilities deteriorated in the NPG, with reduction in performance in the TT, MMT, TUG and RFF, and an increase in the GS. No significant differences were detected for the UWA, OLB and a HF in the NPG.</p> <p>In the PG, postural and motor abilities improved or remained stable, the TT score increased as did success at the OLB and HF decreased. No significant difference to MMT score, TUG, GS, RFF ability, and the</p>	France

			of the lower limbs, rehabilitation of posture, balance and coordination consisting in training to improve postural and protective reactions, and gait rehabilitation.	(UWA)	UWA were noted. Frequency of falls decreased in participants who benefited from the AP program.	
(van Halteren et al., 2007)	Literature review (descriptive)	N/A	Reviews experimental studies examining interventions to improve implicit motor-skill learning in patients with Alzheimer's disease (AD).	N/A	23 controlled trials were reviewed. 4 studies using a Maze test found that the AD patients were able to learn new motor-skills implicitly. 9 studies using a Rotor-Pursuit task reported preserved learning abilities in people with AD. 1 paper each using Puzzle-Assembly task and a Mirror-Tracing task reported preserved learning abilities in people with AD. 4 papers using a Serial Reaction-Time Task (SRTT) showed implicit learning. 1 study using a bimanual coordination tracing task, and 2 using tossing tasks also reported positive results. The authors note that irrespective of the task used, the studies assessing implicit motor-skill learning in AD reported positive outcomes and note that they suggest that people with AD have a performance deficit and not a generalized deficit in motor learning.	Netherlands

5. INTERVENTIONS AIMED AT FAMILIES, PARTNERS AND CARERS OF PEOPLE LIVING WITH DEMENTIA

5.1. DEFINITIONS

Interventions specifically aimed at non-professional carers (those people who provide care for people living with dementia without receiving pay) include the use of a number of different strategies comprising most commonly; skills training, psychosocial interventions, and behavioural management techniques and strategies. Outcomes measured in studies examining these interventions may include caregiver specific effects and outcomes for people living with dementia.

5.2. SYSTEMATIC REVIEWS OF EFFECTIVENESS STUDIES FOR CAREGIVER INTERVENTIONS

5.2.1. A SYSTEMATIC EVIDENCE REVIEW OF INTERVENTIONS FOR NON-PROFESSIONAL CAREGIVERS OF INDIVIDUALS WITH DEMENTIA (GOY, KANSAGARA, & FREEMAN, 2010)

Wide ranging review of high quality controlled trials identified in 31 previously completed systematic reviews of evidence for interventions to improve caregiver burden, mood, management of problem behaviours and effects on the person with dementia.

a) Multicomponent studies (5 RCTs)

There is no consistent evidence that multicomponent interventions delayed rates of institutionalization for people living with dementia. Individually tailored intensive, multicomponent interventions showed promise, but not conclusive results for reducing depression, improving sense of burden, self care abilities, well-being, confidence, and social support ratings for carers.

b) Exercise training (1 RCT)

One RCT indicated improvements in depressive symptoms, stress and burden but no significant difference from an attentional control group which also showed improvements.

c) Case management (5 RCTs)

Five studies of intensive nursing case management indicated little effect on rates of institutionalization for people living with dementia. Two studies demonstrated improved outcomes for carers including reduced stress and depression and improvements in confidence and mastery of caregiving skills.

d) Behavior management training (4 RCTs)

Four RCTs provide limited and not yet consistent evidence that behavioural management training interventions have beneficial effects on caregiver mood. Provision of this type of training as part of a multicomponent intervention resulted in more positive outcomes.

e) Individual skills training (6 RCTs)

Individual skills training studies showed mixed results on heterogeneous outcomes. Two studies demonstrated reductions in caregiver depression but no effect on their sense of burden, anxiety, or quality of life. Three studies indicated slower declines in self-care

capacity among people living with dementia following skills training with components targeting ADL. Two studies reported reductions in disruptive behavior following caregiver training in identifying triggers and modifying the environment to reduce stress. There is no strong evidence documenting the impact of skills training programs on delaying or preventing institutionalization for people living with dementia.

f) Group skills training (8 RCTs)

Three studies demonstrated reductions to caregiver depression with indications that in-home assessment to identify specific needs and individual interventions result in significant improvements. Two studies reported reductions in caregiver distress. Limited evidence from single studies indicate improvements in positive interactions and nurturing, reducing aversive and hostile caregiver responses to problem behaviours, reductions in caregiver burden, and increases in caregiver self-efficacy.

g) Individual, group, and combined individual/group supportive counselling (7 RCTs)

No evidence was found to recommend individual supportive counselling or group supportive interventions as more beneficial than control interventions. One study combining individual and group approaches delayed institutionalization for people living with dementia as well as improving mood of carers. Single studies indicated improvements in affective regulation for coping and aversive reactions to behaviour disturbance. No studies indicated group treatment effects for caregiver burden.

h) Technology based interventions

There is insufficient evidence from controlled empirical studies on the effectiveness of technology-based interventions to allow for solid conclusions. Some uncontrolled studies suggest that GPS location systems for wandering behaviour may improve function and safety of people living with dementia, as well as reduce caregiver depression, burden, and stress. Robust trials with sufficient follow-up are needed to determine the feasibility, effectiveness, and cost-effectiveness of information and communications technology (ICT) interventions.

i) Respite care

A comprehensive systematic review of the effectiveness and cost-effectiveness of respite care services was compiled in 2004 for the NHS. A review of 45 studies on several forms of respite care, found small statistically-significant improvements on some outcome measures, but the evidence on how respite affects the health and well-being of carers was inconsistent.

No enduring improvements in health and well-being in comparison to control groups, or compared to caregiver baseline state was associated with respite services of any form. However, carers frequently expressed high levels of satisfaction, and generally reported benefits from receiving respite services with many studies reporting carers' beliefs that respite enabled them to continue caregiving.

5.2.2. EFFECT OF EDUCATIONAL AND SUPPORTIVE STRATEGIES ON THE ABILITY OF CAREGIVERS OF PEOPLE LIVING WITH DEMENTIA TO MAINTAIN PARTICIPATION IN THAT ROLE (THINNES & PADILLA, 2011)

Systematic review (non-meta-analytic) of 43 studies (35 at Level I, 3 Level II, and 5 Level III).

Five reports of three studies into OT for carers were reviewed, all at Level I.

One study found that providing carers with OT focused on education, problem-solving and technical skills (task simplification, communication), and simple home modifications improved patients' skills, decreased their need for assistance, and reduced behavioural occurrences.

One study enhanced caregiver skills and resulted in greater mastery and self-efficacy, although subjective appraisal of burden was not affected.

Three reports focused on one study which found that OT caused carers to feel significantly more competent than those who did not receive therapy, with effects remaining significant beyond 12 weeks after intervention. An economic evaluation suggested that they are a highly cost-efficient intervention.

- a) 12 studies found improving carers' knowledge of AD and of strategies to better undertake their caregiving role mitigated increases in distress as illness progressed and improves caregiving attitude (nine studies at Level I; one study at Level II; two studies at Level III).
- b) Carers educated in behavioural management and skills for coping with their own stress in joint sessions with the care recipient had better outcomes for general well-being and depression (three studies at Level I).
- c) Caregiver counselling and support groups can have a positive effect on caregiver depression and reaction to troublesome behaviours, which in turn are significant predictors of patient institutional placement. These programmes can; delay institutionalisation (seven studies at Level I; one study at Level III), and improve carers' subjective sense of health (one study at Level I).
- d) Interventions combining supportive and educational strategies tailored to specific needs can be of most use to carers (four studies at Level I).
- e) Home rather than institution based interventions had a modestly positive effect on carers' sense of self efficacy and ability to manage agitation (one study at Level I) and may reduce mortality (two studies at Level I)
- f) Technological interventions including tech-mediated support groups, telephone networks, regular tele-health consultations, telephone delivered cognitive behavioural and education interventions and web-based education were shown to have positive results on carers' psychological well being, self-efficacy, and ability to manage care responsibilities (six studies at level I; one study at Level II; two studies at Level III)
- g) There is little evidence to support the significant long term benefits or adverse effects from the use of respite care for people living with dementia or their carers.

5.2.3. SYSTEMATIC REVIEW OF INFORMATION AND SUPPORT INTERVENTIONS FOR CAREGIVERS OF PEOPLE LIVING WITH DEMENTIA (THOMPSON ET AL., 2007)

Systematic review of 44 papers, rated as methodologically poor by the authors.

a) Technologically supported interventions

Meta-analysis completed for 3/4 studies examining technology based interventions which used computer based approaches to provide information and support to carers of people living with dementia indicated no significant results; n = 229, 95%CI = 0.62 [-1.98, 3.22].

b) Group based interventions

13 studies into group based interventions were reviewed. Of these 13, eight trials reported significant benefits for the interventions compared to controls while five trials reported no differences between groups.

Meta-analysis of five studies of psycho-educational interventions for caregiver depression estimated a statistically significant effect in favour of the intervention; n = 292, 95%CI = -0.71 [-0.95, -0.46].

Meta-analysis of three studies examining psycho-educational intervention used caregiver burden as an outcome but found no significant effects; n = 231, 95%CI = -2.15 [-5.97, 1.66].

Meta-analysis of two studies of support interventions did not identify differences in carer burden between the intervention and control group; n = 119, 95%CI = -0.40 [-5.69, 4.90].

c) Individual-based interventions

27 studies examined individual-based interventions. Ten trials found no difference between intervention and control groups, twelve reported significant intervention effects for some outcomes examined, and one trial reported a significant effect in favour of the control group.

Meta-analysis of individual-based psycho-educational interventions found no significant results relating to improvements in depressive symptoms as an outcome (95% CI = -0.21 [-0.61, 0.20]) or for self-efficacy as an outcome (95% CI = 0.37 [-0.28, 1.02]).

The review authors suggest lack of evidence that information and support-based interventions for carers of people living with dementia are uniformly effective. The evidence in favour of information and support in the context of group psycho-educational approaches is limited but may have a positive effect on depression.

5.2.4. A SYSTEMATIC REVIEW OF INTERVENTION STUDIES ABOUT ANXIETY IN CAREGIVERS OF PEOPLE LIVING WITH DEMENTIA (COOPER ET AL., 2007)

Systematic review (non-meta-analytic) of 24 studies reporting information about three RCTs examining group cognitive behavioural therapy (CBT), three RCTs into behavioural management techniques (BMT), one RCT and two Level II studies of IT for carers, one RCT examined additional professional support provision, one RCT examined respite care, and two level IV studies examined relaxation and yoga.

The authors used the Centre for Evidence Based Medicine guidelines for appraising papers and generated the following recommendations¹:

- a) Grade D recommendation not to provide group CBT because of inconsistent evidence.
- b) Grade B recommendation not to use BMT sessions as consistent level 2 studies showed lack of efficacy immediately and up to six months
- c) Grade B recommendation not to use exercise interventions as there is evidence that it is ineffective immediately post-intervention
- d) Grade D recommendation for provision of additional caregiver support immediately post-intervention
- e) Grade B recommendations not to use respite from consistent level two evidence, immediately or at one month

5.2.5. EFFECTS OF COMBINED INTERVENTION PROGRAMMES FOR PEOPLE LIVING WITH DEMENTIA LIVING AT HOME AND THEIR CAREGIVERS: A SYSTEMATIC REVIEW (SMITS ET AL., 2007)

Reviews 25 reports relating to 22 studies. Quality appraisal using Cochrane Collaboration Guidelines resulted in 8 good quality studies with the remaining being at moderate to high risk of bias. Meta-analysis was not possible as 12/25 studies did not report sufficient information.

The overall general mental health of carers was positively affected by combined programmes. However, no conclusive results were found for combined intervention programmes on a range of specific outcomes including depressive symptoms, well-being and for perceived burden.

There is preliminary evidence suggesting that combined programmes may support increases in competence of some subgroups, specifically women and minority carers.

The mental health of care recipients with dementia is often improved following combined interventions and admission to long-stay care is delayed by the programmes.

The authors note that of the included studies approximately half of the combined programmes examined benefited both carers and care recipients with dementia.

5.3. EVIDENCE FOR CAREGIVER INTERVENTIONS NOT INCLUDED IN PRECEDING SYSTEMATIC REVIEWS

Seven further papers relating to the provision of interventions or therapies for the caregivers of people living with dementia were identified. These included one Level I RCT, three Level IV studies (a single subject research designs and two cross sectional outcomes survey) and three Level V case studies. Summary information including an overview of results can be found in Table 4, [p.31](#).

¹Grade A = consistent level 1 studies; Grade B = consistent level 2 or 3 studies or extrapolations from level 1 studies; Grade C = level 4 studies or extrapolations from level 2 or 3 studies; Grade D = level 5 evidence or troublingly inconsistent or inconclusive studies of any level.

5.4. CONCLUSIONS

The review by Goy et al., 2010 is wide ranging and should be considered as a good summation of the available evidence on the effectiveness of interventions for carers of dementia although no meta-analysis was conducted and findings related to the benefits of interventions are inconclusive. Likewise, more targeted systematic-reviews into interventions to reduce caregiver anxiety and information and support based approaches emphasise the general lack of evidence for their effectiveness. The positive meta-analytic findings indicating a positive effect of psycho-education behaviour on caregiver depression should be noted (cautiously due to potential methodological flaws in the reviewed studies).

Findings from the studies not included in available systematic reviews are consistent with this picture.

Table 4: Summary of studies into caregiver focused interventions

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Nobili et al., 2004)	RCT	69 PWD-family subjects \bar{x} age = 74.5 (approx.) (PWD); 56y (approx.) (carers) \bar{x} MMSE = 11 to 12/30	Examines the effects of a structured intervention on caregiver stress and the institutionalization rate of PWD and problem behaviours. Intervention consisted of 2 home visits, one by a psychologist (60 min) and one by an OT (90 min). Psychologist led visit discussed family dynamics, the caregiver stress and consequences, communication, changes in PWD's personality, and current ways of managing problem behaviour. OT led visit involved practical advice on strategies to prevent and manage problem behaviour, to maintain and/or improve the patient's residual functional abilities, to modify home barriers, to limit dangerous situations, and to adapt the environment to meet the patient's needs Control received care as usual (counselling).	Spontaneous Behaviour Interview (SBI-C) Relative's Stress Scale (RSS) Mini-Mental State Examination (MMSE) Katz Index Lawton ADL	39/69 participants remained in the study at 12 month follow up. No differences were seen between the control and intervention groups in terms of: - Patients' cognitive change - Patients' functional change - Time spent caring - Carers' RRS scores - Use of services - Use of medications Significant differences were seen between the control and intervention groups in terms of: - The SBI-C score was significantly lower in the intervention than the control group - A significant reduction in the frequency of delusions in the intervention group Statistical analysis on mortality and institutionalisation could not be completed due to a lack of participants attaining these outcomes.	Italy
(DiZazzo-Miller et al., 2014)	Non-comparative	72 carers	Examine the feasibility and efficacy of the Family	Researcher developed Caregiver ADL	Significant gains in caregiver knowledge were recorded during the intervention (T2,	USA

	study (single group pre-test post-test design)		<p>Caregiver Training Program for assisting with the basic activities of daily living of people living with dementia.</p> <p>Intervention consisted of the provision of 6-hours of a protocol-based training programme over 3 consecutive weeks (2 hr/wk).</p> <p>Training included presentations, group discussions, real-life demonstrations, and role-playing.</p> <p>Data collected at baseline (T1) and two points during training (T2, T3) and three months after completion (T4).</p> <p>Training delivered by one OT, one legally trained patient advocate, one training specialist for older adult clients with neurological diagnoses, and one rehabilitation administrator for older adults, all of who had been trained in the intervention by study authors.</p>	<p>Knowledge Test (18 item multiple choice questionnaire)</p> <p>The Geriatric Depression Scale (GDS) Short Form</p> <p>Non-validated Quality Assurance Form</p> <p>Six item structured interview measuring general and ADL-related use of medical services</p>	<p>T3).</p> <p>10/72 carers completed the follow-up survey (T4) and variable results were recorded.</p> <p>General use of medical services for PWD decreased from at follow-up, but the number of emergency room visits slightly increased as a result of injuries sustained during ADLs.</p> <p>Use of medical services by carers had decreased by follow up as had visits to the emergency room.</p> <p>All carers who completed the 3-month follow-up survey (n=10) reported that they had retained and continued to perform skills they had learned during the Family Caregiver Training Program and that the content was applicable to their current caregiving situation.</p>	
(Gitlin, Jacobs, & Earland, 2010)	Cross-sectional survey	23 OTs 41 carers of PWD	Evaluates whether the Environmental Skill-building Program (ESP), which reduces caregiver burden and enhances skills managing patient functioning, can be	<p>Post-treatment surveys (carers)</p> <p>Post-training surveys (OTs)</p>	<p>20 carers completed surveys:</p> <ul style="list-style-type: none"> - 83.3% reported a “great deal” of knowledge and skill enhancement in dementia understanding, home safety, and communication. 	USA

			<p>integrated into homecare practices of OTs and reimbursed through Medicare Part B.</p>		<ul style="list-style-type: none"> - 68.4% reported enhanced ability to engage dementia patients in daily activities. - 68.4% reported “a great deal” of overall benefit. - 73.3% reported enhanced confidence managing behaviours. - 89.5% reported enhanced ability to care for family member. - 52.6% reported reduced upset. - 52.6% reported being able to take better care of themselves. <p>22 OT completed post training surveys:</p> <ul style="list-style-type: none"> - 100% indicated training components supported learning ESP. - 95% found face-to-face training strategies helpful (95%). - 90.91% indicated a need for ongoing training. - 72% reported no difficulties introducing ESP, integrating ESP into patient treatment sessions (60%), completing assessment forms (56%), identifying caregiver concerns (62%) and depression (62%), educating about stress (88%), and practicing stress reduction (60%). However, therapists indicated “some” to “a lot of difficulty” using treatment documentation (75%) and using problem solving (62%) with carers. - 95.5% therapists indicated intent to continue using ESP. 	
(Corcoran & Gitlin,	Cross sectional	100 carers of	Describes an environmental intervention designed to help	Case documentation	220 problems were identified by	USA

2001)		PWD \bar{x} age = 78.5y (PWD) 59.3y (carer)	carers of PWD manage areas of concern, and reports the specific aspects of treatment that were adopted by participating carers. Intervention as described in (M. A. Corcoran & Gitlin, 1992).	participating carers (\bar{x} = 2.2/carer). Carers reports problems in the following areas: <ul style="list-style-type: none"> - Caregiver Concerns (71%); objective and subjective burden - Incontinence 29% - Catastrophic Reactions 21% - Wandering 20% - ADL 19% - Communication 17% - Safety 16% - IADL 16% - Mobility 11% Carers tried 1068 new strategies, 896 (81%) of these were later used independently by the carers. 84% of carers used strategies to modify task, 83% strategies to alter social environments and 74% strategies to alter the environment.		
(Holmes, 2000)	Case study with pre-post design	1 PWD-carer dyad Age = 87y (PWD) MMSE = 10/30	Describes the effect of educating a caregiver to use a memory notebook to help reduce behavioural excesses in a relative with PWD. In this study, the notebook was used by PWD carer as a means of supporting communication	Revised Memory and Behaviour Problems Checklist (RMBPC) Behaviour Observations Field notes Global Deterioration Scale (GDS) Mini Mental State Exam (MMSE)	RMBPC score decreased from 42 pre-intervention to 35 afterwards. A reduction in repetitive behaviour was also observed. The participating caregiver reported favourably on the notebook's value.	USA
(Miller & Butin,	Case study	6 PWD-carer	Describes the COPE (Caregiver	Global Deterioration	Short selected case vignettes are reported	USA

2000)	dyads \bar{x} age = 70y (PWD); 68y (carers)	<p>Options For Practical Experiences) intervention designed to address the needs of six carers and their relatives with dementia.</p> <p>Intervention following assessment consisted ten-week demonstration program that combined a participatory model of problem-solving with renewed involvement in activities.</p> <p>A two-hour session held each week consisted of two groups: problem solving with carers alone, and activity involvement for both carers and patients.</p> <p>Data collected prior to and one month after the group ended.</p>	Scale (GDS) Zarit Caregiver Burden Scale Zung Depression Scale	<p>which suggest that the intervention:</p> <ul style="list-style-type: none"> - Heightened carers' awareness of PWDs' remaining strengths - Helped carers transfer a number of activities practiced in the group to their homes - Enabled carers to reduce disturbing behaviours of their relatives by applying specific recommendations modelled in the group - Enabled carers to be more reflective/aware of how their negative cognitions affected emotions and behaviours of their relative 		
(Corcoran & Gitlin, 1992)	Case study	1 PWD-carer dyad	<p>Description of an OT intervention designed for family carer of PWD. Using the competence-environmental press model and the principle of collaboration, 5 home visits over three months were completed to build carers' skills through collaborative identification of problem areas, implementing environmental strategies, and modifying management</p>	Case documentation	<p>Author conclusions indicate three potential benefits from the intervention:</p> <ul style="list-style-type: none"> - Effective application of principles of the competence-environmental press model may lead to decreased caregiver stress and an improved sense of efficacy in the carer's ability to manage daily behavioural problems. - Expansion of a carer's ability to solve problems may enable use of generalized environmental strategies to new problem behaviours, potentially prolonging carers' ability to manage 	USA

approaches.

- progressive behaviours over time.
 - Collaboration is important in community-based service models that require carers to develop skills to adapt their physical and social environments.
-

6. INTERVENTIONS USING INDIVIDUALISED OR PERSONALISED APPROACHES

6.1. DEFINITIONS OF INDIVIDUALISED OR PERSONALISED APPROACHES

Definitions for individualised or personalised care vary but can be summarised as models of care or approaches to therapy that tailor treatments specifically to meet the needs of individual people living with dementia (and in some cases their families, partners and carers). The papers considered in this section references a number of different specific interventions. They have been categorised as pertaining to individualised or personalised approaches as the study authors themselves have specified this as a key element of the intervention being examined. Several of these studies could also be placed in other categories such as multi-modal and interdisciplinary care.

6.2. SYSTEMATIC REVIEWS OF EFFECTIVENESS STUDIES FOR INDIVIDUALISED OR PERSONALISED APPROACHES

6.2.1. THE VALUE OF PERSONALIZED PSYCHOSOCIAL INTERVENTIONS TO ADDRESS BEHAVIORAL AND PSYCHOLOGICAL SYMPTOMS IN PEOPLE LIVING WITH DEMENTIA LIVING IN CARE HOME SETTINGS: A SYSTEMATIC REVIEW (TESTAD ET AL., 2014)

Systematic review (non-meta-analytic) of 40 studies (26 RCTs and 14 quasi-experimental studies).

Six different categories of personalized psychosocial interventions were identified; reminiscence (six studies), personalized music (seven studies), personalized pleasant activities with or without social interaction (ten studies), validation therapy (two studies), personalized exercise/physical activities (12 studies), person-centered care training and practice development (three studies).

The authors concluded from their critical appraisal of methodological quality that:

- a) There is good evidence to support the value of personalized pleasant activities with and without social interaction for the treatment of agitation
- b) There is good evidence to support the use of reminiscence therapy to improve mood
- c) Evidence for other therapies considered was limited due to methodological issues

6.3. EVIDENCE FOR INDIVIDUALISED AND PERSONALISED APPROACHES NOT CONSIDERED IN THE PRECEDING REVIEW

As the review by Testad et al., (2014) focused on care home settings only, a number of other papers were identified which examined individualised or personalised approaches to therapy for people living with dementia.

These include several papers relating to the same study as noted in the accompanying summary, [Table 5, p.39](#).

One RCT was directly reported but was also the subject of two economic evaluations and a cross-sectional feasibility study.

Another RCT was directly reported but was also the subject of an economic evaluation, a separate report focusing on quality of life outcomes, maintenance follow up and a single subject case study.

In addition to these studies with multiple reports, twelve further papers were identified; four Level I studies (RCTs), one Level II (controlled trial), one Level III (observational studies with cross-over designs), one Level IV (single subject research design) and five Level V studies (two case studies and three narrative literature reviews).

6.4. CONCLUSIONS

The evidence in favour of individualised approaches to dementia care is good.

Six well designed RCTs reporting on tailored interventions for people living with dementia and their carers report consistently positive results for a range of outcomes including reductions in behavioral symptoms and their impact, improvements to functional performance, reduced carer burden and improved quality of life.

Four of these RCTs involved the provision of tailored OT in the community while two examined tailored interventions in institutional settings. The non-randomised controlled trial, quasi-experimental and case studies report similar findings.

Economic evaluation of the community based OT interventions are promising, however it should be noted that the evaluative methods used are not true cost-effectiveness designs.

Allied health professionals working with people living with dementia and their carers in both community and institutional settings should consider using tailored or individualised approaches to therapy. Key recurring characteristic interventions proving beneficial in experimental studies include:

- The value of identifying people living with dementias' previous occupations, roles and interests and using these to inform the nature/features of any intervention
- The benefits of matching proposed therapeutic activities with identified residual performance capacities
- Recommending environmental modifications based on individual in-home assessment
- Involving carers in the interventions, including providing them with cognitive behavioural interventions, problems solving and coping strategies
- Intervention duration and frequency vary but all used multiple sessions (home based interventions used approximately 8-10 contacts while institutionally based interventions had more varied durations)

Table 5: Summary of Studies Examining Individualised Approaches

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Gitlin et al., 2008)	RCT	60 PWD-carer dyads \bar{x} age = 79y \bar{x} MMSE = 11.6/30	<p>Evaluates the Tailored Activity Programme (TAP) which was designed to reduce behavioural disturbances by identifying patients' preserved capabilities and previous roles and interests, and devising activities that build on them.</p> <p>The trial also tested whether tailored activities enhanced patient engagement, reduced caregiver burden, and improved caregiver mastery, self-efficacy, and use of effective communication and simplification strategies.</p> <p>2 group RCT</p> <p>Blinded assessment</p> <p>Intervention involved six 90-minute home visits and two 15-minute telephone contacts by occupational therapists over 4 months.</p> <p>Control consisted of waiting list dyads.</p>	<p>Frequency of occurrence of 24 behaviours: 16 from the Agitated Behaviours in Dementia Scale; 2 from the Revised Memory and Behaviour Problem Checklist; 4 identified from previous research; 2 identified by families.</p> <p>Cornell Scale for Depression in Dementia</p> <p>Caregiver report of patient activity engagement in past 2 weeks (5 item, 3-point Likert scale)</p> <p>Quality of Life-AD Scale</p> <p>Mastery scale (5-item, 5 point Likert scale)</p> <p>Zarit Burden Scale</p> <p>Caregiver estimates of real time spent "on duty" and "doing things" for dementia patients</p> <p>CES-D scale</p> <p>Confidence using activities during the past month (5 item, 10-point</p>	<p>At 4 months, when compared with controls, carers in dyads receiving the TAP reported:</p> <ul style="list-style-type: none"> - reduced frequency of problem behaviours, and specifically for shadowing and repetitive questioning. - greater activity engagement including the ability to keep busy. - Fewer incidents of agitation or fewer arguments. - Fewer hours doing things and being on duty - Greater mastery, self-efficacy, and skill enhancement. <p>The control participants showed similar benefits for reductions in behavioural frequency and caregiver hours doing things for the patient and mastery after receiving intervention.</p> <p>Carers with depressed symptoms derived treatment benefits similar to non-depressed carers.</p>	USA

				Likert scale) Task Management Strategy Index		
				OT reports of:		
				<ul style="list-style-type: none"> - Test scores - Time spent testing - Ease of administration of each assessment (5 point Likert scale) - Perceptions of whether sessions were acceptability to carers and PWD (10 items, 10-point Likert scale) - Observed benefits to caregiver (8 item index) - Observed benefits to PWD (4 item index) 	<p>OTs reported the tests were easy to administer, requiring 2x1-hr sessions.</p> <p>81.5% of 170 activities recommended for the 60 dyads were used.</p> <p>These activities were used an average of 4.19 times for 23 min by families between treatment sessions (1-2 weeks apart)</p> <p>Carers reported:</p> <ul style="list-style-type: none"> - Reduced upset with behavioural symptoms (86%) - Enhanced skills (93%) - Increased personal control (95%) - Relatives engaging with the activity independently (56.4%) <p>OTs reported observing PWD as having:</p> <ul style="list-style-type: none"> - Enhanced engagement (100%) - Increased pleasure during sessions (98%) 	
(Gitlin et al., 2009)	Cross sectional	60 PWD-carer dyads (from (Gitlin et al., 2008)	Examines the feasibility and acceptability of the TAP intervention.			USA
				Caregiver reports for each activity of:		
				<ul style="list-style-type: none"> - Time spent in the activity - Responsiveness of their relative - Specific techniques used to introduce activities - Perceived benefits 		
(Gitlin et al. 2010a)	Economic evaluation of	60 PWD-carer dyads (from	Evaluates the cost-effectiveness of TAP	2 items from the 4-item Caregiver Vigilance Scale	Average cost of the TAP intervention was \$941.63 per day.	USA

	RCT	Gitlin et al., 2008)	occupational therapy intervention.	of National Institutes of Health Resources for Enhancing Alzheimer's Caregiver Health (REACH): Hours "doing things" Hours "on duty"	Intervention carers saved one extra hour per day "doing things" at a cost of \$2.37/day and one extra hour per day "being on duty" at a cost of \$1.10/day. Monte Carlo ¹ showed that TAP was cost-effective 79.2% of the time for "doing things" and 79.6% of the time for "being on duty." TAP compares favourably to the few other available economic evaluations of patient and caregiver-based interventions. The authors conclude that the TAP is a cost effective way of realising positive outcomes for the carers of PWD.	
(Jutkowitz, Gitlin, & Pizzi, 2010)	Economic evaluation of RCT	60 PWD-carer dyads (from Gitlin et al., 2008)	Study uses different caregiver-based willingness to pay (WTP) values to retrospectively evaluate the cost effectiveness of the TAP. Three different WTP levels applied to outcomes from the TAP.	2 items from the 4-item Caregiver Vigilance Scale of National Institutes of Health Resources for Enhancing Alzheimer's Caregiver Health (REACH): Hours "doing things" Hours "on duty"	WTP varied between \$1.06/hour and \$4.58/hour (for on-duty outcome measure) WTP varied between \$2.21/hour and \$9.57/hour (for doing things outcome measure) WTP values for the TAP outcomes as calculated using three different WTP values indicated probabilities of being cost effective of between 50% and 80% for both outcome measures.	USA
(Gitlin et al. 2010b)	RCT	237 PWD-carer dyads	Examines the effectiveness of the Care of Persons with Dementia in their	Modified version of FIM Quality of Life–Alzheimer	28 dyads (11.8%) lost by 4 months. 36 dyads (17.2% from 4 months) were lost to follow-up. Total study attrition by 9	USA

¹ Monte Carlo Simulations are statistical problem solving techniques which are used to approximate the probability of certain outcomes by running multiple trial runs, called simulations, using random variables.

<p>Environments (COPE) trial, a non-pharmacologic, behavioural intervention supporting physical function and quality of life for patients with dementia and the well-being of their carers.</p> <p>COPE is personalised to align with individual capabilities and aims to modify environmental stressors to decrease sensory, physical, and cognitive demands</p> <p>The intervention aimed to re-engage patients in daily activities and increase functionality.</p> <p>Random allocation stratified by living arrangement.</p> <p>Dyads received up to 10 sessions over 4 months with occupational therapists and 1 face-to-face session and 1 telephone session with an advance practice nurse.</p> <p>Control group received up to three 20-minute telephone calls from trained research staff members (not occupational therapists or nurses), providing relevant informational brochures by mail and reviewing these</p>	<p>Disease</p> <p>Validated 5-item scale of activity engagement</p> <p>Agitated Behaviour in Dementia scale</p> <p>Perceived Change Index</p> <p>Caregiver confidence using activities over the past month (5 items, 10-point Likert scale)</p> <p>Carer reported problems</p> <p>Caregiver appraisal of study benefits (11-item survey)</p>	<p>months was 64 dyads (27.0%).</p> <p>At 4 months COPE patients had less functional dependence and less dependence in instrumental activities of daily living and improved engagement compared to the control group.</p> <p>COPE carers improved in their wellbeing and confidence using activities compared to those in the control group.</p> <p>At 4 months, 64 COPE dyads (62.7%) vs 48 control group dyads (44.9%) eliminated 1 or more caregiver-identified problems.</p> <p>No group differences were observed at 9 months for patients but COPE carers perceived greater benefits at this follow up.</p>
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			during subsequent calls.			
(Graff et al., 2006)	RCT	135 PWD-carer dyads \bar{x} age = 79.1y (OT); 77.1y (control) \bar{x} MMSE = 19/30 (both groups)	Examines the effectiveness of community based OT on daily functioning of patients with dementia and the sense of competence of their care givers. Treatment consisted of 10 one hour sessions over five weeks. First four sessions focused on diagnostic and goal defining activities including patients and primary care givers choosing and prioritising meaningful activities they wanted to improve. For the final six sessions, patients were taught to optimise individually recommended compensatory and environmental strategies. Primary care givers were provided cognitive and behavioural interventions training, how to supervise effectively, problem solving, and coping strategies. Single blind (assessors blinded to allocation). Data collected at baseline,	AMPS Interview of deterioration in daily activities in dementia (IDDD) Sense of competence questionnaire (SCQ)	Loss to follow up; 3 at randomisation, 12 immediately after baseline data collected, 6 during baseline to 6 week follow-up. At six weeks the per-protocol analyses included 114 patients. At 6 weeks compared to controls, patients who received OT showed significant differences on all outcome measures including significantly improved function in daily life. Primary care givers who received OT felt significantly more competent than controls. 84% in the intervention group and 9% in the control group achieved a clinically relevant improvement on the process outcome at 6 weeks. For all three outcomes together 47% in the intervention group and 2% in the control group achieved a clinically relevant difference at 6 weeks. At 12 weeks retention was 53/68 (78%) in the intervention group and 52/67 (78%) in the control group. At 12 weeks daily functioning of patients who received OT remained better than controls. Carers' sense of competence was significantly better at 12 weeks than at baseline. The proportion of patients continuing to	Netherlands

			six weeks and three months.		<p>have clinically relevant improvement at 12 weeks for the process and the performance interview outcomes were 75% and 82% in the intervention group and 9% and 10% in controls.</p> <p>48% of care givers in the intervention group still felt more competent to care compared with 24% in the control group.</p> <p>A clinically relevant difference was reached on all three outcome measures in 37% of the intervention group and 2% of the control group.</p>	
(Graff et al., 2007)	RCT		Reports the same study as Graff et al.,(2006) but provides additional information on QoL outcome.	Dementia Quality of Life Scale (DQOL)	<p>Patients' DQOL and carers' DQOL were significantly better in the intervention group as compared to controls.</p> <p>This improvement was still significant at 12 weeks.</p>	Netherlands
(Graff et al., 2006)	Case study	1 PWD-carer dyad	<p>Aims to generate insight into the content, context and process of individualised OT at home and to study the possible effects and conditions for success of OT at home for older patients with dementia and their carers.</p> <p>Patient records from previous RCT Graff et al., (2006) were analysed.</p>	Clinical records	<p>Information provided on how OT may improve the daily performance, communication, sense of competence and quality of life of an older patient with dementia and his or her primary caregiver.</p> <p>Education, feasible goal setting, environmental adaptation, compensatory skills training, supervision skills training, and changing dysfunctional cognitions on patient behaviour and caregiver role seemed to be successful.</p>	Netherlands
(Graff et al., 2008)	Economic evaluation of RCT (Graff et		Cost effectiveness study of single blind RCT.		Intervention cost €1183 (£848, \$1738) per patient and primary care giver unit at three months.	Netherlands

			OT visit. Controls only received initial visit and written recommendations. Outcome data collected by phone at 3 months post-initial assessment.		confirmed that OT intervention effects were as expected with PWD in the treatment group having higher levels of positive affect and independence in self-care at the post-test and their carers had significantly lower levels of burden at the post-test.	
(Kolanowski et al., 2011)	RCT	128 PWD \bar{x} age = 86y MMSE range = 8-24/30	Examines the effectiveness of using activities derived from Need-driven Dementia-compromised Behaviour Model (NDB) ¹ for reducing agitation and passivity, and improving engagement, affect, and mood in nursing home residents with dementia. 4 group, double blind RCT. Group 1 activities adjusted to Functional Level (FL), Group 2 activities adjusted to personality style of interest (PSI), Group 3 activities adjusted to FL and PSI (FL1PSI) and a active control group (AC). 1 week baseline; 3 weeks intervention; 1 week follow up.	Observation of engagement, affect, and mood assessed from video recordings and real-time observations Cohen-Mansfield Agitation Inventory Passivity in Dementia Scale (PDS) Philadelphia Geriatric Centre Affect Rating Scale Dementia Mood Picture Test (DMPT)	All treatments improved outcomes during intervention with the exception of the mood which deteriorated in the active control group. PWD receiving tailored activities demonstrated greater engagement, alertness, and attention in comparison to all other groups. PWD in the FL and PSI group demonstrated greater pleasure. Engagement returned to baseline levels except in all groups except the FL group in which it decreased. Both groups containing an element of PSI displayed less agitation and passivity One week after the intervention, mood, anxiety, and passivity improved over baseline; significantly less pleasure was displayed after withdrawal of treatment. The results are inconclusive and it is not possible to confidently assert that	USA

¹ The NDB model aims to alter the negative view of behavioural symptoms of dementia as 'disruptive' or 'problematic' to a perspective that views these behaviours as indicating needs that, if responded to appropriately, will enhance quality of life (Whall & Kolanowski, 2004).

					providing PWD opportunities to participate in activities matched to functional level and personality style generate better outcomes. Any type of activity (including active control) improved outcomes from baseline.	
(Gitlin et al., 2005)	RCT	127 carers of PWD	Examines maintenance of effects at 12 months for family carers who participated in a community based occupational therapy intervention to help families modify the environment to support daily function of the person with dementia and reduce caregiver burden. Maintenance phase following on from the original intervention consisted of one home and three brief telephone sessions to reinforce strategy use.	Seven memory-related behaviours using the REACH modified Revised Memory and Problem Behaviour Checklist REACH vigilance item Days Receiving ADL Help Caregiver upset with the seven behaviours 19-item Task Management Strategy Index Five-item, 5-point Likert scale to assess affect	At 6 months, carers receiving OT reported improved skills, less need for help providing assistance, and fewer behavioural occurrences compared to those in the control group At 12 months, caregiver affect improved and there was a trend for maintenance of skills and reduced behavioural occurrences, but not for other outcome measures.	USA
(Chenoweth et al., 2014)	RCT	601 PWD \bar{x} age = 85y	Examines the effect of both Person centred care (PCC) and Person centred Environments (PCE) on improving agitation, quality of life, emotional responses in care and depression, and care interaction for PWD residing in nursing homes. 4 group RCT in 38 residential homes.	Person-Centred Environment and Care Assessment Tool (PCECAT) Medication prescription Comorbid conditions Global Deterioration Scale of Primary Degenerative Dementia (GDS)	At follow-up: Quality of life and agitation were significantly different for PCE and PCC compared with the non-intervention control group. Quality of life had improved but not significantly for PCC and PCE groups. There were no changes to these groups' agitation levels. Improvements in care interaction quality	Australia

			<p>Blinded allocation and assessment.</p> <p>Group 1 = PCC; 2 = PCE; 3 = PCC + PCE; 4 = no intervention control.</p> <p>Data collected at baseline, post intervention and 8 month follow up.</p> <p>PCC comprised 32 hours of training for staff from participating care homes</p> <p>PCE comprised of expert led planning and implementation of PCE within a maximum budget of AUD\$ 10,000 in participating care homes.</p>	<p>Resident activities of daily living (ACFI)</p> <p>DEMQoL self-report (resident interview) and proxy interview</p> <p>Cohen-Mansfield Agitation Inventory (CMAI)</p> <p>Emotional Responses in Care (ERIC)</p> <p>Cornell Scale for Depression in Dementia (CSDD)</p> <p>Quality of Interactions Schedule (QUIS)</p>	<p>and in emotional responses to care in PCC+PCE were not observed in the other groups.</p> <p>No changes to depression scores occurred in any of the groups.</p> <p>Intervention compliance for PCC was 59%, for PCE 54% and for PCC+PCE 66%.</p> <p>There was no evidence to support the hypothesis that PCC combined with PCE would further improve quality of life and agitation.</p>	
(Edvardsson, Sandman, & Borell, 2014)	Non-comparative single group design	171 care professionals	<p>Evaluates the effects of implementing national guidelines for person-centred care of PWD on self-reported person-centeredness, strain, and stress of conscience as perceived by care staff at a large residential aged care facility.</p> <p>One group pre-test–post-test design with 12-month follow up.</p> <p>Intervention consisted of 10 month programme designed to (1) translate guidelines</p>	<p>Swedish version Person-centred Care Assessment Tool (PCAT)</p> <p>Person-centred Climate Questionnaire (PCQ)</p> <p>Demand/Control/Support questionnaire</p> <p>Stress of Conscience Questionnaire</p>	<p>At follow up:</p> <p>Staff reported significantly higher scores on the person centeredness of care compared to baseline.</p> <p>There was no significant difference in perceived overall person-centeredness of the environment between baseline and follow-up on total PCQ scores.</p> <p>Staff reported that the units were perceived as being significantly more hospitable compared to baseline.</p> <p>No significant differences were found regarding staff job strain</p> <p>Staff scores on their stress of conscience</p>	Sweden

			<p>and their evidence base to all care staff, (2) use the guidelines to develop, implement, and evaluate unit-specific practice improvement projects, and (3) disseminate improvement processes and findings across the care facility.</p> <p>Intervention based on participatory action research cycle and included educational, workshop, practice improvement and reflective seminars.</p>		<p>were significantly reduced post-intervention.</p>	
(Van Mierlo et al., 2014)	Qualitative case study	<p>22 'Stakeholders': project leaders, case managers, insurance companies, municipalities, patient and caregiver advocacy organizations</p>	<p>Investigates factors which facilitate and impede the implementation of two different Dutch case management models, including identifying whether the identified facilitators and barriers differ across models.</p> <p>Also aims to identify which model best enables case managers to provide personalized care for PWD.</p> <p>Two models considered: Combined Intensive Case Management and Joint Agency Model consists of a dementia network where</p>	Semi-structured interviews	<p>The independence of the case management organization in the Combined Intensive Model facilitated implementation.</p> <p>The presence of multiple competing case management providers in the Linkage Model impeded implementation.</p> <p>Most impeding factors were found in the linkage model and were related to the organizational structure of the dementia care networks and how partners collaborate with each other in this network.</p> <p>Results suggest that the implementation of the intensive case management model is preferable to the linkage model.</p> <p>Case managers in the intensive model are</p>	Netherlands

			<p>both case management and any additional care services (such as diagnostics and medical treatment) are embedded in one independent organization.</p> <p>Linkage Model consists of a dementia network in which multiple case management providers are active and the case manager acts as a mediator between the client and the multiple care agencies.</p>		<p>better able to provide personalized care and a higher quality of care overall being less impeded by competitiveness of other care organizations and more closely connected to the expert team.</p>	
(Morhardt et al., 2015)	Case study	4 PWD	<p>Described a tailored approach called the CARE Pathway Model (CARE-D) which aims to use a comprehensive psycho-social assessment based on a neuropsychological framework of cognitive and behavioural strengths and weaknesses to help deliver interventions targeted to a individual's symptoms and distinct profile. Includes use of memory, language, visuospatial and behavioural profiles.</p>	Narrative information about cases	<p>The authors describe the process of using the CARE-D to develop a tailored care plan and report the tailored recommendations for each case-subject.</p>	USA
(van der Ploeg et al., 2015)	Observational study - Repeated measures crossover	34 PWD \bar{x} age = 78y	<p>Aims to explore why some PWD and agitated behaviour showed limited response to personalized interventions.</p>	<p>Observation of single target behaviour per participant based on nurses' ratings of residents' agitated</p>	<p>In non-responders, agitated behaviour scores remained equally high during the intervention and control condition.</p> <p>Interest and constructive engagement</p>	Australia

	design		<p>Participants were randomized to Montessori or control blocks for 2 weeks; they then switched to the other condition.</p> <p>Both conditions were delivered for 30 minutes twice weekly on a one-to-one basis, resulting in a total of four Montessori and four control sessions.</p>	<p>behaviours in the previous 2 weeks, obtained using Cohen-Mansfield Agitated Behaviour Inventory (CMAI)</p> <p>Philadelphia Geriatric Centre Affect Rating Scale</p> <p>Menorah Park Engagement Scale</p> <p>MMSE</p> <p>Clinical Dementia Rating (CDR)</p>	<p>were lower in this group than in responders, they observed more interest and engagement during the intervention compared with this group's baseline and control condition scores.</p> <p>The frequency of agitated behaviour during the intervention was related to the frequency of agitated behaviour before intervention; both were strongly associated with severely impaired cognition.</p>	
(Vickland et al., 2012a) and (Vickland et al., 2012b)	Literature review	N/A	<p>Aims to develop a conceptual framework for the construction of individualized guidelines for working with PWD and aggression.</p>	N/A	<p>Ten concepts were identified as of key importance when managing aggression in dementia clustered along three major dimensions: Patient, Disorder and Treatment.</p> <p>Patient:</p> <ul style="list-style-type: none"> - Patient's individual characteristics - Personal life story - Patient's environment <p>Disorder:</p> <ul style="list-style-type: none"> - Presentation of symptoms - Theory of causation <p>Treatment</p> <ul style="list-style-type: none"> - Goals and expectations - Non-pharmacological interventions - Pharmacological interventions - Ethics and Restraint Use 	Australia

			- Emergency treatment			
(Treusch et al., 2011)	Literature review (descriptive)	N/A	<p>Present a description of neurobiological foundations and clinical correlations between the severity of apathy and impairments in motor, cognitive, and emotional functions.</p> <p>Literature review of the non-pharmacological treatment options of apathy in dementia.</p>	N/A	<p>Focusing on the motor, cognitive, and emotional aspects of apathy may help to implement successful treatment strategies.</p> <p>Multimodal, individualized approaches, including the use of physical activation and biography-based information to motivate dementia patients, seem to be of high relevance.</p>	Germany
(Camberg et al., 1999)	Observational study – cross over design	<p>54 PWD</p> <p>\bar{x} age = 82.7y</p> <p>\bar{x} MMSE = 5.1/30</p>	<p>Evaluates the effectiveness of Simulated Presence as a personalised approach to enhancing well-being in care home residents with Alzheimer’s disease or related dementias.</p> <p>The Simulated Presence intervention is intended to create an environment for PWD comprised of clusters of memories that have positive emotional effects on participants. Delivered in this study using personalised interactive audio recordings from a family member (the stimulated presence).</p> <p>3x3 crossover design comparing Simulated Presence, placebo and</p>	<p>Mini Mental State Exam (MMSE)</p> <p>Test for Severe Impairment (TSI)</p> <p>Bedford Alzheimer’s Nursing Sale</p> <p>ADL Self-Performance Scale</p> <p>Non-participant observer recoded:</p> <ul style="list-style-type: none"> - 7 item scale for agitation - Visual analogue scale of agitation - 2 affect items from the Philadelphia Geriatric Centre Affect Rating Sale (PARS) - Facial diagrams of 	<p>Simulated Presence was found to be equivalent to care-as-usual control and superior to placebo for affect as measured by facial diagrams.</p> <p>Nursing staff observations indicated significant reductions in agitation and withdrawn behaviour in the intervention group compared to both the placebo and care-as-usual controls.</p> <p>The intervention was also reported as superior to control and placebo groups for the outcome of ‘interest’.</p> <p>No significant results were found for any of the other outcomes measured.</p>	USA

usual-care control.	mood
Placebo was an audio recording of a person reading emotionally neutral newspaper articles.	Daily staff observation log documenting use of intervention and their impressions of response
Conditions were provided in a randomised manner, lasting for 17 days each over four weeks with a 10-day washout between treatments.	Weekly staff survey comprising: <ul style="list-style-type: none">- Short form version of Cohen Mansfield Agitation Inventory (CMAI-S)- Multidimensional Observation scale for Elderly Subjects

7. FUNCTIONAL AND TASK-ORIENTED INTERVENTIONS

7.1. DEFINITIONS OF FUNCTIONAL AND TASK-ORIENTED INTERVENTIONS

There is no consistent definition of functional or task-oriented approaches to therapy. Shared characteristics of studies considered in this section include interventions which focus on improving a range of outcomes for people living with dementia by providing therapies which seek to improve capacity to perform the movement of specific tasks meaningful to the participants and informed by their daily occupational needs.

7.2. EVIDENCE FOR FUNCTIONAL AND TASK ORIENTED INTERVENTIONS

No systematic reviews specifically examining functional or task oriented approaches to dementia care were identified during searches. Ten papers were considered in this review including two Level I studies (RCTs), one Level II study (non-randomised controlled trial), four Level III studies (observational pre-post designs) and three Level V studies (case studies). Summary information for these studies are presented in [Table 6, p.55](#).

7.3. CONCLUSIONS

Both RCTs provided tailored interventions designed to maintain functional abilities but neither reported consistent or compelling results. Results from the quasi-experimental studies were positive, though interventions varied in content, and three studies using single-group designs all reported positive effects from interventions on ADL performance. The reviewed case studies also reported positive results in terms of ADL performance and goal attainment.

Table 6: Summary of studies examining functional and task oriented approaches

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Quinn et al., 2014)	RCT	30 people with HD \bar{x} age = 57y	<p>Examines the feasibility and safety of goal-directed, task-specific mobility training for individuals with mid-stage Huntington's Disease.</p> <p>Intervention consisted of delivery of a task specific program by physical therapists twice a week for 8 weeks in each participant's home, up to a maximum of 15 sessions.</p> <p>Sessions were planned to last approximately 1 hour.</p> <p>The programs were individually tailored to participants' specific activity limitations related to the areas of walking, sit-to-stand transfers, and standing ability and modified to their home environments.</p> <p>The control group received usual care and were requested to continue as normal between assessments. They were specifically asked to not begin any new medication or physical activity regimens.</p> <p>Random allocation and blinded assessment.</p>	<p>Retention rates</p> <p>Reports of adverse events</p> <p>Unified Huntington's Disease Rating Scale Total Motor</p> <p>Score (UHDRS-TMS),</p> <p>Physical Performance Test (PPT)</p> <p>Timed "Up and Go" Test (TUG)</p> <p>10-Meter Walk Test (10MWT)</p> <p>30-Second Chair Stand Test (30CST)</p> <p>Berg Balance Scale (BBS)</p> <p>Subjective Vitality Scale</p> <p>Hospital Anxiety and Depression Scale (HADS)</p> <p>EuroQoL (EQ5D)</p> <p>Huntington's Disease Health-Related Quality of Life questionnaire (HDQoL)</p>	<p>The results from the IMI suggest that the participants highly valued the intervention.</p> <p>92% of goals were achieved at the end of the intervention period, with 46% being achieved at much better than expected outcome.</p> <p>At assessment 2, there was no clear evidence of treatment benefit.</p> <p>At assessment 3, there was some potential indication of treatment benefit in the UHDRS-TMS, 30CST, and vitality score but effect sizes were small.</p> <p>The authors conclude that safety and adherence to the intervention were both good. Most participants exceeded goal expectations.</p> <p>Design of the intervention in terms of frequency (dose), intensity (aerobic versus anaerobic), and specificity (focused training on individual tasks) may not have been sufficient to elicit any systematic effects.</p>	UK

			Intrinsic Motivation Inventory (IMI)	Goal Attainment Scale (GAS)		
			Examine effects of an individualized functional enhancement program (FEP) on functional skills and mood symptoms in mild and moderate dementia.		Functional and global cognitive function:	
			RCT – parallel group, double blind	Chinese Disability Assessment for Dementia (DAD)	At 1-month:	
			Intervention group received tailor made functional and skills training.	Assessment of Motor and Process Skills (AMPS)	<ul style="list-style-type: none"> - MMSE scores were maintained in both groups - Significant improvement in AMPS process skills were found in both groups - DAD scores and the AMPS motor skills were not significantly different from baseline 	
			Control group received general occupational therapy on activities appropriate to the severity of cognitive impairment.	Cornell Scale for Depression in Dementia (CSDD)	At 4 months:	
(Lam et al., 2010)	RCT	74 PWD	Intervention was delivered in groups with intervention and control subjects mixed and trained together.	Neuropsychiatric inventory (NPI)	<ul style="list-style-type: none"> - Deterioration in MMSE was found in the intervention group - AMPS skills also deteriorated in both groups 	Hong Kong
			Each group session lasted for 45 min, were conducted twice per week for 8 weeks.	Cantonese version of Mini-Mental State Examination (MMSE)	Affective symptoms:	
			Data collected at baseline and 1 and 4 months post intervention.		At 1 month:	
					<ul style="list-style-type: none"> - NPI-apathy scores in the intervention group improved significantly - There was a non-significant trend for improvement in depressive symptoms in the intervention group. 	
					From 1 to 4-month post- FEP, there were rebounds of apathy and further decreases in CSDD scores in the intervention group but not the control.	
					There were no significant group differences	

						in the changes in DAD, AMPS, and CSDD scores after controlling for the effects of age, educational level, and CIRS total scores.
(Bettcher et al., 2011)	Non-randomised comparative trial	87 PWD \bar{x} age = 77y \bar{x} MMSE = 22/30	<p>Evaluates a task-training action intervention designed to increase error monitoring in dementia patients and to pinpoint the relation between error monitoring and neuropsychological processes.</p> <p>Participants in the intervention group completed the Task Training NAT (TTNAT).</p> <p>The participants in the control completed the Standard NAT.</p> <p>Standard NAT requires participants to perform three everyday tasks using objects that are placed before them on a U-shaped table while the TTNAT had different conditions including implementation of task-training sessions prior to the initiation of each NAT task. Specific rehabilitation techniques employed in the TT-NAT include identification and description of objects used in the task as well as presentation of photographed depictions of important task</p>	<p>Mini Mental-State Examination (MMSE)</p> <p>Boston Revision of the Wechsler Memory Scale-Mental Control Subtest</p> <p>Phonemic fluency (FAS)</p> <p>Clock Drawing Test</p> <p>Boston Naming Test (BNT)</p> <p>Category Fluency (Animals)</p> <p>Philadelphia (Repeatable) Verbal Learning Test-Discriminability Index (PVL-T-Discriminability)</p> <p>Observed number of errors</p>	<p>TT-NAT participants produced fewer total errors and detected significantly more errors than Standard NAT participants.</p> <p>Error detection was strongly related to only the language composite index in the TT-NAT, whereas it was moderately related to both the language and executive composite indices in the Standard NAT condition.</p> <p>Review of task steps and objects before task performance may be a promising intervention for error-monitoring deficits in dementia patients.</p>	USA

		steps.				
(Rogers et al., 1999)	One group pretest-posttest	84 PWD or probable PWD \bar{x} age = 82y \bar{x} MMSE = 6/30	Examines effectiveness of a behavioural rehabilitation intervention for improving the performance of morning care activities of daily living (ADL) of nursing home residents with dementia. Baseline = Usual Care (duration 5 days) Intervention = Skill Elicitation consisting of an individualized behavioural rehabilitation intervention designed to identify and elicit retained ADL skills (duration 5 days) Intervention follow-up =Habit Training, in which the behavioural rehabilitation intervention was reinforced to retain skills and facilitate further functional gains.	Observed frequency of carer assistance required ADL performance Response to care (including disruptive behaviour)	Compared with Usual Care, Skill Elicitation significantly increased the proportion of time participants spent engaging in unassisted and assisted dressing. Overall participation in ADL also increased, with a concomitant significant decrease in disruptive behaviour. Functional gains were demonstrated within 5 days of initiating the behavioural rehabilitation intervention and were maintained for 3 weeks during Habit Training. Physical assists were provided for significantly smaller proportions of a morning care session during Skill Elicitation and Habit Training compared with Usual Care.	USA
(Baldelli et al., 2007)	One group pretest-posttest	34PWD \bar{x} age = 81y MMSE range = 8-15/30	Examines the effect of OT interventions aimed at recovering or improving residual functional capacity in PWD. OT intervention focusing on washing, personal hygiene, dressing, sanitary service and eating were provided for 40 days (no further details provided).	Ronchi Brief Evaluation Battery (RBEB)	Significant improvements were observed in three areas of ADL function measured on the RBE (washing, use of sanitary services and dressing). No significant changes were observed for functional performance in personal hygiene and eating. No differences between participants with Alzheimer's Disease and those with vascular dementia were observed.	Italy

(Josephsson et al., 1995)	One group repeated measures design	4 PWD	<p>Examines the effects of an intervention aimed at improving functional (occupational) performance of PWD attending a day care centre.</p> <p>Intervention consisted of OT to improve one IADL selected individually with each participant. Interventions developed to target procedural motor skills (as opposed to higher order executive functioning) and typically included environmental adaption and assisted learning of tasks (e.g. prompting and guidance).</p> <p>9 training sessions provided followed by 5 assessed performances with support, followed by 5 assessed individual performances.</p> <p>Duration of session ranged from 5-20 min and frequency from 3-5 times weekly. Total data collection time range 5-7 weeks across participants</p> <p>Group followed over 1.5 years with repeat measurements at 6 month intervals.</p>	<p>Assessment of Motor and Process Skills (AMPS)</p> <p>Frequency of support required to complete tasks (reminding, demonstrations and physical assistance)</p>	<p>Some task-performance related gains were noted following intervention for 3/4 participants as measured on the AMPS, primarily in process skills.</p> <p>Support requirements for these participants decreased correspondingly.</p>	Sweden
(Josephsson et al., 1993)	One group repeated measures	4 PWD	Examines the effects of an intervention aimed at improving functional	Assessment of Motor and Process Skills (AMPS)	3/4 participants demonstrated intervention related gains on the AMPS with one demonstrating maintenance in functional	Sweden

	design		<p>(occupational) performance of PWD attending a day care centre.</p> <p>Intervention consisted of OT to improve one IADL selected individually with each participant. Interventions developed to target procedural motor skills (as opposed to higher order executive functioning) and typically included environmental adaptation and assisted learning of tasks (e.g. prompting and guidance).</p> <p>9 training sessions provided followed by 5 assessed performances with support, followed by 5 assessed individual performances. Duration of session ranged from 5-20 min and frequency from 3-5 times weekly. Total data collection time range 5-7 weeks across participants.</p>		<p>performance gains after the withdrawal of environmental prompts.</p> <p>The authors note that the pattern of results suggests that the intervention may support everyday functioning in people living with dementia but further research is required.</p>	
(Ciro, Hershey, & Garrison, 2013)	Case study	<p>1 PWD 73y MMSE = 12/30</p>	<p>Describes the process and outcomes of using the Skill-building through Task-Oriented Motor Practice (STOMP) intervention with a single person with dementia with Lewy Bodies.</p> <p>Intervention model includes collaborative setting of</p>	<p>MMSE Cornell Scale for Depression in Dementia Functional Independence Measure (FIM) Canadian</p>	<p>Mixed scores were realised for goal attainment. Of three chosen goals, one did not change from baseline, one was performed at the expected level and one exceeded performance expectation following intervention.</p> <p>For 2 of 3 goals COPM scores for performance and satisfaction were low but had improved by the end of intervention</p>	USA

			<p>meaningful goals with client and their families, compensatory modifications that may improve performance are made, and the goal is broken down into steps that are practiced repetitively according to specific motor-learning training principles.</p> <p>Intervention sessions completed in the participant's home for 2–3hr/day, 5 days/week, for 2 weeks.</p>	<p>Occupational Performance Measure (COPM)</p> <p>Goal Attainment Scaling (GAS)</p>	<p>while scores for the final goal did not change.</p>	
(Preissner, 2010)	Case study	<p>1 PWD</p> <p>83y</p> <p>MMSE = 9/30</p>	<p>Report describes the use of the OT Task-Oriented Approach with a client with pre-existing dementia and occupational performance limitations after a cerebral vascular accident.</p> <p>The approach is often a preferred neuro-rehabilitation intervention to improve occupational performance by optimizing motor behaviour.</p> <p>Intervention consisted of 90 min of occupational therapy 6 days/week for 4 weeks.</p>	<p>Functional Independence Measure (FIM)</p> <p>Assessment of Motor and Process Skills (AMPS)</p>	<p>Following intervention the participant met most long term goals with some personal care goals only partially met.</p> <p>All FIM domains had improved at discharge.</p> <p>The AMPS was not re-administered after therapy.</p>	USA
(Cartwright, Madill, & Dennis, 1996)	Non-comparative (case study)	<p>65 PWD</p> <p>\bar{x} MMSE = 18/30</p>	<p>Examines the effectiveness of interventions aimed at improving functional performance of cognitively impaired older people</p>	<p>Functional Independence Measure (FIM)</p> <p>MMSE</p>	<p>Functional status measured by the FIM improved significantly during admission. The amount of improvement in functional status did not differ between those with severe and those with moderate</p>	Canada

<p>admitted to an assessment and rehabilitation centre.</p>	<p>Workload Measurement System (WMS)</p>	<p>impairment. Scores for each domain of the FIM also improved significantly during admission. Admission FIM was the single most powerful predictor of outcome, explaining 81% of variance in discharge FIM score. No correlations between change in functional status and time spent providing OT and PT were detected.</p>
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8. ASSISTIVE TECHNOLOGIES

8.1. DEFINITIONS

Studies examining the provision and use of assistive technologies for people living with dementia made up the single largest category of results. Assistive technology is a broad term that includes a range of assistive, adaptive, and rehabilitative devices for people living with dementia. Assistive technologies are typically designed to promote independence by enabling people to perform tasks that have become unachievable or harder to accomplish as a result of dementia symptoms.

8.2. SYSTEMATIC REVIEWS OF EFFECTIVENESS STUDIES FOR ASSISTIVE TECHNOLOGY INTERVENTIONS

8.2.1. TECHNOLOGY-DRIVEN INTERVENTIONS FOR CAREGIVERS OF PERSONS WITH DEMENTIA: A SYSTEMATIC REVIEW (GODWIN ET AL., 2013)

Systematic review (non-meta-analytic) of eight papers referencing four RCTs into technology based interventions designed to improve psychosocial outcomes for informal carers of people living with dementia.

All four included studies reported positive results although not consistently across the outcome areas considered which included burden, depression, anxiety, stress or strain.

No overall statement about methodological quality is made. The authors note difficulties drawing consistent conclusions about the effects of technology driven interventions for carers of PWD due to the low number of available RCTs, which vary in terms of the interventions delivered and how effects are measured.

8.2.2. EVIDENCE SUPPORTING TECHNOLOGY-BASED INTERVENTIONS FOR PEOPLE WITH EARLY-STAGE ALZHEIMER'S DISEASE (BUETTNER & BURGNER, 2010)

Systematic review (non-meta-analytic) of ten studies examining technology-based interventions for people with mild cognitive impairment or early stage dementia

Only one well designed RCT was identified for inclusion in the review with the remaining nine papers comprised of studies using observational designs.

The AT used in the reviewed studies included; computer based functional training, memory aids, video-conferencing assessments and in home technology supports. While meta- analysis was not feasible, positive effects were noted across the included papers for a range of outcomes including; functional behaviours, recall of appointments, dates or tasks, improved concentration, improved cognitive performance, increased recall of routes in the environment, increased social interactions and improved medication adherence.

8.3. EVIDENCE FOR ASSISTIVE TECHNOLOGIES NOT INCLUDED IN SYSTEMATIC REVIEWS

8.3.1. OVERVIEWS AND NON-TECHNOLOGY SPECIFIC PAPERS

14 general papers providing overviews of AT interventions in dementia were identified. Nine of these were narrative literature reviews and therefore rated at Level V. There were 3 qualitative studies (Level IV), one cross-sectional study (Level IV), and one longitudinal observational study following changes to AT use over time (Level IV). Summary information is presented in [Table 7, p.68](#).

No consistent or convincing body of evidence was identifiable from these papers. Recurring elements noted include reviews which focus on categorising the aims of different AT, and reviews which considered barriers and facilitators to the use of AT.

8.3.2. SERVICE DELIVERY, TELE-HEALTH AND WEB BASED INTERVENTIONS

Five papers examining service delivery approaches enhanced by technology were identified and included four case studies (Level V) and one pre-test post-test design (Level III). Summary details are provided in [Table 8, p.75](#).

Variations in the type of interventions examined prevents cross-study comparison. No positive finding about symptoms related outcomes were reported. Two papers reported positively on measures of carer satisfaction related to the interventions.

8.3.3. PROMPTING, CUING AND INSTRUCTIONAL TECHNOLOGIES

13 studies into prompting, cuing and instructional technologies were identified including three Level III studies (cross sectional studies) and ten Level IV studies (primarily using variation on single subject research designs). Summary details are provided in [Table 9, p.78](#).

Most of the studies into cuing or prompting technologies reported positive results though these tended to be in relation to the rate of errors encountered during the performance of basic ADL tasks. Four papers noted the importance of being able to alter cuing/prompting AT to satisfy

individual needs or tailor the device to match particular preferences. These papers mostly referred to real world application of devices, such as stove timers, as opposed to laboratory based studies of more complex task-focussed cuing.

8.3.4. COMMUNICATIONS TECHNOLOGIES

Seven papers examining interventions using technology or devices to support communication for people living with dementia were identified including two papers reporting three Level I (RCTs), one Level III (multicentre cross-sectional study), two Level IV studies (variations on single subject research designs), and two level V case studies. Summary details are provided in [Table 10, p.85](#).

Types of communication technology varied from computer based augmentative devices to simpler solutions. Comparison across the devices studies was not possible.

8.3.5. ASSISTIVE TECHNOLOGY FOR MOBILITY

Ten papers were identified which addressed interventions using technology to support the mobility of people living with dementia including five Level IV studies (three observation studies using variation on single subject research designs and one participatory action research report) and five Level V studies (case studies). Summary details are provided in [Table 11, p.91](#).

Research tended to focus on either the use of GPS to support community mobility, a range of navigational cuing technologies, typically within predefined test routes, and specialist anti-collision equipment for powered wheelchairs. While no conclusive results have been reached, GPS appears to be a useful technology for supporting independence in people living with dementia, and reducing stress and anxiety in their families, partners and carers

8.3.6. SMART HOMES

Two papers were identified which specifically examined pre-designed SMART homes (rather than the post-hoc provision of adaptations and devices. Both used case study designs (Level V). Summary details are provided in [Table 12, p.97](#).

One single subject case-study reported positive clinical outcomes, with the other largely focussed on reporting technical data about Smart home system performance.

8.3.7. ASSISTIVE TECHNOLOGIES FOR COGNITION, MEMORY AND ORIENTATION

Eight papers examining AT interventions to support various aspects of cognitive performance, memory and orientation were identified including one Level III study (a cost benefit analysis using cross sectional methods), one Level IV study (a mixed methods observation study), and six Level V (case studies). Summary details are provided in

[Table 13, p.99](#). Differences in the type of devices used and method of study prevent comparisons.

8.3.8. USER EXPERIENCES AND OPINIONS OF AT

A large proportion of identified literature examining assistive technologies for dementia focus on generating knowledge and information about how people living with dementia, their carers and relevant professionals perceive the provision, use and effectiveness of OT. Most of these papers use data generated in response to the provision of new, or use of existing AT.

Twenty-one papers were reviewed for this subject including thirteen Level III studies (cross sectional surveys), seven Level IV studies (qualitative enquiries) and one Level V (case study). Summary details are provided in [Table 14, p.104](#).

8.4. CONCLUSIONS

Despite the volume of research identified related to the use of AT for and by people living with dementia, very few used high quality designs. Two non-meta-analytic reviews identified five experimental designs, and the studies examining AT to support communications included three experimental designs, but all of the other papers identified which were not addressed in these reviews were rated as Level III or lower.

It is difficult to draw any conclusions from the studies examining AT as a means of supporting service delivery due to differences in intervention content. Where user or provider satisfaction was addressed, service delivery, tele-health and web based interventions seemed to be acceptable regardless of the manner of the intervention. Two studies examined the effect of AT assisted service delivery on health care utilisation but reported conflicting results.

Studies into prompting, instructional and cuing technologies generally reported positive results. However, few of the studies examined the impact of these approaches on real world use by people living with dementia, and the outcomes examined tended to be narrowly focussed on the number of correct steps made, or assistance required, during basic ADL tasks rather than overall occupational or functional performance, quality of life and so forth.

Studies examining AT for communications are also difficult to draw conclusions from due to the disparate nature of interventions examined. Three papers examining interventions are worth noting. Two papers examined AT for communication using experimental designs, and reported positive results for the use of a personal game method for gaining first-person perspectives of PWD, and different configurations of an augmentative communication device. A cross-over design was used to examine the effect of Talking Mats to support communication for people living with dementia which resulted in favourable outcomes.

There is some limited evidence from observational studies to support the use of GPS to assist in navigation and risk management, primarily for measures focused on anxiety or worry related outcomes for both people living with dementia and carers. Other novel or one-off investigations into navigational aids reported positive results. Two case studies examining adapted wheelchairs with collision prevention systems observed no effects.

Of the two case studies examining Smart homes one was focused on system testing rather than outcomes for people living with dementia. The other reported positive results for a range of functional, cognitive and behavioural outcomes with a single participant.

The case studies and observational study examining AT to support cognition, memory and orientation all suggested positive outcomes from a range of devices including basic devices through to more complex electronic systems.

Much of the literature identified was related to user experiences and opinions of using AT. Within this large and diverse body of work the following themes were detected:

- Simplicity and ease of use are key to the successful adoption and use of AT.
- AT should include the ability to be altered to fit the specific need and environment of users.
- It is important that AT devices are discreet, non-stigmatising, do not appear overly medical and are small and easy to carry.
- Ethical concerns related to the impact of GPS monitoring and 'tagging' on a person's independence, privacy and autonomy appeared to be overridden by the ability to manage risks and safety issues.
- Devices designed to support the completion of practical daily activities are viewed as more useful than those designed to support cognitive performance.

Table 7: Summary details of overview papers examining AT

Study	Design	Population	Intervention or aim	Outcomes/data used	Results	Country
(Sugihara et al., 2015)	Literature review (descriptive)	N/A	Provide an overview of ATs for PWD and a road map detailing anticipated developments in AT for the next 10 years	N/A	Currently available AT for PWD overviewed in the categories of - Screening technology to identify symptoms related to cognitive impairment; Memory aids; Health and safety monitoring; Information sharing and telecare; Communications aids and therapy; AT for person-centred care. Results of the road mapping exercise indicate future AT will be developed in the areas of – information and communication technology based observation and appropriate intervention; ICT-based on-the-job training for apprentices; ICT-enabled social involvement.	Japan
(Boger et al., 2014)	Cross sectional study (semi-structured interviews)	N = 13 3 carers of PWD 10 OTs	Pilot study to understand the use of AT by community-dwelling older adults with dementia and family carers to support daily occupations that have been impacted by changes in cognition.	AT used by PWD and carers Factors influencing use of AT Needs for new AT	Frequently used AT included - medication reminders or management aids; signage and environmental aids; orientation aids. Falls detectors and memo minders were not in use. A range of enablers and barriers are reported.	Canada
(Robinson et al., 2013)	Literature review (descriptive)	N/A	Summarizes evidence on the use of AT by the oldest old (>85y). Discusses ethical issues associated with the use of AT with this population and identifies key directions for future research and development.	N/A	All 4 papers reported the in review are summarised in this report ((Bharucha et al., 2009; L. N. Gitlin, Winter, & Dennis, 2010; Lauriks S et al., 2007; P. Topo, 2009)). Research into tracking devices reveals that families view these devices positively as a way of supporting the independence and safety of their relative and offer them peace of mind. Likewise professional staff are particularly concerned about	UK

			Amongst the wider review presents information on studies related to dementia.		<p>minimizing risk of harm to the individual with dementia.</p> <p>Balancing individuals' rights to independence and their carers' duty to minimize harm is a core issue in decision-making around the use of AT.</p> <p>Potential areas for future research related to PWD include - Greater inclusion in studies exploring design and evaluation of AT; Greater use of ethnographic methods to understand AT use in context.</p>	
(Riikonen, Mäkelä, & Perälä, 2010)	Qualitative study (ethnographic)	N=23 PWD-carer dyads \bar{x} age=79y	<p>Study undertaken to identify the most appropriate AT solutions to support home care for PWD, the impact of home care AT in enabling PWD to continue living at home, and the financial outcomes associated with the use of AT.</p> <p>Data collected at 4 points following needs-led provision of AT.</p>	<p>Mini-Mental State Examination (MMSE)</p> <p>Clinical Dementia Rating (CDR)</p> <p>GDS-FAST-classification</p> <p>Neuropsychiatric Inventory (NPI)</p> <p>Structured questionnaires and interviews completed by homecare professionals from 6 participating municipalities</p> <p>Interviews with PWD-carer dyad</p>	<p>29 AT solutions were provided during the study (26 commercially available and 3 adapted from available devices).</p> <p>Devices categorised as:</p> <p>Risk preventive technology,</p> <p>Assistive technology and Emergency technology.</p> <p>112 individual devices were installed and \bar{x} duration of use = 7.5 months.</p> <p>On average, carers estimated that installed AT increased the time at home (before requiring institutional care) of PWD by about 8 months (range 0 to 12 months or over).</p> <p>\bar{x} cost of device provision = €700/person (€30-2100) including training and installation costs.</p>	Finland
(Bharucha et al., 2009)	Literature review (descriptive)	N/A	Aims to illustrate the range of emerging AT devices that may find a role in dementia	N/A	58 different technologies identified and categorised as - Prospective memory aids; Communication devices for aphasia;	USA

			care rather than a comprehensive review.		Navigation aids; Environmental sensors and detectors; Physiological and functional alarms and sensors.	
(Carswell et al., 2009)	Literature review (descriptive)	N/A	Evaluates reported healthcare technologies appropriate to night time care of PWD.	N/A	<p>4 papers reported on specific night time AT including - monitoring systems; lighting and guidance technology; aids to improve normal sleep patterns.</p> <p>14 papers reported on AT for use during night and day including - monitoring systems; light and music therapies; user experiences of AT.</p> <p>36 papers reported on AT used during the day which could also be used at night including - monitoring systems; AT for reminiscence; light and music therapies; instructional and cognitive devices and aids specifically for use by carers.</p> <p>Does not report solely on AT (includes information about horticulture and recreational activities for instance).</p>	UK
(Gentry, 2009)	Literature review	N/A	Outlines available smart home technologies, research into smart home AT, and discusses clinical and consumer resources. It aims to review ethical, funding and professional training considerations for smart home applications.	N/A	<p>Provides a taxonomy of smart home types (including - in home AT; connected homes; learning homes; attentive homes) presenting selected research and examples of each.</p> <p>Notes lack of rigorous evidence into the efficacy of Smart home interventions or their cost effectiveness.</p> <p>Discusses the importance of collaborating with PWD when considering Smart home interventions and considering ethical issues related to the potential to increase social</p>	USA

					isolation.	
					46 original studies and 1 review (covering 20 studies) included.	
					Of the 66 studies mentioned in 47 papers- 10 focussed specifically on PWD; 15 focussed on both PWD and their carer's; 10 focussed on care home staff; 5 focused on improving access to information.	
					5/66 studies involved PWD living at home.	
					The most common foci of studies examined - Challenging behaviours (including anxiety, restlessness, affective/psychotic symptoms and wandering); Access to information; Burden of care; Temporal and spatial orientation; Sleep disturbance; ADL.	Finland
(Topo, 2009)	Literature review (descriptive)	N/A	Review of studies focused on technology supporting people living with dementia and their carers. Meta-analysis not possible.	N/A		
					Most AT studied focused on - Monitoring movement as an element of safety/risk reduction; Social stimulation; Light therapy.	
					Feasibility and acceptability of the devices was rarely evaluated.	
					The 15 caregiver focussed studies examined - IT-based peer support and its effect on a carer burden; carer wellbeing; carer knowledge about assistive technologies.	
(Lauriks et al., 2007)	Literature review (descriptive)	N/A	Overview of ICT solutions for unmet needs of PWD and informal carers.	ICT for general and personalized information (18 websites and 3 papers)	Digital information relating to dementia, health services, support offerings, and financial/legal issues is provided with varying quality on multiple websites, as well as by digital social charts.	Netherlands UK

				<p>ICT for support symptoms with of dementia (4 websites and 20 papers)</p> <p>ICT for social contact and company (11 papers)</p> <p>ICT to monitor health and safety (12 papers)</p>	<p>Most of these sites offered useful tips and support for carers but are less focused on providing information for PWD (both in terms of design and content).</p> <p>No research testing the websites was identified.</p> <p>Demand-orientated and personalized information was difficult to obtain and most content currently available tends to be generic.</p>	
(Murphy, Gretebeck, & Alexander, 2007)	Literature review (descriptive)	N/A	<p>Reviews studies to identify best intervention strategies for remediation and prevention of bathing disability.</p> <p>Reports on 3 papers into bathing for PWD (among the wider focus of bathing for older adults).</p>	N/A	<p>Very few of the studies examined aspects of the Person-Environment-Occupation interaction. 2 included in the review reported caregiver identified bathing problems as including - resistance in performing bathing; agitation; lack of ability to follow the bathing routine; safety.</p> <p>1 study examined environmental adaptation, use of verbal and tactile cueing, formal healthcare support and positive reinforcement of appropriate behaviours.</p> <p>1 RCT examined the effectiveness of two types of bathing approaches (person-focused showering and towel bed bath) in which members of staff were trained to work with PWD residing in nursing homes. Both significantly reduced incidents of agitation, aggression and discomfort.</p>	USA
(Nygård & Starkhammar, 2007)	Qualitative study (ethnographically inspired)	<p>N=8 PWD</p> <p>\bar{x} age=69y</p> <p>\bar{x}</p> <p>MMSE=24.9/30</p>	<p>Study undertaken to identify and characterize difficulties in using everyday technology by PWD (mild to moderate stage)</p>	<p>Interviews</p> <p>Observations at home</p>	<p>A detailed taxonomy of barriers to technology use is presented and arranged as four categories:</p> <ol style="list-style-type: none"> 1. Person and context related conditions, 2. Limitations in the participants' 	Sweden

					<p>knowledge of the technology and its potential,</p> <p>3. Communication problems related to how to interpret and understand technology and related to how to handle devices,</p> <p>4. The illusory nature of manufacturer instructions as a means of support.</p>	
(Chalfont & Gibson, 2006)	Qualitative study using interviews and focus groups. Based on Grounded Theory	<p>26 PWD (residential and community dwelling)</p> <p>18 professional carers</p> <p>23 relatives of PWD</p>	<p>Aims to analyse user requirements and determine the potential role of AT in promoting wellbeing, identify areas requiring development of AT, and identify environmental factors which can enable or barrier the use of AT.</p> <p>Presents the preliminary findings from an ongoing study.</p>	N/A	<p>Key areas for development of AT include promoting; identity, personal history, social engagement, access to music, access to nature, enabling relationships, conversation prompting, activity sequencing and creative activities.</p>	UK
(Cash, 2003)	Literature review (descriptive)	N/A	<p>Provides definition of AT and overviews the applications of AT for PWD and considers ethical debate around AT.</p> <p>Selective – no search strategies reported.</p>	N/A	<p>Describes initiatives and research relating to Smart homes, tele-care, and low level or 'off the shelf' (e.g. commercially available) technology.</p> <p>Discusses issues around the use of AT and informed consent.</p>	UK
(Mann et al., 1996)	Observational study (no intervention provided)	N = 19 PWD	<p>Sample followed over 1 year to track changes in use of AT. Interviews completed one year apart and included collection of data from standardised measures</p>	<p>MMSE</p> <p>Older Americans Research and Service Centre Instrument (OARS) - Health status</p>	<p>Between first interview and second interview one year later:</p> <p>Number of visits to a doctor in preceding 6 months increased from 3.7 to 4.8.</p> <p>Length of hospital stay increased from 8.0</p>	USA

domain	to 10.7 days
Functional Independence Measure (FIM)	Number of medications use dropped from 2.2 to 1.8
Sickness Impact Profile (SIP) – Physical dysfunction section	Jette pain score did not change \bar{x} MMSE decreased significantly from 8.8 to 6.1
Jette Functional Pain Index	SIP and FIM measures of disability status increased from 30.3% to 37.8% (FIM score decreased from 66.5 to 54.2)
Consumer Assessments Assistive Technology Used	No significant changes in AT device ownership or satisfaction were observed. Overall usage of AT declined significantly from 6.11 to 4.95 with significant reductions in AT to address physical and cognitive impairments but not those for hearing and vision problems. 10/19 participants made a total of 17 home modifications primarily for security, improved access or mobility, prevention of wandering and in-home safety.

Table 8: Summary of studies examining AT to support service delivery

Study	Design	Sample	Intervention or aim	Outcomes / data used	Results	Country
(Lundberg, 2014)	Case study (observational)	10 households with a family member caring for a PWD (n=9) or CVA (n=1)	Examines the provision of and ICT-based system developed to support carers of those suffering from stroke, AD or other dementias. ICT system comprised of computer equipped with a software package of information programs, a videophone (linked both to a support call centre staffed by trained personnel and other ICT system users), an internet connection and the opportunity to attend group meetings arranged by the local municipality. Study aimed to better understand how ICT can support elderly family carers.	Interviews Observations in home and at local group meetings ICT system data Health service usage data	Participating carers socialised with other ICT users in the group (as long as they remained members). Group meetings were seen to be important opportunities for exchanging experiences and reducing some anxieties. The ICT system did not reduce the level of health and social care services required by the participating families. Interaction with the ICT system decreased over time and the information programmes built into the system required constant updating to remain useful to participants. The videoconferencing element was the most valued element of the ICT system providing social support. The call centre was used primarily for social issues and for technical support.	Sweden
(Leuty et al., 2013)	Mixed methods - concurrent nested design and qualitative follow up	6 OT-PWD dyads PWD >65 \bar{x} MMSE = 16.5	Computer based art device (ePAD) designed to engage PWD in creative activities. Features included AT prompting to maintain engagement.	Satisfaction, effectiveness and efficiency as measured by questionnaires with 5-point Likert scales	OTs responses suggest the ePAD effectively engaged clients and they were generally satisfied with its design. PWD responses suggested the AT prompting was ineffective. Note high risk of bias due to sampling, allocation	Canada

			Intervention delivered as ≤ 5 x 1 hour 1:1 sessions.		and control methods. 3 withdrawals (only 3 dyads completed full 5 hours).	
(Burrow & Brooks, 2012)	Service delivery case study (descriptive)	N/A	Describes the development of a web-based resource (atdementia.org.uk) designed to provide independent information on assistive technologies for PWD, carers, families and professionals Survey methodology not specified.	N/A	Describes the process of developing the service including drawing on expertise from local services, involving PWD as stakeholders and including the views of relevant health and social care workers. An online satisfaction survey indicated that 69% of respondents found the site very useful and 44% of respondents were in the process of obtaining AT features on the site.	UK
(Dang et al., 2008)	Non-comparative study	113 carers of PWD	Evaluates a care-coordination intervention supported by the use of tele-care (screen-phone used to deliver caregiver education and monitoring). Data collected at baseline and 12 months.	Zarit Burden Interview (ZBI) Centre for Epidemiologic Studies Depression Scale (CES-D) Brief Cope (COPE) SF-36 Carer knowledge about dementia and resources Satisfaction survey Healthcare utilisation data	60/113 (53%) dyads responded at 12 months. No significant differences were detected between ZBI, CES-D and COPE scores at baseline and 12 months. 40/113 (35%) dyads participated in the satisfaction survey and were more satisfied with the care-coordination (90%) aspect of the programme than the education (77%) or the monitoring (50%). 85% felt that the screen-phones were reliable and easy to use. 75% believed that the programme improved communications with health care providers and helped them feel more secure. 92% said they would recommend the programme to others. Healthcare utilisation data was collected for 81 subjects - Hospital admissions reduced from 18 admissions to 11; Hospital bed-days for carers were	USA

					<p>reduced from 282 to 71; Clinic visits decreased from 1614 to 798; Emergency room visits decreased from 32 to 17; Outpatient prescriptions increased from 2180 to 2303.</p> <p>The total facility cost for the 81 patients in the six months pre-enrolment was \$718,881, which decreased to \$364,046 in the following six-month period.</p>	
(Chiu & Henderson, 2005)	Service delivery case study (descriptive)	N/A	Provides guidelines for OTs when developing internet-based services and provides a case study of an Internet-based service for family carers of PWD.	N/A	<p>Details 7 development activities to follow when setting up internet based services.</p> <p>Few details given about the case illustration.</p>	Canada

Table 9: Summary of studies examining prompting, cuing and instructional technology

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Lancioni et al., 2014)	Observational study (multiple baseline designs)	8 PWD	Study 1: (n=4) Provision of visual-instruction device to support 2 ADL; preparing a snack and coffee (n=2) and preparing an orange drink and coffee or tea (n=2).	Study 1: Number of correct steps in ADL	Study 1: All participants' mean percentage of correct steps increased from baseline during the AT assisted intervention.	Italy USA New Zealand
			Investigated using multi-probe design (variation on multi-baseline design).	Study 2: Number and types of music activated by participants	Study 2: All participants selected and activated more pieces of music during the AT intervention than at baseline	
(O'Neill et al., 2014)	Classification study	40 PWD and 26 carers \bar{x} age = 73y \bar{x} MMSE = 28/30 \bar{x} age (carer) = 67	Study 2 : (n=4) Provision of a computerised device for music selection and activation.	Social validation panel (n=44) scoring 6 item, 5-point Likert scale.	Social validation scores were significantly higher for 5 of 6 items in the intervention trials compared to the baseline trials.	UK
			Investigated using multi-probe design (variation on multi-baseline design).	Provision of mobile phone-based video streaming system to provide reminders for everyday tasks using a familiar voice, face and articulation, delivered over everyday technology.	Interview data Workshops Patient visit logs 4-point Likert scale indicating level of AT adoption	

			<p>Aims to identify the factors and parameters that influence AT adoption and to develop a predictive model to assess the likelihood of adoption by PWD-carer dyads.</p> <p>14 separate parameters considered.</p> <p>Applies factor analysis and confirmatory classification to data.</p>			
(Lancioni et al., 2010)	Observational study (follow up of non-concurrent multiple baseline designs)	9 PWD	<p>Follow up of (Lancioni G et al., 2009); verbal-instruction technology provided to help PWD in ADL and to improve mood.</p> <p>Data collected at 5 months (n=2), and between 6 to 14 months (n=7).</p>	<p>Observation of task performance and scoring of correct steps</p> <p>Observation of mood during activity and non-activity trials.</p>	<p>Participant performance remained largely accurate and above baseline at follow up.</p> <p>Most patients also showed improvements to mood during trials.</p>	Italy (USA)
(Bewernitz et al., 2009)	Observational study	<p>11 PWD</p> <p>MMSE = 12-20/30</p> <p>Community dwelling</p>	<p>Comparison of face-to-face, intercom and machine based prompting (audio and visual cues) for completion of self-care tasks (drinking water, brushing teeth, dressing upper body).</p>	<p>Ability to complete self care tasks as measured by number of prompts required (including repeats, when clarifications were requested, and successful task performance).</p>	<p>Drinking water task completed with machine-based cues on 85.7% (43 out of 49) of the trials.</p> <p>Brushing teeth task completed with machine-based cues on 88% (15 out of 17) of the trials</p> <p>Upper body dressing completed with machine-based cues on 80% (12 out of 15) of trials.</p> <p>7 different categories of cue were used.</p> <p>A range of tasks components were identified as requiring monitoring for the cueing machine to</p>	USA

					<p>work.</p> <p>No conclusive information is presented relating to the effect of the different types of cuing used.</p> <p>Audio cueing appears as effective as visual cuing (based on researcher opinion).</p> <p>Need for cuing assistance did not appear related to MMSE or FIM score</p> <p>No standardisation of procedure or location.</p> <p>Effect of task learning not considered.</p> <p>Some participants included with co-morbid cognitive impairments (CVA).</p> <p>Sampling strategy unclear- appears to be convenience sampling.</p>	
(Lancioni et al., 2009)	Observational study (Non-concurrent multiple baseline designs)	9 PWD	<p>Verbal-instruction technology provided to help PWD in ADL and to improve mood.</p> <p>Study 1: n = 6 Snack preparation (22 steps) using AT .</p> <p>Study 2: n = 3 shaving (16 steps) using AT.</p>	<p>Observation of task performance and scoring of correct steps.</p> <p>Observation of mood during activity and non-activity trials.</p>	<p>Study 1: Significant increases in correct steps from baseline to intervention were observed for all PWD.</p> <p>Indices of happiness during intervention/activity trials compared to non-activity trials increased for 5/6 participants.</p> <p>Study 2: Significant increases in correct steps from baseline to intervention were observed for all PWD.</p> <p>Significant differences in indices of happiness between intervention/activity trials and non-activity trials were observed.</p>	Italy
(Mihailidis et al., 2008)	Observational study (Single subject alternating baseline design)	<p>6 PWD</p> <p>\bar{x} MMSE = 12.5/30</p> <p>\bar{x} Age = 85y</p>	<p>Evaluates the efficacy of a computerised audio or audio-visual prompting device to support ADL (hand washing).</p> <p>ABAB design with 10</p>	<p>Number of steps completed independently.</p> <p>Number of caregiver interactions</p> <p>Functional assessment</p>	<p>Results (n = 5, omitting 1 subject classed as severe, MMSE 3/30)</p> <p>Improvements noted in all three areas.</p> <p>4/5 participants were able to independently complete the activity.</p> <p>\bar{x} decrease in interactions with the caregiver</p>	Canada

			<p>trials held at each of the four stages</p> <p>Trials consisted of one trial per day per participant, Mondays to Fridays, for eight weeks for a total of 40 trials each.</p>	scale (FAS).	<p>required by the participant to successfully complete the task = 66% when the device was introduced.</p> <p>FAS scores for the activity increased by a negligible 2% for the group.</p>	
(Boger et al., 2006)	Cross sectional survey	30 professional carers of institutionalised PWD	<p>Determining the efficacy of a computerised guidance system (to support hand washing) which employed Markov decision processing.</p> <p>Participants scored videos of researchers simulating PWD rather than genuinely cognitively impaired participants</p> <p>Assessors blinded to type of cueing (e.g. human vs computer)</p>	5 point Likert scale for 5 different dimensions of effectiveness scored by carers watching 6 video clip (3 guided by computer system and 3 guided by human caregiver)	<p>Human guided scenarios were scored as being significantly more effective than those guided by computer.</p> <p>Qualitative feedback indicated the importance of language construction of prompts, allowing time to complete, the benefit of also having visual cues, importance of tailoring prompts, using positive feedback.</p>	Canada
(Labelle & Mihailidis, 2006)	Observational study (Multiple-treatment, single-subject design)	<p>8 PWD residents of long term care unit</p> <p>\bar{x} age = 83y</p> <p>MMSE range = 3-14/30</p>	<p>Comparison of the effectiveness of verbal and audio visual (verbal prompt with additional video component) prompts in aiding PWD to wash their hands.</p> <p>ABAB design with randomly allocated</p>	<p>The number of hand washing steps that a participant completed without prompts from caregiver</p> <p>The number of interactions required with the caregiver to complete the hand</p>	<p>PWD completed more hand washing steps (approx. 1 more step on average) with less dependence on carers (reduced by approx. 50%) when automated prompts (both verbal and audio-visual) were introduced.</p> <p>No significant difference in the efficacy of methods was noted.</p> <p>Statistically fewer caregiver interactions were required when using the audio-visual approach</p>	Canada

			<p>counterbalance for receipt of treatment.</p> <p>15 trials per test phase were recommended, for a total of 60 trials.</p> <p>429/480 trials completed.</p> <p>Limited power due to sample size and missing data (11%).</p> <p>Convenience sample.</p> <p>Gender imbalance (7M:1F).</p>	washing step.	compared to the verbal approach.	
(Mihailidis, Fernie, & Cleghorn, 2001)	<p>Observational study</p> <p>(Single subject multiple baseline design)</p>	<p>1 PWD</p> <p>81y</p> <p>MMSE = 12/30</p>	<p>Examines the feasibility of a computerised cueing device designed to support PWD with hand-washing.</p> <p>ABAB design with each phase conducted over a 3 day period, for half an hour each day. Phase A consisted of normal hand washing supported by the minimum number of prompts necessary from carer. Phase B used the computerised cuing device.</p>	6-point Likert scale for participant's performance based on level of independence in performing the activity.	<p>The number of tasks the PWD completed independently increased when the computerised cuing device was used.</p> <p>6 point scoring collapsed dichotomous categories for analysis.</p> <p>Not possible to determine a stable baseline performance.</p>	Canada
(Nygård, 2009)	Qualitative study	23 OTs, nursing, electrician,	Study to investigate the reasoning and views of	5 focus groups (2 mixed professions, 3 home	All participants agreed that stove timers were provided to ensure safety.	Sweden

	informed by Grounded Theory	device supplier, home service personnel	different professionals involved in providing stove timers and supporting older adults with cognitive impairment or dementia at home.	service personnel only)	<p>The timing of device provision and PWD motivation to use it affected its uptake and featured in professional reasoning relating to provision.</p> <p>Carers reported that the timer often caused unintended issues as its discreet nature meant many users did not know how to reset their stoves following cut-off by the device, or alter its setting to allow longer cooking periods. This included withdrawal from or significant changes to stove use. Some also noted that learning how to use the device would be unachievable for many of their clients.</p> <p>Most professional effort focused on installing devices as a general fire precaution rather as individually adjusted home modifications to allow continued engagement in activities.</p>	
(Nygård, Starkhammar, & Lilja, 2008)	Retrospective audit of case notes	N=945 Final sample = 939 cases, 788 had problems associated with memory loss or dementia.	<p>Provision of stove timers.</p> <p>The study aimed to identify the characteristics of those who were provided with timing devices on stoves, and to investigate the application procedure and recommendations for timer options.</p>	Usage data from case notes	<p>Only 10.5% (of 788) had, or were suspected of having dementia.</p> <p>Applicants tended to be elderly females, living alone. Assistance from health professionals in completing applications was common.</p> <p>Options available for tailoring the device were used inconsistently and there were limited opportunities for professional follow-up.</p> <p>Devices seemed to be used as a safety precaution rather than as a device to support independent activity performance.</p>	Sweden
(Starkhammar & Nygård, 2008)	Qualitative study using a grounded theory approach	9 PWD or memory impairments 5 relatives	Provision of stove times. Qualitative study aiming to illuminate users' experiences of stove times	Data collected from interventions and participant observation.	<p>Users rarely participated in the process of choosing the timer device.</p> <p>Device adaptation often left to professionals, with users trying to learn how it worked or adjust it on their own.</p>	Sweden

						<p>Most users felt the device provided increased safety but also caused some unforeseen difficulties.</p> <p>Users strive to relate to and make sense of technology. The authors suggest that home modifications with assistive technology should more actively involve the user and include follow-up technical support.</p>
(Nygard & Johansson, 2001)	Qualitative study	<p>5 PWD \bar{x} age – 63y \bar{x} MMSE = 20/30 3 spouses of participating PWD also included</p>	<p>Baseline interview followed by provision of a time aid (inclusive of patient choice) to help reduce disorientation.</p> <p>Intervention period lasted 6 weeks for 3 participants with weekly telephone or face to face contact with OT. Details of intervention period for the remaining 2 participants not detailed.</p> <p>Evaluative interviews held immediately after agreed intervention period.</p>	N/A		<p>Baseline interviews indicated several themes including different ways of judging and responding to time, difficulty related to temporal disturbance, a range of strategies for managing temporal difficulties including modified occupations, trusting others and adapting the environment.</p> <p>Individual case reports for each participant presented post intervention. Overall 2/5 participants benefitted from the time aid intervention.</p> <p>Comparison of cases indicated that problems which could be compensated for with time aids were mostly related to knowing ‘when to do things’, while problems related to knowing ‘how long’ to engage in an activity for could not be solved.</p>

Table 10: Summary of studies examining AT for communication

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Suijkerbuijk et al., 2015)	RCT	12 PWD \bar{x} age = 74.9y	<p>Presents the evaluation of a personal game approach to evaluating AT for use with PWD. Intended to facilitate direct involvement of PWD in the design of AT.</p> <p>Used to score the in-home provision of a dynamic lighting device designed to improve sleep-wake patterns.</p> <p>Participants alternately assigned to use personal game evaluation method or standard questionnaire scored on a tablet.</p> <p>Data collected at baseline and 2 weeks post AT provision.</p>	<p>Data from personal game evaluation method</p> <p>Data from standard questionnaire</p>	<p>Personal game method was able capture the first-person perspective of PWD while the tablet based questionnaire often required caregiver support.</p> <p>More extensive responses were given by those PWD using the personal game device.</p> <p>The authors conclude that the new method may be an appropriate research tool for PWD.</p>	Netherlands
(Fried-Oken et al., 2012)	Study 1 – RCT Study 2 - RCT	Study 1 = 30 PWD Study 2 = 11 PWD	<p>Examines the effectiveness of different configurations of AT to support communication for PWD.</p> <p>Study 1</p> <p>Participants randomly allocated to receive one</p>	<p>Study 1</p> <p>Conversations coded according to 5 domains of social communication framework</p> <p>Study 2</p> <p>Number of targeted</p>	<p>Study 1 –</p> <p>The AAC had no significant effects nor did input symbol type.</p> <p>The effect of voice output was significant across with participants displaying fewer total utterances and significantly more one-word utterances when AAC devices included voice output.</p>	USA

<p>of 6 configurations of an augmentative or alternative communication (AAC) device.</p>	<p>words used, percent of targeted words used (out of total words), and percent of related words (targeted plus highly related words out of total words).</p>	<p>Study 2- A significant effect for AAC was noted and was associated with greater use of targeted words during personal conversations.</p>
<p>3 groups received AAC devices configured so that verbal outputs could be generated. This was then twinned with print only inputs (n=5), 2D image and print inputs (n=5) or 3D image and print inputs (n=2).</p>	<p>Number of references to AAC device.</p>	<p>Consecutive sampling Unequal cell sizing in study 1</p>
<p>The remaining 3 groups received AAC devices which did not generate verbal outputs. This was then twinned with print only inputs (n=6), 2D image and print inputs (n=5) or 3D image and print inputs (n=7).</p>		
<p>Intervention consisted of 10 conversations (5 with and 5 without the AAC device) conducted over a period of 5–8 weeks. Conversation with and without AAC were alternated and counterbalanced across participants.</p>		

			<p>Study 2-</p> <p>As above with changes to the protocol; researchers used a standard protocol to structure the conversation, verbal output from the AAC was removed, a training component was provided before each experimental conversation.</p> <p>Participants were randomised to 3 conditions - Control (conversations conducted without an AAC device); Primed control (conversations conducted without an AAC device that were preceded by a SR priming exercise); Primed AAC (conversations conducted with an AAC device that were preceded by a SR priming exercise).</p>			
(Tomori et al., 2015)	Multicentre cross-sectional study	N = 116 PWD = 28%	To determine the level of cognitive function required to use an iPad	N/A	Optimal MMSE cut-off score for selecting meaningful activities with ADOC identified as 8/30, sensitivity = 92.1%, specificity = 70.4%.	Japan

			<p>application (Aid for Decision-making in Occupation Choice - ADOC) in supporting PWD to choose meaningful occupations.</p> <p>Patient performance on ADOC scored by caregiver and compared to baseline MMSE score.</p>		Convenience sampling used.	
(Murphy et al., 2010)	Observational study (crossover design)	31 PWD	<p>Conducted to investigate the well-being of PWD using Talking Mats – a low tech communication framework which uses sets of picture symbols.</p> <p>3 interview conditions were used and allocated using a crossover design:</p> <p>1 - Talking Mats</p> <p>2 - Unstructured conversation</p> <p>3 - Structured conversation using the same topics and options as presented using the Talking Mat in session 1.</p> <p>Sessions videoed for</p>	<p>4-item, 5 point Likert scale covering indicators of communication:</p> <p>Participant understanding based on verbal and non-verbal responses.</p> <p>Engagement with the task.</p> <p>Time spent 'on track' during the interview.</p> <p>Interviewer's understanding of participant responses.</p> <p>Observations of perseveration in topic.</p> <p>Observation of participant distractibility.</p> <p>Overall time taken for</p>	<p>Talking Mats were associated with significantly better performance than both structured conversation and unstructured conversation for all four indicators of communication effectiveness.</p> <p>Improvements to communication occurred regardless of severity of dementia.</p> <p>Participants with early stage dementia communicated effectively regardless of interview condition but there was a significant difference in total communication effectiveness between Talking Mats and structured conversation but not between Talking Mats and unstructured conversation.</p> <p>PWD at a moderate stage only achieved effective using Talking Mats with scores significantly higher both structured and unstructured.</p> <p>PWD at a late stage remained below the effectiveness level for all three interview conditions. However, Talking Mats scored significantly higher than structured and unstructured conversation.</p> <p>Less perseverative behaviour was observed at all</p>	UK

			data analysis.	each interview condition.	<p>stages of the Talking Mats framework compared to structured or unstructured conversation.</p> <p>Participants at all stages exhibited more on task behaviours when using Talking Mats than the other two conditions.</p> <p>Talking Mats did not last significantly longer than structured conversation but did last significantly longer than unstructured conversation.</p>	
(Bourgeois, 1990)	Observational study (Multiple baselines design)	N = 3 PWD MMSE = 12-18/30	<p>Evaluates the effectiveness of teaching carers to train PWD to use a prosthetic memory device during conversations with familiar partners.</p> <p>Memory device consisted of a wallet containing list of facts relating to topics of personal relevance to the subject and topics for which the subject may have been experiencing memory failures (e.g., names of family members, orientation facts, etc.).</p> <p>Data collected from 5 minute sessions with researcher 4/week and from twice weekly conversation sessions completed with</p>	<p>Use of aid to provide appropriate statements of fact (trained and untrained) during conversations.</p> <p>Degree to which ambiguous, perseverative, and unintelligible utterances were affected by the use of the memory aid.</p> <p>Partners also completed an 8 item, 7 point Likert scale designed to capture opinions about changes in conversation quality.</p>	<p>All subjects learned to use the memory aid displayed improved quality of conversational content.</p> <p>Subjects made significantly more statements of fact and fewer ambiguous utterances.</p> <p>Novel, untrained statements in conversations also increased.</p> <p>Treatment effects were maintained at high levels throughout training and at 3 and 6 week follow up.</p> <p>Partners rated post-treatment conversational samples as significantly improved on all eight conversational dimensions.</p>	USA

			partners.			
(Boman et al., 2014)	Case study Observational and qualitative	N = 4 PWD and significant other dyads	Examines the provision of touch screen video phone. Data collected from interviews and structured observations during test sessions (2-3 hours each).	Management of Everyday Technology Assessment (META). Qualitative data regarding experiences of difficulties using communications technology and opinion of the videophone intervention	Participants responded positively to the videophone and reported it to be useful, easy to use and satisfied their requirements as users. A number of potential improvements to technical elements were suggested to improve intuitiveness and lessen possibility for user confusion. Scores on the META items noted to be challenging pre-intervention were observed to be of less impact once participants had become familiar with using the videophone.	Sweden
(P. Topo, Jylhä, & Laine, 2002)	Qualitative case study	6 PWD and families Age = 55-90y	Provision of easy to use phone (simplified with pictures of contacts and single button calling)	Family completed questionnaire 6-item open response format at 10 points over 2 month study period.	The easy to use phone simplified the process of finding and calling contacts. In some cases it helped the person to remember who called and what was discussed. The simplified phone did not resolve many of the problems that the PWD generally experienced when using the phone.	Finland

Table 11: Summary of studies examining AT for mobility and navigation

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Caffo et al., 2014)	Multiple baseline study with alternating interventions and partial crossover	4 PWD	<p>Comparison of two orientation strategies: AT (remotely controlled sound/light devices) and a backward chaining procedure (BC) for promoting indoor traveling.</p> <p>2 sessions/day, 5 days/week for a total of 150 trials.</p>	<p>Outcomes measured by recording the number of route sections travelled without errors or pauses > 20s, and the number of music cues or verbal instructions provided for each route section</p> <p>Social validation completed with 12 undergraduate students</p>	<p>Levels of correct travel obtained with AT were significantly higher than those obtained with BC strategy for 3/4 subjects.</p> <p>Validation scores were significantly higher for AT on items concerning comfort, competence, and self-determination.</p> <p>Validation scores for BC were higher for the item regarding environmental noises or disturbances.</p> <p>No differences were found with respect to cost-effectiveness and raters' interest to carry out training with one of the two strategies.</p> <p>Convenience samples for test subjects and validation group.</p>	Italy
(Pot, Willemse, & Horjus, 2012)	Single group pre-post design	<p>28 PWD-carer dyads</p> <p>\bar{x} age = 73</p> <p>\bar{x} IQCODE = 4.6/5</p> <p>\bar{x} age (carer) = 63</p>	<p>Provision of a tracking device combining GPS and General Packet Radio Service allowing carers to locate PWD and contact them through a loudspeaker system. The device also allowed PWD users to contact carer with a single button.</p> <p>Data collected to evaluate feasibility, acceptability, and benefits for both dyad members at 3 months post provision.</p>	<p>Carers scored 10-point scale recording impressions of the device</p> <p>Dyads completed structured questionnaire with additional open questions for carers</p> <p>PWD asked to respond to several statements with 3-point Likert scale</p> <p>Caregiver scores on: Self-Perceived Pressure from Informal Care Scale</p>	<p>Feasibility:</p> <p>15.2% dropout rate at 3 months.</p> <p>GPS device taken on 67% of occasions when PWD left the home (n.b. this does not mean the device was switched on).</p> <p>50% of carers used the call option on the device.</p> <p>39% of carers checked locations of the PWD.</p> <p>80% carers rated the tracking website as easy to use and 92% felt in control of the website.</p> <p>80% of carers were able to easily find their dyad partner.</p> <p>27/28 carers could use the call option but 30% of them were unable always to reach the PWD.</p> <p>77% of carers would recommend the device.</p>	Netherlands

				<p>Bespoke scale measuring feelings of worry</p>	<p>Acceptability</p> <p>25% of PWD reporting going out more often and 45% reported receiving more freedom from their carers.</p> <p>50% PWD were less worried about going outside alone when using the device.</p> <p>60% carers provided more freedom for PWD as result of the device.</p> <p>Effectiveness</p> <p>Carers showed a tendency to feel less worried at 3 months though no significant difference was found on the SPPIC.</p> <p>Carers who could reach PWD using the call function showed significant decrease in their feelings of worry, but not in their feelings of role-overload.</p>	
<p>(Hettinga et al., 2009)</p>	<p>Observational study (Multiple baseline design)</p>	<p>4 PWD</p> <p>MMSE range 17-25/30</p>	<p>Each participant walked 4 predefined test routes (0.89 – 1.16 km) with equal number of decision points with help of visual and auditory navigation instructions from a GPS enabled PDA.</p> <p>Auditory output consisted of either a standard voice or one familiar to the participant and audible</p>	<p>Observations of behaviour and safety</p> <p>Mid-test interview for task load (NASA Task Load Index)</p> <p>Post-test interview on preferences</p>	<p>Results reported for n = 3 after 1 withdrawal.</p> <p>No evidence of unsafe walking behaviours was observed when using the device.</p> <p>Overall, PWD scored better in the familiar voice conditions than in the unfamiliar voice conditions.</p> <p>The use of warning sounds consistently resulted in poorer achievement compared to conditions where no warning sounds were used.</p> <p>No differences in task load were noted across conditions.</p>	<p>Netherlands</p>

			<p>warning sounds or none.</p> <p>Order of routes and audio conditions randomised to participants with wash out period to prevent learning effects.</p>			
(Robinson et al., 2009)	Participatory Action Research	<p>Scoping stage = 10 PWD, 11 carers, 4 AlzSoc volunteers</p> <p>Design workshops = 8 PWD, 7 carers and 4 PWD, 3 carers</p> <p>Prototype development = 2 PWD</p>	<p>PAR project to create acceptable and effective prototype technologies to facilitate independence in PWD. Key element of project to use AT to facilitate mutual communication between PWD and families as opposed to surveillance.</p>	<p>Scoping stage- focus groups</p> <p>Participatory design workshops</p> <p>Feedback from PWD at prototype development meetings.</p>	<p>PWD reported concerns included getting lost, a loss of confidence with curtailment of usual activities, and carer anxiety.</p> <p>Existing technologies, typically mobile phones were used occasionally with associated problems reported as remembering to take the device on outings and inappropriate size for some valued activities such as running.</p> <p>Participants felt AT devices should be disguised and be integrated easily into their daily routines.</p> <p>Areas for improvement included two-way communications, flexibility of function as the illness progresses, and something to “guide” them home when out walking or driving.</p> <p>Attention should also be focused on minimizing the size, weight and visibility of devices to reduce stigmatization.</p> <p>2 prototype devices designed for participating PWD. Initial feedback criticised the size of the two devices although functionality was largely acceptable (with some suggested alterations) and feedback positive.</p>	UK
(McCabe & Innes, 2013)	Cross sectional	12 PWD	Aims to explore the ideas and opinions of	2 focus groups with mixed participants	All participants clearly reported a need for AT that would promote safe walking for PWD.	UK

	qualitative study	3 Carers 5 Older adults	potential users about a GPS device designed to support independent mobility.	(convenience sample of those attending day centres)	<p>Most participants valued and remained engaged ‘getting out and about’ using various techniques to enhance safety.</p> <p>GPS devices were seen as a reasonable way of supporting independent mobility and confidence.</p> <p>Little concern about ethical issues relating to ‘tagging’ were raised and the focus of interest was about how the GPS devices could promote independence rather than just as a safety precaution offering carers peace of mind.</p> <p>Recommendations for GPS to be discreet were made to avoid exacerbating potential stigma.</p>	
(Grierson et al., 2011)	Case series	11 PWD and 1 MCI	<p>Four-motor way-finding belt which provides wearers with a tactile signal indicating the direction to their destination</p> <p>4 trials completed by each participant</p>	<p>Number of directional errors made.</p> <p>Qualitative 5-item questionnaire about the experience of using the way-finding belt.</p>	<p>10/12 participants successfully navigated all four routes during trials.</p> <p>The two participants unable to complete had the lowest MMSE scores of 8/30 and 16/30.</p> <p>For the 10 successful participants no significant correlations between the number of navigational errors and MMSE, JLOT and Rey Copy scores</p> <p>6/10 participants were error free on all 4 trials.</p> <p>All of the recorded errors resulted from inattention to the belt vibration rather than incorrect interpretation of the stimuli.</p> <p>Participants generally rated the belt as easy to use, comfortable and extremely useful as a navigational aid.</p>	Canada
(Wang et al., 2011)	Case study (single subject design and qualitative inquiry)	6 PWD \bar{x} age = 86.7y \bar{x} MMSE = 19/30	Provision of powered wheelchair with a collision-prevention system, including training sessions on	<p>Daily distance travelled.</p> <p>Safety observations (collisions and near misses during training</p>	<p>Two PWD could use the device but only one successfully proceeded to using the powered chair.</p> <p>One participant did not like its usability, speed, and appearance.</p>	Canada

		Qualitative data: 6 Care home residents and 57 Care home personnel	use. ABCA design (A = baseline, B = training, C = power wheelchair use). Each phase ≥ 1h/day for 12 days	sessions only). Focus groups (with care home personnel n=37 (care managers, nurse specialists, occupational therapists, physical therapists, recreation therapists, nurses, and resident support workers). Interviews (with residents who had observed wheelchairs in use (n=6) and care home personnel n=20).	For two participants the device failed to compensate for decreased initiation, motor planning, and awareness of obstacles. Some safety issues were noted with the design of the collision sensors system. Obstacles above the sensor could potentially cause injury or damage. Qualitative data indicated concerns with the size and appearance of the chair although users reported feeling safe. Opinions of the chairs usefulness were generally positive both in terms of safety and improving independence.	
(Mirolsky-Scala & Kraemer, 2009)	Case study (before and after design)	1 PWD MMSE = 5/30 Age = 85y	Provision of fall management program included lower extremity and core therapeutic exercise, balance, gait, and assistive device training (Merry Walker™), and caregiver instruction. 30 minute sessions provided 3/week over 4 weeks for a total of 12 sessions.	International Classification of Functioning, Disability, and Health (ICF34) Performance Oriented Mobility Assessment (PPMA) Tinetti Assessment Tool Berg Balance Scale (BBS) Facility-generated incident reports.	Tinetti Assessment Tool score increased from 8 to 16/28 BBS score increased from 7/56 to 19/56. Number of documented falls decreased from 2 to 0 in a 4-week period of time. ICF 34 scores indicated improvement in 4 areas of the Impairments of Body Functions domain, 12 areas of the Activity Limitations and Participation Restriction domain, and in 3 areas of the Environmental Factors domain.	USA
(Wang, Holliday, & Fernie, 2009)	Case study	1 PWD	Provision of powered wheelchair with a collision-prevention system including training sessions on	Social participation and mood/affect as observed by researchers.	Provision of the modified wheelchair encouraged but did not sustain social participation. The participant remained unable to operate the wheelchair on his own. Researcher observed affect and attempts to make	Canada

			<p>use.</p> <p>Data collected from medical records, standardized assessments, interviews, observations of daily activities, and a driving log.</p> <p>12 x 1 hour session over 4 weeks.</p>		<p>social contact were noted to increase during usage.</p> <p>No standardised or structured measures of outcome used.</p>	
(Hagen et al., 2007)	Case study	1 PWD-Carer dyad	Simplified phone with GPS tracking to support outdoor mobility	Qualitative feedback from participants	<p>Feedback from participants was mixed.</p> <p>3-button interface was noted as too complicated for PWD, GPS localisation of PWD was also inaccurate.</p> <p>Both dyad members confirmed the device could, in principle, support them but reliability and ease of use would need to be improved.</p>	Netherlands

Table 12: Summary of studies examining Smart Homes

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Aloulou et al., 2013)	Case study	8 PWD in nursing home 2 carers	Testing of sensors (e.g. pressure sensors, proximity sensors, vibration sensors, motion sensors), designed to monitor residents and interaction devices (e.g. speakers and tablets for the residents, smart-phones and a nursing console for the carers), designed to provide reminders and notifications for patients or carers. Evaluation based on analysis of computer system logs, carer observation diaries and qualitative feedback from nursing home staff.	System performance as measured by records of false alarms, system crashes and technical errors. Human and technological requirements of AT as established by pre-deployment observations and discussions.	System performance: 29% of total alarms were noted as false, reducing to 17% by trial end (4 months). Main human requirements of AT noted as: need to provide caregiver relief, support for independent ageing, level of dementia at which AT becomes useful and personalisation of assistance. Technological requirements noted as guaranteeing privacy, able to function with multiple residents (including non-PWD), automatic recovery systems to resolve crashes and adaptability of systems. Sampling methods not specified.	Singapore
(Evans et al., 2007)	Case study with before/after measures	N = 1 82y MMSE = 10/30 1 family carer of PWD	Evaluation of a Smart flat equipped with enabling AT (sensors, automatic lighting, cooker and tap shut off devices, prompting technologies) 10 week baseline data from in-home sensor	Range of data from inbuilt sensors examined including frequency and distance of night time wandering (including exiting home), average sleep time, continence. Questionnaire	Sensors indicated that while night time wandering continued, frequency of wandering outside the home was reduced but not eliminated. Average sleep time increased from 3 to 6 hours. Continence also improved. MMSE improved from 10 to 16/30 Carer reported less behavioural symptoms and being more settled and discuss the AT as providing a safeguard, allowing a better understanding of PWD	UK

prior to AT being switched	MMSE Interviews with participant and family carer.	lifestyle and increasing PWD independence.
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Table 13: Summary of studies examining AT for memory, cognition and orientation

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Meiland et al., 2012)	Observational study (mixed methods including before-after designs)	29 PWD-carer dyads	Evaluation of the usability of a cognitive AT device (COGKNOW Day Navigator CDN) designed to support memory, social contact, daily activities, feeling safe. Data presented from evaluation of three 1-year long test cycles: Test 1 (n=16) Test 2 (n=14, 10 from previous test) Test 3 (n=12, 3 from previous test)	Semi-structured interviews Observations of PWD using device Diary and 'bottleneck list' completed by carers Systems data Experienced Autonomy Questionnaire (based on the Mastery scale) WHOQOL-100 QoL in Alzheimer's disease scale (QoLAD – patient and family version) Daily activities, Memory, Inadvertent self harm, Psychological distress and Company items from the Camberwell Assessment of Need for the Elderly (CANE) Dementia Coping Questionnaire Short Sense of Competence Questionnaire (SSCQ)	Usability of AT device (in final configuration at end of test 3): PWD and carers were generally positive about the device design and considered it easy to use. Most PWD were able to use the device with some support. It was judged to be too large, too heavy and with insufficient battery life. Usefulness of AT device: Most respondents were generally satisfied with the CDN. Perceived usefulness of the different functions was related to personal preferences and support needs. Carers considered the time and day indication, the reminders and the picture dialling functions most useful for PWD. At the end of the final test period, carers were more dissatisfied which was caused mainly by the technical instability of the system. Effectiveness of AT device (data from test 3 only): Qualitative data showed that nearly all PWD felt the device had no effect on their QoL or their way of functioning. Nearly all the carers felt that the CDN had no effect on the QoL of the persons with dementia or their daily functioning. Data from the standardised assessments showed no statistical differences between pre- and post-test measurements.	Netherlands UK Sweden

(Hagen, Duff, & Dolphin, 2007)	Cost-benefit analysis using qualitative cross sectional method	80 PWD-Carer dyads	Provision of AT (various including automatic night and day calendars; picture-telephones; automatic night-lights; gas cooker monitors; and item locators.) for community dwelling PWD.	User reports and opinions of use, usefulness, levels of satisfaction, whether they would recommend the device to a friend and whether people were willing-to-pay for the device.	<p>Authors report that indicators suggest the benefit of AT outweigh the costs in terms of net social gain as a very high majority of PWD and their carers reported using the devices, finding them useful, being satisfied with them and recommending them to others.</p> <p>Level of carer burden decreased very slightly but insufficiently to allow attribution to the provision of AT.</p> <p>Almost half of carers reported AT devices supporting independence.</p> <p>More than one-third reported that AT devices reduced general emotional burden.</p>	Ireland Norway Finland Lithuania
(Inoue et al., 2012)	Case study	5 PWD \bar{x} age = 85.8y MMSE Range 16-23/30	Interactive verbal communication robot designed to keep PWD informed of daily schedules, including prompts for desired actions. 30 min interaction with robot over 5 days (3 days for 1 PWD)	Counts of comments about acceptability of robot Observed response rates Information acquisition rates	<p>Results indicate that the information support robot could provide information to support users' daily life.</p> <p>Alert interactions demonstrated a 100% response rate.</p> <p>Information acquisition by PWD was rated at 90%.</p> <p>Most comments about the robot were positive (27 compared to 4 negative comments) with some reports of difficulty of use also noted.</p>	Japan
(Nijhof et al., 2012)	Case study (mixed methods)	7 PWD \bar{x} age = 87y 5 Professional carers	Provision of a watch which monitored sleep-wake patterns. Study completed for 3 months to gain insights into the effects of the watch on the sleep/wake rhythm and on the care delivery process of patients with dementia.	Interviews with professional carers (n=5) Diaries – completed by carers Observations of carers to collect data about events, use and usability Systems data recording	<p>Carers reported the appearance of the watch as not user-friendly. It was felt to be too big for the PWD whom tended to have small/fragile arms. The hard strap irritated PWD skin when showering. Data printouts were felt to be easy to read and interpret.</p> <p>4 different types of intervention results from use of the watch.</p> <p>Sleep interventions (changing sleep positions), quality of life (teddy bear, entertainment by playing</p>	Netherlands

				PWD sleep patterns	<p>a billiard game, taking a bath before going to bed), medication (changing timing or type), and no intervention. The results of these suggest 3/5 interventions resulted in an improved sleep time, 2/5 improved sleeping periods and 3/5 improved circadian rhythm but differences were small and not statistically significant.</p> <p>Carers reported use of the watch had made it easier to coordinate care. Including more precise medication management.</p>	
(Karlsson et al., 2011)	Case study (qualitative)	2 PWD-carer dyads	<p>Provision of COGKNOW device consisting of two parts, one stationary, the other mobile which support memory, social contact, ADL and safety. Devices could be adjusted to meet individual needs.</p> <p>Data collected in three phases over a time period of 24 months</p> <p>Phase 1 – 6 months during use of device (unstructured observations)</p> <p>Phase 2 – At 6 months (observations and interviews)</p> <p>Phase 3 – 18 months from initiation (interviews)</p>	<p>Participant observation</p> <p>Semi-structured interviews</p> <p>Interviews with carers</p>	<p>Findings indicate that that self-image has a significant affect on how the AT was used. The PWD tended to only use those functions which matched their own self-image and tended not to use the device to compensate for cognitive deficits which contrasted with these.</p> <p>Receiving support from partners was necessary for the usage of new devices.</p> <p>Integrating AT into daily life of PWD should be seen as a process that incorporates individual needs, personalised functions and congruity with self-image.</p>	Sweden

(de Oliveira Assis et al., 2010)	Case study (Before-after study and survey)	1 PWD (73y; Moderate probable AD) 7 OTs	Provision of low cost AT; activity board, calendar, routine organizer, software program used for cognitive rehabilitation. Intervention delivered as 1:1, 50-minute sessions twice a week (one at home and one at the outpatient clinic setting) for four months. At least two of the four pieces of equipment were used in all of the sessions.	MMSE Verbal Fluency Test – animal category Clock test Katz Index OT opinions of the AT used as measured on 5 point Likert scale	MMSE increased from 20 to 22 with improved score on the temporal orientation domain. VFT score increased from 7 to 11. No changes to Katz index core or clock test score were recorded. OTs all scored the AT positively.	Brazil
(Hagen, Topo et al., 2007)	Case study (qualitative)	40 PWD-carer dyads	Night and Day Calendars to support temporal orientation.	Qualitative data from interviews conducted at 3 weeks, 3 months, 6 months and 1 year post provision. Interview topics included; the use of the device and its usefulness; use of services in the last three weeks; and quality of life.	Data from three months of device use indicate that most PWD used it and found it useful as did their carers. The authors conclude it is possible to compensate for problems in time orientation by using Night and Day Calendars an assistive aid. Assessment of individual and family needs is required, so that the AT can be fitted to specific needs. Usefulness of the device requires motivation of individuals to use the device.	Ireland Norway Finland Lithuania UK
(Caffo et al., 2014)	Literature review - descriptive	N/A	Describes eight experimental studies using spatial cues, AT programs, reality orientation training,		Categorises the interventions into restorative and compensatory approaches. Compensatory approaches include - spatial cues (typically calendars; memory, notebooks; shopping	Italy

Assistive Technologies (Table 13) – AT for memory, cognition and orientation

<p>errorless learning techniques, and backward chaining programs designed to reduce spatial orientation disorders</p>	<p>lists; medication reminders); AT based on orientation using verbal cues.</p> <p>Restorative approaches include - reality orientation; errorless learning; backwards chaining.</p> <p>All the studies reported positive or mixed results on spatial orientation.</p> <p>Both compensatory and restorative strategies seemed to enhance correct way-finding with various degrees of effectiveness. Compensatory strategies appeared slightly more effective.</p> <p>Spatial cues and AT increased ability to accurately locate the target destinations by 50–70%.</p> <p>The use of RO training plus spatial cues gave mixed results.</p>
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Table 14: Summary of studies examining opinions and perceptions of AT

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Chiatti et al., 2015)	Cross sectional survey (preliminary baseline info from 3-group RCT)	N = 438 PWD-carer dyads \bar{x} MMSE = 16.2/30	RCT subjects will receive either; systematic and comprehensive support of a case manager social worker and three nurse home visits, or this as well as an AT intervention. The control group will receive support in the form of a printed brochure and three nurse home visits.	Caregiver Burden Inventory ADL Hierarchy Scale IADL Involvement Scale Caregiver reports of behavioural symptoms Short-Form-12 Health Survey Hospital Anxiety and Depression Scale Multidimensional Scale of Perceived Social Support Caregiver disease count	Family member provided 50 hours of care/week on average. GPs visited 11.2% of households. Nurses visited 3.9% of households. 10.3% of families brought relatives with dementia to visit a doctor. 5.9% of PWD attended day centres. 0.9% of households had private nursing. 19.6% of the families had non-live-in paid assistants. 11.0% of the households had a live-in private care worker. Female gender, number of hours providing care, caring as a child of a PWD, and caring for someone with behavioural disturbances were all associated with increased caregiver burden. No associations between use of formal care services and burden were detected. Social support from family reduced caregiver burden.	Italy
(Jentoft, Holthe, & Arntzen, 2014)	Qualitative study	8 PWD <65y and carers	Qualitative study to understand young PWD experiences of using a simplified universal TV remote control. Range of use 0-14 months (\bar{x} 8.5)	Three to four in-depth semi-structured interviews covering: Normal daily routines and the effects of condition on these. Experience of using AT.	Watching TV was a highly valued activity which had been affected as PWD struggled to use technological objects such as TV remote controls. The simplified remote control became a valued solution but required continuing consideration to be made (typically by the caregiver) to support its habituation.	Norway

			months).	Advise the participants would offer professionals helping others in the same situation. How the AT has affected everyday life.	Its use led to feelings of relief for both PWD and their carers. Access to professional support and advice about AT is vital as a continued collaboration and adaptation need to occur over time.	
(Meiland et al., 2014)	Cross sectional qualitative study	14 PWD 13 informal carers 6 professional carers 9 dementia experts 7 care partners 1 volunteer	Aims to describe the end users' needs and wishes regarding the development and design of the new AT to be provided by an integrated system (Rosetta System).	Focus groups/workshops Semi-structured Individual interviews Expert consultations	Functionalities of AT rated most positively by PWD and informal carers were - Help in cases of emergencies (e.g. movement sensors); Outdoor navigation support; Calendar functions. Dementia experts rated several behaviours that could be monitored to detect changes in functioning - Eating and drinking; Toileting; Taking medicine; Activity performance; Sleep patterns. None of the participants mentioned ethical issues regarding the use of sensors and cameras.	Netherlands Germany
(Alwin, Persson, & Krevers, 2013)	Qualitative – cross sectional telephone survey	47 carers	Telephone interviews consisted of modified version of the Patient perspective on Care and Rehabilitation process instrument. Sampling methods not specified.	Aimed to generate information about how relatives of PWD perceive AT intervention processes, including if there were differences between those valuing the intervention as being of great significance and those who felt it was of some or no significance. Identifying whether there were differences in categories of ATs	Most carers valued the AT intervention (33 compared to 13 who did not). Being shown consideration and accessing support were perceived as highly important. Those who thought the AT intervention had great significance reported higher fulfilment with the intervention process. Only AT considering of alarms and security devices were noted to be significantly different between the two groups with the not satisfied group receiving this intervention less often. No significant differences were noted in the other AT categories (time-orientation and planning aids,	Sweden

				provided, between relatives valuing the intervention as those who did not.	communication technology, and spatial or ADL management devices).	
(Harrefors et al., 2013)	Cross sectional survey	408 Leaders, project leader, care developers, nurses, OTs, PTs, assistant nurses and Care administrators	Survey to describe professional carers' perceptions on the use of digital photo diary to facilitate PWD to talk with family about daily events.	<p>79 item questionnaire eliciting Likert scale responses covering the following topics:</p> <p>Use of computer during leisure time</p> <p>Opinions about use of wearable digital cameras and smart phones, home memory station (to view and sort photos), consequences of using device and prerequisites for using the device</p> <p>Open ended questions about further important aspects of using the assistive digital device were included</p>	<p>Qualitative analysis led to several prerequisites for use of the device:</p> <p>Immediate implementation after receiving a diagnose</p> <p>Relatives' participation and ability to use the technology.</p> <p>Strengthened self-esteem and meaningful everyday life were felt to be likely positive consequences.</p> <p>Conversely, concerns about increased alienation and a feeling of isolation associated with using wearable technology were reported.</p>	Sweden
(Lindqvist, Nygard, & Borell, 2013)	Qualitative study using grounded theory methods	10 PWD	Aims to describe how PWD (early stage AD) became users of AT in everyday life and what the use of AT came to mean to them and their significant others.	Semi structured interviews following 6 months post-implementation of need-specific AT	<p>Findings indicate 4 junctures in the process of adopting AT at which significant decisions were made that influenced whether the participants became users of the AT.</p> <p>The junctures were linked chronologically (appearing in the same order for all participants).</p> <p>The decisions at these junctures dealt with -</p>	Sweden

					Deciding to use AT; Adjusting everyday routines to include the AT; Trusting the AT; Perceiving the sense of having capacity when using the AT.	
					Results do not include data from the noted measures.	
(McKenzie et al., 2013)	Cross sectional survey	N = 60 carers of PWD	<p>Aims to report caregiver opinions of a range of AT to determine which may be used to support carers.</p> <p>4 categories of AT considered: ongoing surveillance, provision of care, prevention of injuries, and improving home safety.</p> <p>Data collected 1 and 3 months after installation of need related AT.</p>	<p>Questionnaires (no further details provided)</p> <p>Safety Assessment Scale</p> <p>Caregiver Vigilance Scale</p> <p>Peace of Mind Scale</p> <p>Sleep Disorders Inventory</p> <p>Informal interviews with carers</p> <p>Feedback from health and social care personnel</p>	<p>Authors report that key elements of AT which increased acceptability for carers included - AT that did not alter the appearance of the home or resembled medical devices; AT that enable ongoing surveillance and monitoring; Device alarms that sounded remotely at the site of the carer; AT that met unique specific carers' needs.</p> <p>The most effective AT in descending order were: Medication organisers (100%); Wireless home security system (100%); Bed occupancy sensors (95%); Driveway sensors (80%).</p> <p>Less effective AT included wireless cameras with handheld LCD screens.</p> <p>Secondary reports from personnel involved in the provision of AT indicate that carers felt the AT provided increased the safety and security of the PWD in the home environment.</p> <p>Primary information from carers also reported that the AT increased their sense of security and helped to ensure that the PWD remained safe in the home.</p>	USA
(Olsson et al., 2012)	Qualitative study	<p>14 spouses of PWD</p> <p>\bar{x} age (spouse) = 73y</p> <p>\bar{x} age PWD = 76y</p>	<p>Aims to describe the opinions/reflections of relatives of PWD on different kinds of ICT devices that are used or can be used in their daily care.</p>	Interviews	<p>Relatives of PWD identified 3 key themes related to ICT</p> <p>The first related to how ICT supports daily life and in particular - Maintaining independence; Getting help in an emergency; Preventing harm; Locating PWD.</p> <p>The second related to conditions essential for ICT</p>	Sweden

					to work and included - Knowledge skills and abilities related to ICT; Financial aspects of ICT. The final theme related to decisions about using ICT and included some information on ethical concerns and conditions for including PWD in decisions.	
(Rosenberg, Kottorp, & Nygård, 2012)	Qualitative study (grounded theory)	16 significant others of PWD (spouses, relatives & neighbours)	Explores how significant others of PWD relate to AT, and to their relatives with dementia as AT users.	8 individual interviews 5 focus groups	Overall participants had a positive attitude and were ready to use AT in their roles as significant others of PWD. Two major categories with several subcategories identified during analysis Conceptions of technology included utilitarian views of technology, its role in maintaining active lifestyles, and its role in maintaining self image. Conditions for incorporation of technology included the experience of specific needs, the importance of habituating integrating technology use, the importance of simplicity in design of technology, the need for flexibility enabling individual settings and modifications, and the importance of technology being non-stigmatising.	Sweden
(Rosenberg & Nygård, 2012)	Case series (qualitative – based on grounded theory)	3 PWD \bar{x} age = 85y 10 Significant others (Relatives, neighbours, OTs and home helps)	Explores factors involved in the process of introducing AT into the life of PWD. Case series following 3 PWD and significant others in their lives. Study initiated when decision to provide AT was made until data saturation detected in	Interviews Participant observations	Doing the 'right thing' was the main influence on actors although views on what was right differed sometimes. Attention should be paid to the person who has decision-making power in each case, as their views are likely to govern the process, regardless of whether they are in agreement with PWD, particularly when potential risks are also considered It was noted that those involved in introducing and prescribing AT may be guided by individual	Sweden

			<p>responses.</p> <p>AT provided included electronic calendars, speaking clocks and watch with memory prompts and scheduling devices.</p>		<p>experiences and views rather than by following recommended guidelines.</p> <p>Flexibility and a process- oriented approach were key to the introduction of AT.</p>	
(van den Heuvel, Jowitt, & McIntyre, 2012)	Cross sectional study	<p>58 carers of PWD</p> <p>16 in focus groups</p> <p>42 questionnaire respondents</p>	<p>Investigates the awareness and use of AT and explore barriers to the uptake of, and the unmet needs for AT for dementia.</p>	<p>Focus groups</p> <p>Questionnaires</p>	<p>0/16 focus group participants and 0/42 questionnaire respondents reported any direct experience of using AT.</p> <p>Participants reported various concerns, problems and unmet needs that could potentially be addressed by existing and commercially available AT.</p> <p>The most commonly reported concerns included getting frustrated with PWD and understanding what PWD want. Safety/risk concerns were less commonly reported.</p> <p>Losing things, toileting issue and finding things to occupy free time were the most prominent problems noted.</p> <p>Most carers did not feel that the person they cared for had unmet needs but 29% (n = 12) identified unmet needs, most commonly around meaningful leisure activities, and access to services (day centre and staff).</p>	UK
(Czarnuch & Mihailidis, 2011)	Cross sectional survey	<p>106 family carers of PWD</p> <p>\bar{x} age = 56y</p>	<p>Examines the needs of older PWD and their family carers during ADL, and the role of intelligent AT</p>	<p>94 item online questionnaire designed to collect family caregiver views about the ADL which are challenging for an older PWD to complete</p>	<p>Factor analysis of questionnaire responses indicate that PADL and IADL both emerged as areas requiring assistance with IADL scored as more challenging.</p> <p>Results suggest that carers do not generally find assisting with PADL and IADL difficult. Supporting</p>	Canada

				independently, the ADL which are difficult for a caregiver to assist with, role of intelligent AT as a tool to support ADL, and the features and functions of an in-home AT designed to support the completion of ADL.	private ADL tasks such as washing and dressing were reported as harder to support than more general tasks such as administering medication, preparing meals and cleaning the home. Hygiene and personal care, food and nourishment, and medication and housekeeping emerged as the factors for which AT has a role, but responses suggested carers think it is unlikely that AT will be able to support these activities. The only exception to this was AT to remind for medication. Appearance and Usability; Familiarity and Autonomy; and Technical Expertise emerged as features required of in-home AT	
(Marquardt et al., 2011)	Cross sectional study (data drawn from larger RCT)	82 PWD \bar{x} MMSE = 19/30	Descriptive study aiming to report common environmental features that present safety issues or barriers to the mobility of home-dwelling PWD who receive care.	Assessment of environment (using bespoke tool) 8 –item questionnaire for carers	Steps inside and outside the home were the main barrier to accessibility. Most carers had made modifications for physical limitations 50% had modified bathrooms. 50% (n=41) of the homes were rated as being very structured and providing sufficient space for moving about safely and 38% (n = 31) were rated as somewhat cluttered but still offered clear paths to move about. 12% (n = 10) of the homes were rated as very cluttered and did not allow for moving safely. 57% (n = 47) of PWD has at least one fall in the preceding 2 years in various locations; bedrooms (26%), living room (17%) and the bathroom (12%), at the entrance or in the hallway near the home entrance (12%), and on steps (11%). AT was used rarely and tended to be established items, such as emergency call buttons (26%) and	USA

					<p>baby monitors (4%).</p> <p>Modifications for cognitive deficits were less common.</p> <p>Major barriers to making home modifications were scepticism about usefulness and financial constraints.</p>	
(Gitlin, Winter, & Dennis, 2010)	Cross sectional survey (drawn from data of wider RCT)	N = 63 PWD-carer dyads	<p>Follow up structured questionnaire 4 months after provision of AT.</p> <p>Variety of AT provided on an individualised basis including AT for (1) IADLs – mobility devices, seating, medication dispensers, transfers devices and aids for leisure activities (2) ADLs - devices for eating, bathroom, toileting and grooming activities (3) Safety - medical alert identification bracelets, monitors, and other devices such as lost item finders.</p>	<p>Continued use of AT (y/n)</p> <p>Extent to which it was felt to be helpful (4-point Likert scale)</p> <p>Associated costs</p>	<p>197 devices provide for 63 participants (average 3/dyad, average cost \$152.52).</p> <p>87.6% of issued devices were reported by carers as in use at 4 months and carers also reported that devices overall were somewhat to very helpful.</p> <p>The greatest number of AT devices were ordered were for activity engagement, and bathroom/toileting challenges.</p> <p>The fewest devices were issued for ambulation and transferring.</p>	USA
(Landau et al., 2010)	Cross sectional survey using questionnaires and focus groups	42 healthy older adults	Examines opinions of cognitively intact older people toward the use of tracking devices for people living with dementia.	<p>23 items structured questionnaire using 5-point Likert scale (n=42)</p> <p>Focus groups (n=23)</p>	<p>Analysis of questionnaire responses revealed significantly lower scores opposing GPS tracking compared to; Carers' peace of mind; Respecting autonomy; Supporting restricted use of the device; Improvement to patient safety.</p> <p>Significantly higher scores were found GPS tracking</p>	Israel

					<p>carers' peace of mind compared to - Respecting patients' autonomy; Supporting restricted use of the device; Patient safety.</p> <p>Support for GPS tracking for safety scored higher than respecting patients' autonomy.</p> <p>Size, weight and usability of GPS devices were all scored as more important than design and the ability to lock it to a user's wrist.</p> <p>Qualitative findings yielded a variety of attitudes toward GPS tracking.</p> <p>Many opposed the use of GPS devices on the grounds of individual privacy. This opinion was overridden when "signs" of risky behaviour, formal diagnosis, or specific incidents were considered in which case the majority of participants prefer the use of the device.</p> <p>Convenience sample.</p>	
(Harada et al., 2008)	Cross sectional survey	45 relative of PWD	Questionnaire eliciting opinions about the use of GPS microchips for use with relatives with dementia at risk of wandering.	10 item questionnaire with free-text responses	<p>60% of respondents supported the use of GPS microchips. 44.8% felt it would provide peace of mind and 55.2% believed it would support the early identification of wandering.</p> <p>4.4% were against using GPS microchips with elderly wandering relatives with the main objection being the possibility of linking with the national identity system.</p>	Japan
(Wherton & Monk, 2008)	Qualitative study (grounded theory)	20 OTs and professional carers 18 PWD and carers	Aimed to understand problems faced by people in the early to middle phases of dementia, living at home with an informal carer. Completed to	Focus groups Interviews	<p>Areas of difficulty and potential AT were – Dressing; Medication management; Preparing food and drink; Washing; Toileting; Leisure and social participation; Managing negative behaviour and symptoms including wandering being vulnerable; Carer demands</p>	UK

			help Identify opportunities for using AT.			
(Hagen et al., 2007)	Cross sectional survey (preliminary info from mixed method longitudinal study)	20 PWD-Carer dyads	Provisions of AT (various including automatic night and day calendars; picture-telephones; automatic night-lights; gas cooker monitors; and item locators.) for community dwelling PWD.	Semi-structured questionnaire	All calendars (n = 6) and picture telephones (n = 6) allocated were being at 3 months and were considered useful to the dyads. Only half the sample who had a night lamp installed (n = 3) and one third of those with an item locator installed (n = 3) were using them at 3 months. Technical capacity appeared related to the use and usefulness of the AT. Highly technical AT such as the item locator and the night lamp had the lowest level of use and were perceived as least useful. Calendars and telephones, that had low levels of technical difficulty, had the highest level of use and fewer dropouts.	Ireland
(Sixsmith, Orpwood, & Torrington, 2007)	Qualitative	26 PWD	Commentary from an ongoing project examining QoL in dementia which included presentation of a conceptual model of QoL in dementia, describes the results of user research.	Interviews	People at different stages of the dementia reported different needs and experiences.	
(Sixsmith, Orpwood, & Torrington, 2010)		Project workshops: medical engineering, architecture, social gerontology, home care and residential care providers, industry and user	Provides “wish list” of potential technology solutions developed from multi-professional engagement in project	Workshops 2010 study includes unstructured researcher observation/opinion	People with milder impairment placed most importance on participating in ADL, community, and social participation, aiding communication and memory, stress reduction, and physical activity. People with more moderate or severe impairments focus more on basic areas for close personal contact with other people. Reminiscence, communication, and stimulation emerged as particularly relevant areas. Wish list included AT to support - Oral/personal histories; Social participation; Conversation prompting; Encouraging use of music; Encouraging	UK

		organizations.	workshops, and describes the resulting development of a simple music-playing device designed. The 2010 article re-reports the user research and provides information on initial trialling of the music player in 2 care homes.		community participation; Supporting sequence of activities; Exercise/physical activity; Encouraging access to outdoor space; Sharing experiences of care and caring; Encouraging creative activities; Pottering in the home. Initial 'field tests' suggest many PWD enjoyed having music playing though some modification could be made..	
(Taylor, 2005)	Cross sectional study	6 care managers 6 technology advisers	Exploratory study into the views and experiences of care managers in providing AT for PWD at home as part of a system including specialist support from technology advisers provided by the local authority.	Systems data relating to the equipment issues Semi-structured interviews with home care managers and technology advisers	Equipment provided included door contacts, PIR movement detectors, temperature extreme monitors, enuresis monitors, smoke alarms, PIR reminder lights. Findings from interviews indicated that informed consent for provision of AT was always sought from PWD. The most frequently requested/recommended AT were those which minimised risks (predominantly related to outdoor wandering). All home care managers appreciated and valued the peer support provided by technology advisers.	UK
(Cahill et al., 2004)	Cross sectional survey (preliminary baseline info from mixed method longitudinal study))	92 PWD MMSE 12-29/30 (\bar{x} 20.93)	Provisions of AT (various including automatic night and day calendars; picture-telephones; automatic night-lights; gas cooker monitors; and item locators.) for community dwelling PWD	Dementia Quality of Life (DQoL Brod Scale) Qualitative interviews	PWD reported a more positive appraisal of their lives, roles and relationships than family carers might expect. 72.4% of the sample claimed they enjoyed either an excellent, very good, or good quality of life. 90% (n = 80) reported they continued to feel happy, cheerful, content and hopeful with similar numbers claiming they find things to laugh and joke about.	Ireland Norway Finland Lithuania

Data collected pre and post AT provision (only pre intervention data reported)	Many participants also reported illness and distress but these were experienced much less frequently than the more positive emotions. Convenience sampling.
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9. INTERVENTIONS TO MANAGE DEMENTIA ASSOCIATED RISKS

9.1. DEFINITIONS OF ASSOCIATED RISKS

While most studies into non-medical interventions for dementia focus on attenuating the symptoms of dementia, some work has been completed examining interventions which help to manage risks associated with these symptoms. Four categories were identified during literature searches; driving, falls, wandering and pain.

9.1.1. DRIVING

Six papers examining interventions relating to driving with dementia were identified. Two of these were systematic reviews (non-meta-analytic) as detailed below. The remaining four papers were comprised of one Level IV (qualitative study) and three Level V papers including a review of consensus statements and intervention descriptions. Summary details are provided in [Table 15, p.119](#).

EVIDENCE-BASED REVIEW OF INTERVENTIONS FOR MEDICALLY AT-RISK OLDER DRIVERS (Classen et al., 2014)

Systematic review (non-meta-analytic) into interventions for older drivers with medical conditions, including consideration of research related to stroke, visual impairment and cognitive impairment.

For older people with cognitive impairments, one Level II nonrandomized three-group study and one Level I systematic literature review (Man-Son-Hing et al., 2007) reported below) were considered. The authors conclude:

- a) There is only weak evidence in favour of driving restriction interventions to improve driving outcomes. OTs using driving restrictions with clients with cognitive impairment should be cautious and consider multiple factors that may affect fitness to drive, such as client insight, external support, and unanticipated events in the driving environment.
- b) There is insufficient evidence to support compensatory strategies as a means of enhancing the driving capabilities of people living with dementia.

SYSTEMATIC REVIEW OF DRIVING RISK AND THE EFFICACY OF COMPENSATORY STRATEGIES IN PERSONS WITH DEMENTIA (Man-Son-Hing M et al., 2007)

Systematic review (non-meta-analytic) of 23 papers examining strategies designed to compensate for dementia related increases in driving risk. The review identified a number of potential intervention strategies (listed below) but no studies addressing the efficacy of these approaches were found.

- a) Retraining/education programmes
- b) Co-piloting
- c) On board navigation and crash warning systems
- d) Restricted licensing

- e) Self or family imposed restrictions
- f) Cognitive enhancers

9.1.2. FALLS

Three papers, all Level I, focussing on falls interventions in dementia were reviewed¹ including one systematic review (reported below) and two RCTs. Summary details are provided in [Table 15, p.119](#).

EFFECTIVENESS OF INTERVENTIONS TO PREVENT FALLS IN PEOPLE WITH ALZHEIMER'S DISEASE AND RELATED DEMENTIAS (Jensen & Padilla, 2011)

A systematic review (non-meta-analytic) of twelve studies focussed on three different approaches to therapy; exercise and motor-based interventions, nursing staff directed interventions, and multidisciplinary interventions.

Six studies (including a systematic review of 11 RCTs) examining individualized or group exercise were considered (three Level I, two Level III and one Level IV). Aggregated results from these studies were positive but remain inconclusive because of a lack of consistency across studies and while they showed statistically significant reductions in falls as a result of physical training or motor interventions, no single approach to therapy stood out as clearly superior to others.

Three studies focusing on interventions directed at staff, rather than people living with dementia or their carer, were considered (one Level I and two Level III studies). All three studies focused on the provision of fall management training, typically including education regarding fall risk factors, environmental modifications, behaviours, and how to give reinforcing reminders. All three studies reported positive results.

Two high quality (Level I) studies reported on the effect of multidisciplinary interventions on fall reduction demonstrating that multidisciplinary interventions return better results than standard single discipline approaches to care.

9.1.3. WANDERING

Four papers examining methods for managing wandering were considered² including one systematic review (reported below), one Level IV (single subject research design) and two Level V papers (a case studies and a narrative literature review). Summary details are provided in [Table 15, p.119](#).

A SYSTEMATIC LITERATURE REVIEW OF THE EFFECTIVENESS OF NON-PHARMACOLOGICAL INTERVENTIONS TO PREVENT WANDERING IN DEMENTIA AND EVALUATION OF THE ETHICAL IMPLICATIONS AND ACCEPTABILITY OF THEIR USE (Robinson et al., 2006)

¹ A number of papers included in the Exercise and Motor Interventions section include falls as an outcome.

² A number of papers included in the Assistive Technologies section examine devices designed to help manage wandering.

Systematic review (with partial meta-analysis) of ten studies (seven RCTs and three controlled trials). The authors rated the methodological quality of these studies as low due to incomplete reporting. The intervention topics addressed in these studies included; multisensory environments (3), music therapy (1), exercise interventions (1), special care units (2), aromatherapy (2), and behavioural interventions (1).

Meta-analysis was completed for interventions using multi-sensory environments (2 studies) indicating a small positive effect at outcome on reducing wandering or restlessness as measured by the INTERACT assessment, 95% CI = 0.22 [0.02, 0.41]. One RCT (n = 30) comparing exercise with usual care provided found some evidence that moderate-intensity exercise may reduce wandering.

None of the other non-pharmacological interventions examined presented robust evidence for their use in reducing wandering in dementia.

The review authors were unable to identify any relevant studies into the cost-effectiveness of non-pharmacological interventions for wandering in dementia.

9.1.4. PAIN

The management of pain in people living with dementia was specifically examined in one quasi-experimental level IV study using a multiple baselines design. Summary details are provided in [Table 15, p.119](#). Results suggest that the well timed provision of music can lessen experiences of pain in people living with dementia.

9.2. CONCLUSIONS

There is no conclusive evidence in favour of interventions to manage driving related risks.

The AOTA concluded from their 2011 reviews that there is some evidence to support the use of both exercise interventions and the provision of carers training to help manage and prevent falls, however a recent RCT contradicts the conclusions from this non-meta-analytic review .

There is some very limited and inconclusive evidence suggesting multisensory environments can help prevent wandering. Likewise, one study suggests there may be some benefit in using music as a means of helping to manage pain in dementia.

Table 15: Summary of studies examining interventions to manage dementia associated risks

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
General risk awareness and management						
(Thom & Blair, 1998)	Literature review (descriptive)	N/A	Explores literature concerning key areas relevant to risk assessment and management	N/A	<p>Most evidence identified in the review was practice rather than research based and largely discussed issues regarding assessment rather than management.</p> <p>The key finding related to the a contrast in approaches, with functional assessments tending to lead to a protectionist approach to therapy, while those which also considered PWD rights, views and remaining capacity lead to more balanced interventions.</p>	UK
Driving						
(Carmody et al., 2014)	Pre-post intervention survey	12 PWD \bar{x} age = 75	Examines the effect of a driving with dementia decision aid on decision making about driving retirement by individuals living with dementia.	<p>Decisional conflict</p> <p>Knowledge of dementia</p> <p>Satisfaction with decision</p> <p>Booklet use</p> <p>Booklet acceptability</p>	<p>Decisional conflicts improved following use of the decision aid.</p> <p>The majority of participating PWD felt that the decision aid was balanced, presented information well, and helped them decide about driving.</p> <p>Knowledge scores also improved after booklet use.</p> <p>The authors conclude that the intervention can contribute towards enhancing patients' quality of life while maintaining personal and public safety.</p>	Australia
(Byszewski et al., 2013)	Intervention description	N/A	Reports a toolkit developed to assist PWD and their carers in planning for retirement from driving.	N/A	<p>Toolkit provides paper based information about:</p> <ul style="list-style-type: none"> - General information about driving and dementia 	Canada

					<ul style="list-style-type: none"> - Typical assessment processes and procedures - Likely steps that will follow depending on results of assessment - A list of useful resources - A section detailing how to cope with grief following driving cessation. <p>No empirical evidence or data is presented.</p>	
(Perkinson et al., 2005)	Qualitative study (grounded theory approach)	68 health professionals, transportation and law-enforcement professionals, current and former drivers with AD, and family carers	Examines the views of people involved in driving decisions for older adults concerning AD and driving and, including identifying effective strategies to limit or cease unsafe driving.	Questionnaires 10 focus groups	<p>Most participants reported that a diagnosis of very mild AD alone did not preclude driving.</p> <p>Family members were seen to be key in monitoring and managing unsafe driving although the important support roles of physicians in counselling and assessing health-related fitness of older drivers was recognised.</p> <p>Commonly reported strategies to support the management of dementia related driving risks included:</p> <ul style="list-style-type: none"> - Assisting family members to deal with AD related driving risks - Invoking outside authority figures to help convince PWD of the need to stop driving - Using reasoning to discuss and address the need to restrict driving - Providing concrete evidence of the need to take away the opportunity to drive - Recognising the symbolism and significance of driving to the driver - Finding substitute activities 	USA

(Wheatley, Carr, & Marottoli, 2014)	Consensus statement	N/A	<p>Presents evidence and discussion to affirm eight consensus statements related to drivers with dementia and the impact of dementia on the driving task.</p> <p>Guidance for occupational therapists when addressing driving and community mobility is given.</p>	N/A	<p>- Finding alternative transportation</p> <p>3/8 consensus statements were affirmed at the highest level (e.g., Level 1: Evidence is strong and allows for an evidence based consensus statement):</p> <ul style="list-style-type: none"> - Individual with moderate to severe dementia should not drive. - Individuals with very mild or mild dementia may be appropriately referred for further testing when risk factors for unsafe driving are present. - Individual with neurodegenerative dementia should receive counselling (including consideration of alternative methods of transportation) should start immediately anticipating that driving cessation will likely occur in the future. <p>1/8 statement was affirmed at level 2 (the evidence is suggestive):</p> <ul style="list-style-type: none"> - For individuals with dementia, self-report regarding driving capability may be inaccurate; therefore, observation of occupational performance (e.g. IADL or performance in vehicle) is recommended. <p>1/8 consensus statement relating to co-piloting and navigation was affirmed at level 3 (evidence based on clinical opinion):</p> <ul style="list-style-type: none"> - Co-piloting, of driving lacks sufficient evidence to recommend it as a strategy to improve fitness to drive. <p>3/8 consensus statements designed to maintain a person's community mobility</p>	USA
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				<p>were affirmed at level 3 (evidence based on clinical opinion):</p> <ul style="list-style-type: none"> - Regardless of diagnosis, assessment and recommendations for optimal and safest community mobility should be provided. - Regardless of the driving assessment outcome, when an individual is diagnosed with dementia, OTs should start planning exploration of alternative transportation options early and begin to use these options to increase the person's familiarity with them. - OTs need to know their legal and ethical obligations related to driving and community mobility. 		
Falls						
(Wesson et al., 2013)	RCT	22 PWD-carer dyads	<p>Pilot RCT for feasibility of a novel approach to falls prevention for people with mild dementia living in the community.</p> <p>Home safety and exercise fall prevention program tailored to individual cognitive levels and implemented as a carer-supported intervention.</p> <p>Single blind.</p> <p>Alternating weekly schedule of 2 OT or PT visits for 8 weeks followed by telephone follow up once a week for 3 weeks and 1 final OT visit at week 12.</p> <p>Allen's Cognitive Disabilities</p>	<p>Interview for Deterioration of Daily Activities in Dementia (IDDD)</p> <p>Cornell Scale for Depression in Dementia (CSDD)</p> <p>Agitated Behaviours in Dementia Scale</p> <p>Incidental and Planned Exercise Questionnaire – weekly (IPEQ-W)</p> <p>Zarit Burden Interview (ZBI)</p> <p>Task Management Strategy Index (TMSI)</p>	<p>The pilot study was deemed feasible and acceptable to people with mild dementia and their carers.</p> <p>No significant differences between groups for any of the outcome measures were detected at retest.</p>	Australia

			<p>Model used to tailor the adaptation and delivery of the exercises and home safety fall prevention interventions.</p> <p>Westmead Home Safety Assessment used to identify home safety interventions.</p> <p>Exercise intervention consisted of six individually tailored strength and balance exercises selected from the Weight-Bearing Exercise for Better Balance (WEBB) program.</p> <p>Control group received usual care.</p>	<p>Physiological Profile Assessment (PPA)</p> <p>Hill Step Test</p> <p>Near-tandem test of standing balance with eyes closed</p> <p>Falls Efficacy Scale - International (Short Form)</p> <p>Iconographical Falls Efficacy Scale – International (ICONFES)</p> <p>Number of falls reported</p>		
(Buettner, 2002)	RCT (multicentre)	<p>25 PWD</p> <p>\bar{x} age = 83.3y</p> <p>\bar{x} MMSE = 2.63/30</p>	<p>Examines the effect of therapeutic recreation interventions on falls and injuries among people living with dementia resident at a nursing facility.</p> <p>Two group RCT at three facilities.</p> <p>Intervention group received falls prevention programme: graded walking (daily), functional exercises (3 times weekly) and sensory air mat therapy (twice weekly) for three months.</p> <p>Control group received care as usual for 2 months and one</p>	<p>Number of falls and related injuries</p>	<p>Following two months of intervention falls in the intervention group dropped from 74 at baseline to 28 while falls in the control group rose from 46 to 56.</p>	USA

			<p>month of exposure to the intervention.</p> <p>Baseline falls data collected for 2 months prior to commencement and data collected from both groups for the first two months only.</p>			
Wandering						
(Cipriani et al., 2014)	Literature review (descriptive)	N/A	Reviews literature relating to wandering and dementia including consideration of non-pharmacological treatment options.	N/A	Largely refers to the findings of (L. Robinson et al., 2006) systematic review which concludes there is currently no adequate, robust evidence from controlled trials to recommend the use of any non-pharmacological intervention to reduce wandering in dementia.	Italy
(Padilla et al. 2013)	Case Study (multiple baseline-multiple treatment design)	1 PWD 80y	<p>Tests the effectiveness of an intervention program for reducing the frequency of wandering behaviour of a patient with dementia, through the use of different non-invasive and non-restrictive strategies (environmental and cognitive-behavioural).</p> <p>Environmental intervention consisted of altering the exit by the addition of subjective barrier (taping on floor and door)</p> <p>Cognitive behavioural intervention consisted of differential reinforcement of</p>	Number of escape attempts	<p>Results showed a decrease in wandering behaviour frequency in the subject, for all three types of intervention.</p> <p>The cognitive/behavioural intervention, both when applied alone (C) and in joint implementation (BC), was shown to most reduce wandering behaviour frequency.</p>	Spain

			behaviours while working with the patient on different types of language, memory, and attention tasks (e.g. diverting attention from exit and reinforcing non-maladaptive acts and behaviours).			
			A-B-A-C-A-B-BC-B design			
(Yamakawa et al., 2015)	Case study	1 PWD 62y MMSE = 5/30	Reports on the effectiveness of pharmacotherapy and non-pharmacological interventions used to treat wandering. Pharmacological intervention = increase in Olanzapine (from 2.5 to 7.5 mg). Non-pharmacological intervention = change of room to reduce triggers observed by care staff.	Distance wandered Sleep duration Sleep quality	Pharmacological intervention reduced overall distance wandered but did not improve sleep duration or quality. Non-pharmacological intervention further reduced overall distance wandered and improved sleep quality and duration.	Japan
Pain						
(Park, 2010)	Observational study (repeated measures design)	15 PWD	Investigates the effect of music on pain for home-dwelling PWD. Subjects listened to their preferred music for 30 minutes before peak agitation time, for 2 days per week, followed by no music for 2 weeks. Pain level was measured for the 30 minutes before listening to music, the 30	Mini-Mental State Exam (MMSE) Assessment of Personal Music Preference (APMP) Modified Cohen-Mansfield Agitation Inventory (M-CMAI) Modified Pain Assessment in the Dementing Elderly (M-	Pain levels were found to be significantly lower after listening to music than before listening to the music Mean pain levels were not significantly lower while listening to music than before listening to the music. Pain levels while listening to music were not significantly lower than after listening to the music. Mean pain levels during the music intervention weeks (weeks 1, 2, 5, and 6) were not significantly lower than during the	South Korea

<p>minutes while listening to the music, and the 30 minutes after listening to the music.</p> <p>The process was repeated once.</p>	<p>PADE).</p>	<p>no music intervention weeks (weeks 3, 4, 7, and 8).</p> <p>Music may potentially help to control pain if timed sensitively.</p>
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10. INTERVENTIONS FOCUSED ON MANAGING BEHAVIOURAL, PSYCHOLOGICAL AND NEUROPSYCHIATRIC SYMPTOMS

10.1. SYSTEMATIC REVIEWS OF EFFECTIVENESS STUDIES OF INTERVENTIONS TO MANAGE BEHAVIOURAL SYMPTOMS

10.1.1. META-ANALYSIS OF NONPHARMACOLOGICAL INTERVENTIONS FOR NEUROPSYCHIATRIC SYMPTOMS OF DEMENTIA (BRODATY & ARASARATNAM, 2012)

Meta-analytic review of 23 studies including randomised or pseudo-randomised non-pharmacological interventions with outcomes related to the frequency or severity of behavioural and psychological symptoms of dementia, carer reactions to these symptoms, or carer distress attributed to these symptoms. The types of intervention examined in these studies included; carer skills training, education for carers, activity planning and, environmental redesign, enhancing support for carers, self management techniques for carers and two individual papers examining collaborative care with a health professional or care manager, and exercise interventions for care recipients.

Meta-analysis of 17 studies which examined the effects of interventions on psychological symptoms indicated positive results: 95% CI = 0.34 [0.20, 0.48].

Meta-analysis of 13 studies reporting outcomes related to carers of people living with dementia were also positive suggesting that these interventions effectively improved carers' reactions to the behavioural symptoms of dementia; 95% CI = 0.15 [0.04, 0.26].

The successful interventions identified in this review included approximately nine to twelve sessions tailored to the needs of the person with dementia and the carer, delivered individually at home using multiple components over 3-6 months with periodic follow-up.

The authors conclude that non-pharmacological interventions which are delivered by family carers can:

- a) Potentially reduce the frequency and severity of behavioural and psychological symptoms of dementia
- b) Achieve these outcomes with effect sizes equal to those that result from pharmacological therapy
- c) Reduce carers' adverse reactions.

10.1.2. THE EFFECTS OF PSYCHOSOCIAL METHODS ON DEPRESSED, AGGRESSIVE AND APATHETIC BEHAVIORS OF PEOPLE LIVING WITH DEMENTIA: A SYSTEMATIC REVIEW (VERKAIK, VAN WEERT, & FRANCKE, 2005)

Systematic review (non-meta-analytic) of 23 papers reporting 19 separate RCTs, covering 10 distinct approaches to therapy.

Following critical review of the studies three types of intervention were found to have some limited evidence in their favour:

- a) There is some evidence that Multi Sensory Stimulation/Snoezelen in a multi sensory room reduces apathy in people in the latter phases of dementia.
- b) Behaviour therapies focused on pleasant events and problem solving can reduce depression in people with probable Alzheimer's disease who are living at home with their primary carer.
- c) Limited evidence was discovered in favour of psychomotor therapy groups as a means of reducing aggression in a specific group of nursing home residents diagnosed with probable Alzheimer's disease.

The remaining psychosocial methods examined had no, or insufficient, indications that they reduce depressive, aggressive or apathetic behaviours in people living with dementia:

- a) Supportive Psychotherapy
- b) Reality Orientation
- c) Activity/Recreational Therapy
- d) Validation/Integrated Emotion-Oriented Care
- e) Skills Training Therapy
- f) Art Therapy
- g) Simulated Presence Therapy
- h) Reminiscence

10.2. EVIDENCE FOR INTERVENTIONS TO MANAGE BEHAVIOURAL SYMPTOMS NOT INCLUDED IN SYSTEMATIC REVIEWS

12 additional papers focusing on interventions to manage behavioural and neuropsychiatric symptoms were identified including two Level I studies (RCTs) one Level II study (controlled clinical trial), one Level III study (a retrospective cohort study), and eight Level V studies (seven literature reviews and a case study). These are summarised in Table 16, p.129.

10.3. CONCLUSIONS

From the existing systematic reviews and RCTs there is good, but not conclusive evidence to recommend that AHPs and other professionals working with people living with dementia and their carers should consider providing a range of interventions to help manage behavioural and neuropsychiatric symptoms. These could include:

- Providing skills training, problem solving strategies, education, self-management techniques, and access to support for carers
- Providing activity based interventions
- Making environmental changes to remove or reduce behavioural triggers
- Providing exercise-based interventions for people living with dementia

Table 16: Summary of studies examining interventions focused on managing behavioural, psychological and neuropsychiatric symptoms

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Gitlin et al., 2010b)	RCT	272 carer of PWD \bar{x} age = 82.1y (PWD); 66.3y (carer) \bar{x} MMSE = 13/30	Examines the effects of an intervention (Advanced Caregiver Training, ACT) to help families manage distressing behaviours in family members with dementia. ACT used to identify and then modify potential triggers to problem behaviours caused by patient based, carer based and environmental based factors. 2 group RCT Intervention consisted of 16-week active phase of up to nine OT sessions and two nursing sessions (one home and one telephone) and a maintenance phase (16–24 weeks) of three brief OT telephone contacts to reinforce strategy use. Control received no intervention.	Carer upset (10 point Likert scale) Confidence in managing problem behaviours (10 point Likert scale) Zarit Burden Scale Centre for Epidemiologic Studies Depression Scale (CES-D) Perceived Change Index Task Management Strategy Index Frequency of 6 forms of communication (5 point Likert scale) 11-item investigator-developed survey of carer perceptions of study benefits	Remaining participants at 16 weeks = 239 (87.9%) and 24 weeks = 220 (81.0%), representing 12.1% and 19.1% attrition. At 16 weeks statistically significant results include: - Greater improvement in occurrence of the primary targeted problem behaviour for the intervention group was observed than in the control group - Greater reduction in upset with the target problem behaviour was observed for carers in the intervention group than control group carers - Greater improvement in confidence managing the target problem behaviour was found in carers receiving the intervention compared to controls - Differences favouring the intervention were found for carers' wellbeing (burden, upset with problem behaviours overall, perceived change) - Improvements in the intervention group were observed for each domain of perceived change(affect, somatic symptoms and managing daily care) - Greater symptomatology (as measured on the CES-D) was found in control group compared to the intervention group carers At 24 weeks: - All carer outcomes statistically	USA

					<p>significantly favoured intervention except for negative communication which showed a non-significant trend to favour intervention</p> <ul style="list-style-type: none"> - Carers receiving intervention reported greater improvements in: <ul style="list-style-type: none"> - Understanding the disease (69.0% vs 25.2%) - Confidence managing behaviours (71.9% vs 29.1%) - Making life easier (46.0% vs 9.7%) - Ability to provide care (58.0% vs 16.7%) - Patient's daily life (36.4% vs 7.8%) - Ability to keep patients at home (46.5% vs 17.6%) - Overall benefit in caregiving (79% vs 36.9%) - Overall benefit in daily life (46.1% vs 9.7%) 	
(Rovner et al., 1996)	RCT	<p>89 PWD \bar{x} age = 81-82y \bar{x} MMSE = 9/30</p>	<p>Examines the effects of the A.G.E. dementia care program (Activities, Guidelines for psychotropic medications, and Educational rounds) on behaviour disorders, antipsychotic drug and physical restraint use, patient activity levels, and cognitive and functional status.</p> <p>2 group RCT. No blinding.</p>	<p>Absence/presence of composite behavioural disorder</p> <p>Psychogeriatric Dependency Rating Scale (PGDRS)</p> <p>Mini Mental State Exam (MMSE)</p> <p>Cohen Mansfield Agitation Scale</p> <p>Medication usage</p>	<p>Attrition at 6 months = 8/89</p> <p>Outcomes at 6 months:</p> <p>Significantly fewer participants in the intervention group showed behavioural disorders in comparison to the control group 28.6% vs 51.3%).</p> <p>Participants in the control group were significantly more likely to require antipsychotic medication (almost twice as likely).</p> <p>Control participants were significantly more likely to be restrained both during activity</p>	USA

			<p>Intervention group was provided daily opportunity to attend an activity programme which included options for music, exercise, crafts, relaxation, reminiscence, word games and food preparation. Psychiatrist (rather than primary care physician) based medication review. Educational round consisted of discussion between AGE providers and the psychiatrist.</p> <p>Control group received nursing home care as usual.</p>	<p>Frequency of restraint use</p> <p>Observation of engagement in activities</p>	<p>times and on nursing units.</p> <p>Activity participation was significantly higher in the intervention group.</p> <p>The authors conclude that the AGE programme reduces the prevalence of behavioural disorders, medication use, and restraint and appears to improve the lives of patients with dementia in nursing homes.</p>	
(Han et al., 2011)	Controlled trial	<p>43 PWD</p> <p>\bar{x} age = 78y</p> <p>\bar{x} MMSE score = 14/30</p>	<p>Examines the effects of weekly structured music and activities programme on the behavioural and depressive symptoms in PWD.</p> <p>Intervention consisted of a morning session (warming up and stretching exercises, walking group, then an activity including gardening and horticulture, massage and aromatherapy, pet therapy, intergenerational activities with preschool children, and organized outings. The afternoon session consisted of music therapies such as singing, music and movement, memory sequences and</p>	<p>Mini Mental State Examination (MMSE)</p> <p>Apparent Emotion Scale (AES)</p> <p>Revised Memory and Behavioural Problems Checklist (RMBPC)</p>	<p>Post intervention RMBPC scores in the intervention group had improved significantly in comparison to the controls which had decreased. Most change was on the depression subscale.</p> <p>No significant differences on the AES were observed after intervention.</p> <p>The authors conclude that the weekly structured music and activities programme may ameliorate behavioural and depressive symptoms in PWD.</p>	Singapore

			<p>drumming.</p> <p>Duration of intervention was 6 hours of intervention each week over 8 consecutive weeks provided by OTs, certified music and licensed creative arts therapist and a registered nurse. Family carers were encouraged but not obliged to join in the program.</p> <p>The control group comprised a waiting list who received usual care.</p>			
(Mowrey et al., 2013)	Retrospective single cohort study	<p>39 PWD</p> <p>\bar{x} age = 85y</p> <p>MMSE range = 4-20/30</p>	<p>Examines the effects of Behaviour Based Ergonomics Therapy (BBET) on quality of life and behavioural medication usage of PWD residing in supported accommodation.</p> <p>BBET intervention consists of individualised therapeutic activities which complemented group activities and addressed resident stress caused by boredom or disengagement. Multimodal therapies in a customized manner that includes family inputs and round-the-clock availability.</p> <p>4 types of intervention included in two categories of</p>	<p>Number of falls</p> <p>Pro re nata medication usage</p> <p>Frequency of abnormal behaviours (wandering, verbal abuse, physical/self-injurious, socially inappropriate, and resisting care)</p> <p>Frequency of mood indicators (negative statements, repetitive questions, repetitive verbalization, persistent anger, self-depreciation, unrealistic fears, recurrent statements,</p>	<p>No significant changes to outcome were observed for a sub-cohort (n=9) of residents who resided in the specialist dementia care section of the facility for the duration of study.</p> <p>For the remaining population:</p> <ul style="list-style-type: none"> - Abnormal behaviour counts decreased significantly by 66% - Mood indicator counts decreased significantly by 68% - No statistically significant decreases to behavioural episodes or falls - No significant changes to medication use were observed 	USA

Interventions to manage behavioural, psychological and neuropsychiatric symptoms

			comforting (listening to music, watching videos, memory box) and stimulating (games and puzzles).		health complaints, non-health complaints, bad morning mood, insomnia, sad facial expressions, crying/tearfulness, physical movements, activities withdrawal, and reduced social interaction).	
(Fitzsimmons, Barba, & Stump, 2015)	Literature review (descriptive)	N/A	Categorises diversional and physical non-pharmacological interventions for behavioural and psychological symptoms of dementia, and presents the evidence supporting their use.	N/A	Provides basic, descriptive and non-appraised information about 10 different categories of diversionary non-pharmacological intervention.	USA
(Konno, Kang, & Makimoto, 2014)	Literature review (descriptive)	N/A	Best-evidence review of non-pharmacological interventions for resistance-to-care behaviours of nursing home residents with dementia in a personal-care context	N/A	<p>Reviews 19 intervention studies (3 RCTs, 16 quasi-experimental designs).</p> <ul style="list-style-type: none"> - Nine quasi-experimental studies examined interventions using music as an environmental modification (playing music to groups; playing resident's preferred music during personal care etc.) resulted in significant reductions in resistance-to-care behaviours. - 4 studies (2 RCTs, 2 quasi-experimental) examined interventions focusing on person-centred care approaches to bathing with 3/4 reporting significant reductions to resistance-to-care behaviours - 5 studies reported on different ability-focussed interventions (1 RCT and 4 quasi-experimental) with two reporting 	Japan Korea

Interventions to manage behavioural, psychological and neuropsychiatric symptoms

					significant reductions in behaviours.	
(Laver et al., 2014)	Literature review (descriptive)	N/A	Narrative review which summarises details of interventions found to be effective in managing behavioural and psychological symptoms of dementia.	N/A	Re-reports and comments on the findings of the systematic review considered above (Brodaty & Arasaratnam, 2012).	Australia
(Gitlin, Kales, & Lyketsos, 2012)	Literature review (descriptive)	N/A	Descriptive and opinion piece including literature review which lists specific and general strategies for managing behaviours in PWD.	N/A	Numerous strategies noted but appraisal of evidence base not presented.	USA
(Bourbonnais & Ducharme, 2008)	Literature review (descriptive)	N/A	Reviews empirical evidence into screaming in dementia	N/A	Summarises factors which contribute to screaming in dementia noting that work to date indicates this behaviour communicates needs or a lack of stimulation and may be a possible end-of-life predictor. Further research is recommended. Treatments for screaming in dementia have mostly used basic case study designs to investigate the effectiveness of biomedical treatments, behavioural approaches, modification of the environment, and concomitant use of multiple interventions. No convincing or consistent body of evidence has yet been developed in favour of specific treatments.	Canada
(Barton, Findlay & Blake, 2005)	Literature review (descriptive)	N//A	Reviews studies into the management of inappropriate vocalisation by PWD	N/A	36 papers considered and indicate that non-pharmacological strategies include environmental interventions and behavioural therapies to address underlying causes of screaming including most commonly, pain, depression and level of	UK

					stimulation.	
(McMinn & Draper, 2005)	Literature review/practice guidance	N/A	Reviews evidence and presents guidance for the management of verbally disruptive behaviour in dementia	N/A	Notes the general lack of robust and consistent research evidence for management strategies. Recommends an individually tailored approach to treatment that includes psychotropic medication, identification and removal of causes of discomfort or suffering, interventions to reduce sensory deprivation and social isolation, behavioural strategies based on operant learning.	Australia
(Smith, 2001)	Case study (Project evaluation)	PWD (sample not reported) 6 nursing staff	Examines the effects of an activity and social interaction group on behaviour and mood of elderly patients with dementia in a general hospital setting. Duration, frequency and attendance not reported. Variety of activities used during groups including creative activities, reminiscence, sensory stimulation and physical activity. Observational measures made for 10 minutes before and 10 minutes after sessions.	Interact and Interact Short scales Staff questionnaire	Overall effects appeared positive although confusion scores worsened during the groups. All nursing staff who returned the survey reported that group had helped to manage participant's behaviour on the wards. 4 of the respondents felt the group had been beneficial for individual participants.	UK

11. MULTICOMPONENT AND INTERDISCIPLINARY INTERVENTIONS

11.1. DEFINITIONS OF MULTICOMPONENT AND INTERDISCIPLINARY INTERVENTIONS

Multicomponent interventions are those which involve the provision of two or more distinct therapeutic treatments. They can be delivered by one single professional group but more commonly include a number of different health professionals.

Studies were included in this section if they examined multicomponent interventions for outcomes that do not fit easily within one of the outcome areas already noted, including those which examine a broad range of outcomes. For instance most of the studies examined in the tailored and individualised therapy section could also fit into this category as they use a number of different distinct interventions.

11.2. EVIDENCE FOR MULTI-COMPONENT AND INTERDISCIPLINARY INTERVENTIONS

Seven papers were identified which reported studies using multicomponent or interdisciplinary interventions with multiple outcomes which could not be included with other categories. These included four Level I studies (RCTs), two Level III (single group studies reporting outcomes) and a Level IV retrospective longitudinal study. Summary details are provided in [Table 17, p.137](#).

11.3. CONCLUSIONS

It is difficult to draw comparisons across the four RCTs due to differences in design, including the outcomes that were measured. Two RCTs reported positive results for people living with dementia resulting from multicomponent interventions while two did not. Results from the non-experimental studies correspond with these findings reporting variable results on a number of different outcomes. However, only one of these RCT was a true comparison (Bach 1995), examining different configuration of multicomponent care rather than comparing this to a no-treatment or treatment as usual control group. This study reported positive findings for an intervention which combined reactivating OT in addition to functional rehabilitation when compared with functional rehabilitation alone on the cognitive performance, psychosocial functioning, and quality of life of people living with dementia.

It is not possible from these results to confidently comment of the benefits of drawback of multi-component intervention although it should be noted that interventions of this type are referred to in several of the more specific categories mentioned in this review, often with positive results.

Table 17: Summary of studies examining multicomponent and interdisciplinary interventions

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Kumar et al., 2014)	RCT	77 PWD \bar{x} age = 69.39y	Examines the effects of effects of a multicomponent OT program on QoL in people with mild to moderate dementia. 2 group RCT Open Label (i.e. non-blinded) Intervention consisted of 10 treatment session of 70 minutes each over 5 weeks. Components: - Relaxation (10 min) - Physical exercise for strength mobility and circulation (10 min) - Personal care activities (15min) - Cognitive exercises (20 min) - Recreational activities (10 min) Control group received medical care as usual.	WHO Quality of Life- (WHOQOL-BREF)	Overall quality of life (as measured by the WHOQOL- BREF) improved significantly in the intervention group and declined in the control group. In the intervention group significant improvements were seen in each of the sub-domains of the WHOQOL-BREF with the exception of the social relationships domain. The authors conclude that the results show the multi-component OT intervention improved the short term physical performance and psychological well being domains of quality of life in older adults with dementia.	India
(Lam et al., 2010)	RCT	102 PWD \bar{x} age = 78y \bar{x} MMSE = 18/30	Examines an OT led case management (CM) model for people with mild dementia. 2 group RCT. Blinded allocation and assessment.	Zarit Carer Burden Interview (ZBI) General Health Questionnaire (GHQ) Personal Well-Being Index for adults (PWI-	Attrition at 12 months = 6/59 intervention group and 4/43 control group. Outcomes at 4 months: - No significant changes in PWI-A, ZBI, and GHQ scores in both groups - Significant drop in CSDD scores for the	Hong Kong

<p>(Onor et al., 2007)</p>	<p>RCT</p>	<p>16 PWD-</p>	<p>Examines the effects of a multimodal intervention</p>	<p>MMSE</p>	<p>Outcomes for PWD</p>	<p>Italy</p>
<p>Intervention group received CM from an OT for 4 months during which home visits were offered and the following interventions provided:</p> <ul style="list-style-type: none"> - Assessment and advice for safe performance in basic self-care activities, environmental modifications to promote safe home living, behavioural management, and communication techniques - Cognitive stimulation - Support and information about locally available social centres and social services <p>Control group received one OT visit for home safety.</p> <p>Data collected at baseline, 4-months (cessation of intervention) and 12 months (follow-up).</p>			<p>As) Use of social care Mini Mental State Exam Cornell Scale for Depression in Dementia (CSDD) Neuropsychiatric Inventory (NPI) Personal Well-Being Index-Intellectual Disability (PWI-ID)</p>	<p>intervention group but not for the control group</p> <ul style="list-style-type: none"> - Significant reductions in NPI total scores was noted in both groups. - No change in PWI-ID was observed in both groups <p>Outcomes at 12 months:</p> <ul style="list-style-type: none"> - No significant changes in ZBI and PWI-A - Significant increases to GHQ scores were recorded in the intervention group but not the controls - Both groups showed a significant deterioration in MMSE scores - Neither group showed significant changes to CSDD and PWI-ID scores. <p>None of the changes in outcomes at fourth and twelfth months showed significant group difference.</p> <p>There was no significant group difference in MMSE and PWI-ID scores of demented subjects, and ZBI, PWI-A, and GHQ scores of carers at all three time points.</p> <p>Use of social support was significantly greater in the intervention group compared to the control group at both 4 and 12 months.</p> <p>The authors conclude that short-term time-limited intervention in carers with low stress levels may not offer significant impact on the quality of care nor alleviate carer stress.</p>		

		carer dyads	<p>program for patients with AD and their carers.</p> <p>2 group RCT.</p> <p>No blinding reported.</p> <p>For PWD intervention consisted of three 60-minute sessions a week of reality orientation therapy, occupational therapy, and reminiscence therapy over a period of 4 months, delivered by a psychologist</p> <p>For carers intervention consisted of a weekly psycho-educational group (60 min sessions) including information about dementia, disease progression and how to use some of the reality orientation and OT techniques at home.</p> <p>Control group received no intervention.</p> <p>Data collected at baseline (T0), 2 months (midway, T1) and four months (intervention cessation T2).</p>	<p>Milan Overall Dementia Assessment (MODA)</p> <p>Lawton Instrumental Activities of Daily Living scale(IADL)</p> <p>Katz Activities of Daily Living scale (ADL)</p> <p>Geriatric Depression Scale (GDS)</p> <p>Brief Symptom Inventory (BSI)</p> <p>Caregiver Burden Inventory (CBI)</p>	<p>No differences over time within each group, or between the two groups were observed for:</p> <ul style="list-style-type: none"> - MMSE scores - Cognitive performance as measured by the MODA - ADL scores - IADL scores <p>GDS scores decreased in the rehabilitation group, but not in the control group.</p> <p>Outcomes for carers:</p> <p>Carers in the intervention group were observed to have significant differences in:</p> <ul style="list-style-type: none"> - Anxiety as measured by the BSI between T1 and T2 and T0 and T2 - Depression as measured by the BIS between T0 and T2 <p>The authors conclude that the study demonstrates that the multimodal rehabilitation program had limited efficacy on the cognitive and functional aspects of dementia but good efficacy on behavioural aspects, particularly depression.</p> <p>The psycho-educational intervention given to carers was effective in reducing anxiety and depression.</p>	
(Bach et al., 1995)	RCT	44 PWD \bar{x} age = 83.4y	Compares the effects of two different multi-component OT programmes for people with mild or moderate dementia.	<p>Clinical Assessment Geriatric Scale (SCAG)</p> <p>Hamilton Depression Rating Scale (HAMD)</p>	<p>At 12 weeks significant changes for the both groups was observed for scores on the:</p> <ul style="list-style-type: none"> - SCAG 	Austria

			<p>2 group RCT.</p> <p>Double blinded (treatment providers and recipients).</p> <p>Group 1 received functional rehabilitation comprising functional OT, physiotherapy, and speech therapy for 24 weeks (frequency not specified).</p> <p>Group 2 received the same functional rehabilitation intervention and an additional component of reactivating OT stimulated by memory training, manual/creative activities to improve sensorimotor functions, and self management practice (two, 1-hour long session a week).</p>	<p>Depression Status Inventory (DSI)</p> <p>Scale of Well-being</p> <p>Benton Test (BT)</p> <p>Grunberger Verbal Memory Test (GVG)</p> <p>Nuremberg Aged Persons Inventory subscales:</p> <ul style="list-style-type: none"> - Number Association Test - Number Symbol Test - Latent Learning 	<ul style="list-style-type: none"> - HAMD - DSI - LL <p>At 24 weeks significant changes for the both groups was observed for scores on the:</p> <ul style="list-style-type: none"> - DSI - BT - GVG - Number symbol test - Latent learning test <p>At 12 weeks significant differences between the groups were noted for scores on the:</p> <ul style="list-style-type: none"> - SCAG - GVG - Number symbol test - Latent learning test <p>At 24 weeks significant differences between the groups were noted for all outcomes except the number association tests.</p> <p>The authors conclude that providing reactivating OT in addition to functional rehabilitation is significantly more efficient than the application of functional rehabilitation alone on levels of cognitive performance, psychosocial functioning, and the degree of contentedness with life.</p>	
(Cruickshank et al., 2015)	One group pretest-posttest	15 participants with HD	Examines the effect of multidisciplinary rehabilitation on cognitive and executive functioning, and brain	<p>Structural MRI - measures grey matter volume</p> <p>Colour Word</p>	<p>Programme adherence:</p> <ul style="list-style-type: none"> - Supervised clinical program = 84.2% - Home-based program = 58.6% 	Australia

		\bar{x} age = 52.5y	<p>structure.</p> <p>Intervention consisted of:</p> <ul style="list-style-type: none"> - Clinical exercise program, supervised weekly aerobic and resistance exercises for an hour. - Home-based exercise program, self-directed muscle strengthening and fine motor exercises for an hour, three times a week. - Fortnightly occupational therapy, paper and pencil, verbal planning, memory, and problem solving exercises designed to enhance cognition and executive function. <p>Measures at baseline and 9 month follow up by blinded assessors.</p>	<p>Interference Test (CWIT) and Trail Making Test components of the Delis-Kaplan Executive Function System (D-KEFS)</p> <p>Symbol Digit Modalities Test (SDMT)</p> <p>Hopkins Verbal Learning Test-Revised (HVLTR)</p>	<ul style="list-style-type: none"> - Occupational therapy sessions = 79.2% <p>Cognitive and executive function outcomes at 9 months:</p> <ul style="list-style-type: none"> - Significant improvements were detected observed on the delayed recall (number of words recalled after delay) component of the HVLTR. - No significant changes were found for CWIT, TMT, and SDMT outcomes. <p>Structural changes to brain at 9 months:</p> <ul style="list-style-type: none"> - Significant increases in the volume of grey matter in the dorsolateral prefrontal cortex (DLPFC) and right caudate nucleus were noted. - The other cortical and sub-cortical brain regions examined all displayed loss of volume. 	
(Zinzi et al., 2007)	Within subjects research design	<p>40 people with HD</p> <p>\bar{x} age = 52y</p> <p>\bar{x} MMSE = 24.9/30</p>	<p>Examines the effects of an intensive, inpatient rehabilitation programme including respiratory exercises, speech therapy, physiotherapy, OT and cognitive rehabilitation exercises on individuals affected by Huntington's disease.</p> <p>Intervention consisted of:</p>	<p>Zung Depression Scale (ZDS)</p> <p>Mini-Mental State Examination (MMSE)</p> <p>Barthel Index</p> <p>Tinetti Scale</p> <p>Physical Performance Test (PPT)</p>	<p>Overall no significant changes were observed for:</p> <ul style="list-style-type: none"> - Depression as measured by the ZDS - Cognition as measured by the MMSE - ADL function as measured by the Barthel Index <p>Depression scores did decrease during admissions (and hence exposure to intervention) 1-3.</p> <p>Tinetti Scale and PPT scores improved after each intervention exposure and the overall</p>	Italy

			<ul style="list-style-type: none"> - Respiratory rehabilitation provided jointly by physiotherapists and speech therapists. - Gait, balance and transfers training, strengthening, coordination and postural stability exercises. - OT consisted of individually tailored exercises aimed at learning new strategies to perform tasks made more difficult by disease progression. - Cognitive rehabilitation exercises focused on improving attention, memory, oral and written language. <p>Intervention was performed in an intensive regimen for 8 hours a day for five days and 4 hours a day for one day per week over multiple admissions - three-week admissions, three times a year (max 6 over two years).</p>		<p>effect of intervention on motor performance was a significant improvement.</p> <p>The authors conclude that the results indicate an intensive, residential, multidisciplinary rehabilitation programme can positively influence motor and functional performance of people with HD and can maintain a stable condition for at least for two years.</p>	
(Baldelli et al., 2007)	One-group longitudinal observation	26 PWD \bar{x} age = 85.7	Examines the effects of OT provided in special care unit over one year. Interventions provided included 'educational procedures' such as cooking,	Mini mental state examination (MMSE) Barthel Index (BI) Tinetti Scale Neuropsychiatric	At 12 months no significant decreases were observed in: - Cognition as measured by MMSE - ADL as measured by the BI - Motor performance as measured by the	Italy

<p>gardening, colouring and drawing; and physical activity session lasting 2 hours and provided five days per week.</p> <p>Data collected at baseline, six months and 12 months.</p>	<p>Inventory (NPI)</p>	<p>Tinetti scale</p> <p>At 12 months, significant improvements to behaviour as measured by NPI scores were observed.</p> <p>The authors suggest that the provision of OT intervention may explain the attenuation of psychophysical decline and improvements to behaviour.</p>
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12. STUDIES INTO THE EFFECTS OF SERVICE DELIVERY MODELS ON DEMENTIA

12.1. DEFINITIONS

Papers have been included in this section if they address the effects of specific service delivery models on outcomes for people living with dementia and their carers.

12.2. EVIDENCE FOR THE EFFECTS OF SERVICE DELIVERY MODELS

No systematic reviews were identified which specifically examined the role service delivery models may play in outcomes for people living with dementia. A limited amount of primary research was identified comprising two RCTs and two cohort studies (details in [Table 18, p.145](#)).

12.3. CONCLUSIONS

Neither of the multicentre RCTs reported positive outcomes related to the provision of specialist services. Similarly the results of the two quasi-experimental studies were inconclusive and did not provide any compelling evidence in favour of the specialist care delivery models examined.

Table 18: Summary of studies examining the effects of service delivery methods

Study	Design	Population	Intervention or aim	Outcomes/data used	Results	Country
(Wenborn et al., 2013)(Bone, Cheung, & Wade, 2010)	RCT (multicentre)	210 PWD \bar{x} age = 84y \bar{x} MMSE = 5.8-5.8/30	Examines the effect of providing an OT programme designed to enable care home staff to increase activity provision. Cluster RCT with matched pairs. Blinded assessment. OT provided to care homes (8) in the intervention group consisted of: - Assessment of and recommendations to modify care home physical environments to enable residents' engagement in activity. - Education programme to enhance staff knowledge, attitude and skills (5 x 2 hour sessions with interim work-based learning tasks) - One-to-one coaching sessions to support skill acquisition Control sites (8) provided usual care with no limitation on training or introducing new activity provision. Data collected at baseline, 4	Quality of Life in Alzheimer's Disease - Patient and Caregiver Report (QOL-AD) Mini Mental State Examination Clifton Assessment Procedures for the Elderly – Behaviour Rating Scale (CAPE-BRS) Challenging Behaviour Scale (CBS) Cornell Scale for Depression in Dementia (CSDD) Rating Anxiety in Dementia Clinical Dementia Rating Scale	Attrition at follow up = 51/210. At 4 weeks and 12 weeks staff scores on the QOL-AD at sites receiving the intervention were significantly lower than those in the control group. No other significant differences were found at either time point for any other outcome measured. The authors suggest that limitations including variability in intervention implemented and inconsistent provision of additional activities to residents may have impeded data quality.	UK

			weeks post intervention and 12 weeks post intervention.			
(Meeuwssen et al., 2012)	RCT (multicentre)	175 PWD-carer dyads \bar{x} age = 78.1 (PWD), 63.5 (carer) \bar{x} MMSE = 22.7/30	Examines the effectiveness of post-diagnosis dementia treatment and coordination of care by memory clinics compared with general practitioners. 2 group RCT with 12month follow up. Interventions consisted of usual care by either the memory clinic or the general practitioner. Memory clinics provided tailored treatment and care coordination based on the dementia guidelines of the Dutch Institute for Healthcare Improvement, typically including drug therapy, occupational therapy, providing day structure, or referral to a nurse specialist, day care, or home care. General Practitioner (GP) intervention was provided according to Dutch general practice and homecare dementia guidelines. Data collected at baseline (pre-randomisation), 6 months and 12 months.	Quality of Life in Alzheimer's disease (QOL-AD) Sense of Competence Questionnaire (SCQ) Geriatric Depression Scale (GDS) Neuropsychiatric Inventory (NPI) Interview for Deterioration in Daily living in Dementia (IDDD) Centre for Epidemiologic Studies Depression Scale State-Trait Anxiety Inventory Eysenck Personality Questionnaire Pearlin Mastery Scale Inventory for Measuring Social Involvement	Attrition by 12 months = 13/88 (14.7%) in GP group; 9/87 (10.3%) in the Memory Clinic group. For PWD at both 6 and 12 months no statistically significant differences were found between the two groups for any outcomes (quality of life, neuropsychiatric symptoms, deterioration in daily living activities, or depression). For carers at 12 months three outcomes showed statistically significant favouring the GP group (detailed below) but the authors note that mean scores on these instruments for the two groups were well below the cut-offs for relevant clinical symptoms of anxiety or depression. - General anxiety as measured by the State-Trait Anxiety Inventory - Anxiety at the moment of measuring as measured by the State-Trait Anxiety Inventory - Depressive symptoms as measured by the CES-D The authors conclude that no evidence was found indicating that memory clinics were more effective than GPs at providing post diagnostic treatment and care coordination.	Netherlands

(de Bruin et al., 2012)	Cohort study	88 PWD	<p>Examines the effect of two different day-care service delivery methods on functional performance of PWD.</p> <p>Comparison made between Green Care Farms (GCF) and Regular day care facilities (RDCFs).</p> <p>3 cohorts at each site followed, A – participants who were about to start or had recently started day care (1.3 months previously on average); B – those who had participated in day care for approximately 6 month and; C those who had been participating in day care for 12 to 24 months previously.</p> <p>Green Care Farms combine agricultural production with care services for people with care needs providing opportunities for participating in leisure and recreational activities, normal home-like activities, farm-related activities and outdoor activities.</p> <p>Regular day care facilities tend to be either socially or medically oriented. Socially oriented facilities mainly offer</p>	<p>Mini Mental State Examination (MMSE)</p> <p>Barthel Index (BI)</p> <p>Interview for Deterioration in Daily living in Dementia (IDDD)</p>	<p>For all cohorts at both sites:</p> <ul style="list-style-type: none"> - No significant changes in basic ADL dependence were observed between groups or over time. - No significant changes to average of sub-domain scores for Instrumental ADL were observed between groups or over time. - No significant difference to the number of diseases and the number of psychotropic medications were observed between groups or over time. <p>The authors conclude that functional performance did not significantly change over the one-year study period in community-dwelling older people living with dementia attending two to three days of day care per week.</p>	Netherlands
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			<p>social and (therapeutic) recreational activities and are mostly affiliated to a residential home, whereas medically oriented facilities offer medical treatment, rehabilitation and/or personalized therapeutic programmes and are mostly affiliated to a nursing home.</p> <p>Data collected from family carers at baseline, 6 months and 12 months.</p>			
(Saxton et al., 1998)	Cohort study	<p>52 PWD</p> <p>\bar{x} age = 80.6y and 85.5y</p> <p>\bar{x} MMSE = 11/30</p>	<p>Examines the effects of two different approaches to residential care provision on functional decline of PWD.</p> <p>Follows residents from two different residential care facilities; a specialist dementia facility, and a traditional nursing home.</p> <p>Participants matched for characteristics across sites.</p>	<p>Retrospective Collateral Dementia Interview</p> <p>Mini-Mental State Examination (MMSE)</p> <p>Functional Independence Measure (FIM)</p> <p>The Nursing Home Behavioural Problem Scale (NHBPS)</p> <p>Cornell Scale for Depression in Dementia (CSDD)</p>	<p>Overall ADL (as measured by the FIM) and cognitive decline (as measured by the MMSE) did not differ between the two groups.</p> <p>Differences in decline between groups was noted on two of the FIM subscales with residents at the specialist facility showing a greater decline in self-care, while the traditional nursing home residents showed a greater decline in independence in toileting.</p> <p>No differences in rates of decline in social and cognitive functioning were observed.</p> <p>No differences in the rates of falls were noted between the two sites.</p> <p>Significant differences were noted on mobility scores with the specialist facility showing no change over time while the traditional nursing home saw an average decline in mobility scores of 25.5%</p>	USA

although the authors note that it is not possible to discount the effect that higher baseline mobility scores at the specialist had on this finding.

The authors conclude that the findings suggest no overall difference in the cognitive and functional decline of residents with dementia at a specialised care facility and a traditional nursing home.

13. HORTICULTURAL THERAPIES, GARDENING INTERVENTIONS AND GARDENS

13.1. DEFINITIONS

Horticultural therapy and gardening interventions typically refer to approaches to therapy in which activities related to cultivating plants are used with a view to improving an individual's social, emotional, educational, psychological, and physical well-being. Horticultural therapies may occur inside as well as in outdoor garden areas.

Alongside this range of approaches to dementia treatment is the provision of gardens, sometimes referred to as therapeutic gardens, which are intended as an environmental intervention to improve wellbeing. Gardens may vary in the degree to which they have been designed to provide specific sensory stimuli and may or may not include opportunities for participation in horticultural activities.

13.2. EVIDENCE FOR HORTICULTURAL THERAPIES, GARDENING AND GARDENS

Of the eight studies considered, six examined horticultural therapy while one examined the provision of a specially designed garden space, and one the provision of plants and ability to see outdoor spaces to residents of a health care facility.

The papers reporting on examinations of the effect of horticultural therapy included one Level I study (RCT) and five Level III studies (two single-group pretest-posttest designs and three cross sectional studies).

Two papers examined gardens as a therapeutic environment using Level III designs (a single group pretest-posttest design and a cross sectional study).

One non-meta-analytic scoping literature review was also identified.

Summary information for these papers is presented in [Table 19, p.151](#).

13.3. CONCLUSIONS

The RCT by Jarrott and Gigliotti (2010) suggests that HT can be an effective way of engaging people living with dementia in meaningful activities though it may not have any impact on affective state. The non-experimental studies considered report corresponding results in terms of increased levels of engagement compared to usual care or 'traditional' activities. Unlike the RCT several of these studies reported positive results for the effect of HT and gardening interventions on depression, agitation, quality of life. Both studies examining access to garden environments reported positive results in relation to quality of life.

These conclusions are similar to those offered in the scoping review by Gonzalez (2014) which notes that despite the lack of high quality studies consistent findings for the benefit of gardening and gardens on behavioural outcomes, well-being and affect suggests they may be appropriate for use in dementia care.

Table 19: Summary of studies examining horticultural therapy, gardening interventions and gardens

Study	Design	Population	Intervention or aim	Outcomes / data used	Results	Country
(Jarrott & Gigliotti, 2010)	RCT (multicentre)	129 PWD	Examines the effects of group based horticultural therapy (HT) on engagement and affect during for PWD. 4 of 8 participating programmes randomly assigned to provide HT twice-weekly for six weeks. Remaining 4 participating programmes were assigned to provide traditional activities as the control group. Data collected at weeks 1,2,5,6.	Mini mental status examination (MMSE) Apparent Affect Rating Scale (AARS) Menorah Park Engagement Scale (MPES)	Significant differences between the treatment and comparison groups were found in 4/5 engagement categories on the MPES, with the intervention group spending significantly greater percentage of time than the comparison group exhibiting active engagement. The control group demonstrated significantly higher levels of self-engagement than the intervention group. No significant differences between the intervention and control groups were observed for affect (pleasure, anxiety and interest) as measure by the AARS. The authors conclude that the trial suggests HT can successfully engage PWD in activities that elicit high levels of adaptive behaviour and may reduce levels of self-engaged activity that can be viewed as problematic or indicative of distress.	USA
(Edwards, McDonnell, & Merl, 2013)	Single group Pretest-posttest	12 PWD	Examines the effects of a therapeutic garden on the quality of life of care residents with dementia and their carers. Basic pre-post test design collecting data before and after installation of a new garden in a dementia care residence with quantitative and qualitative elements.	Cohen-Mansfield Agitation Inventory (CMAI) Mini-Mental Status Examination (MMSE) Cornell Scale for Depression in Dementia (CSDD) Dementia Quality of Life Instrument	Attrition by 3 months post-provision = 2/12 Significant changes in all measures were observed including: - Increases in residents' mean quality of life score - Decreases in mean depression score - Decreases in mean agitation score Qualitative interview results returned consistently positive feedback concerning the garden including opinions that it	Australia

			<p>Garden consisted of components thought to elicit pleasurable explicit and implicit memories and encourage engagement including memory boxes, tinka car, mural of the local headland, viewing platform, finch aviary, woodpile, quiet area with a water feature and raised growing beds where residents can dig and pick produce.</p> <p>Data collected three months prior and three months post garden installation.</p>	(DQOL)	improved the quality of life for residents and decreased staff and visitor stress levels.	
(Hewitt et al., 2013)	Single group pretest-posttest	12 PWD-Carer dyads \bar{x} age = 58.6y (PWD)	<p>Examines the effects of 2 hours per week structured activity programme of gardening for people with young-onset dementia. Programme continued for a total of 46 sessions.</p>	<p>Mini-Mental Status Examination (MMSE)</p> <p>Bradford Well-Being Profile</p> <p>Large Allen Cognitive Level Screen (LACLS)</p> <p>Pool Activity Levels (PAL)</p> <p>Bristol Activities of Daily Living Scale (BADLS)</p> <p>Interviews with carers</p>	<p>No significant changes were observed for:</p> <ul style="list-style-type: none"> - Wellbeing scores - MMSE scores (a significant decline was seen at 12 months) <p>No data reported for BADLS, PAL or LACLS.</p> <p>Some positive but variable results were returned from the carer interviews.</p>	UK
(Lee & Kim, 2008)	Single group repeated measures	23 PWD	Examines the effects of indoor gardening on sleep, agitation and cognition of dementia patients in a care home.	Sleep data (sleep onset, wake-up time, wake after sleep onset, and naps)	<p>At outcomes significant improvements were observed in:</p> <ul style="list-style-type: none"> - Reductions in the number of wake up after sleep onset occurrences 	Korea

			<p>Intervention consisted of twice daily opportunities, of approximately 1 hour each (supported by nursing staff) to grow plants selected by participants at the start of the study.</p> <p>Baseline lasted one week, intervention duration was 4 weeks.</p>	<p>Modified Cohen-Mansfield Agitation Inventory (M-CMAI)</p> <p>Hasegawa Dementia Scale- Revised (HDS-R)</p>	<ul style="list-style-type: none"> - Reductions in the number of naps taken - Increase in nocturnal sleep time - Increase in nocturnal sleep efficacy - Reductions in agitation as measured by the M-CMAI - Increases in cognition as measured by the HDS-R <p>No significant changes to sleep onset, wake-up time, or total sleep time were observed.</p>	
(Spring et al. 2014)	Cross sectional study	<p>7 people with HD</p> <p>8 relatives</p> <p>31 residential staff</p>	<p>Examines the suitability of gardening as an activity for people with advanced HD.</p> <p>Data collected using non-validated questionnaires with participants and semi-structured interviews</p>	<p>Relatives' questionnaire = 18 items with mixed response options.</p> <p>Staff questionnaire = 17 of the items from the relatives' questionnaire and five additional items relating to clients' use of gardens and benefit/drawbacks</p> <p>Clinical staff were asked four further items about therapeutic use of the garden.</p> <p>Resident's with HD questionnaire = pictorial based to elicit preferences in plant types, flower colour, and activity.</p>	<p>Reports a range of activity and usage data.</p> <p>A linear analogue scale in the residents' questionnaire measuring happiness when gardening returned a mean score of 72% (range 51.6% to 96.3%).</p> <p>Staff opinion regarding the garden were positive including:</p> <ul style="list-style-type: none"> - 86% of staff thought the clients liked gardening - 59% felt gardening gave residents a sense of achievement - 59% felt gardening was advantageous because it was an outdoor activity - 55% felt it was a constructive activity - 48% said it promoted social interaction - Additional staff comments included gardening as an aide to communication, a source of purpose for residents that improved their sense of well-being <p>Clinical staff reported the following benefits:</p>	UK

					<ul style="list-style-type: none"> - Provides a sense of achievement - Improves - Increases social interaction - Promotes well-being - Improves participation - Provides a rich sensory environment to stimulate the brain <p>Relatives' results are very briefly reported as positive.</p> <p>Data from interviews (n = 5) confirmed many of the questionnaire results and also indicated that gardening provided opportunities for:</p> <ul style="list-style-type: none"> - Increased functional movement - Use of habituated patterns of movement - Physical work, especially use of the hands. - A sense of ownership - Engagement in problem solving and sequencing. - Grading activities to enhance participation and achievement. 	
(Rappe & Topo, 2007)	Cross-sectional survey and observations	123 PWD 65 care home staff	Examines the impact of plants, and of seeing and being outdoors on the well-being of PWD in day care and in residential care. Survey of staff opinion. Observations of resident behaviour.	No standardised measures completed	The authors reports that having access to outdoors may contribute to quality of life for PWD especially when resident in care units. Experiencing nature may have calming effects, evoke memories, stimulate activity and social interaction and support feelings of competence.	Finland
(Gigliotti & Jarrott,	Cross sectional	48 PWD	Examines adult day service (ADS) participants' responses	7-item interview	The amount of time spent actively engaged were significantly higher in the horticulture	USA

2005)	study	<p>to HT as compared to traditional activities.</p> <p>Each participant had the opportunity to perform one activity in a group setting each week for approximately 30 minutes.</p> <p>Observations of participants affect and engagement during horticultural and 'traditional' activities were taken.</p> <p>Short interviews conducted with some participants to provide anecdotal supplements to the observational data.</p>	<p>Researcher developed observational tool of behaviour (level of engagement) and affect</p>	<p>activities compared to traditional activities (78% compared to 28%).</p> <p>During HT activities the level of non-engagement was also significantly lower than during traditional activities (14% compared to 60%).</p> <p>Participants also demonstrated significantly more positive affect during HT compared to traditional activities.</p>		
(Gigliotti, Jarrott, & Yorgason, 2004)	(Heath, 2004)Cross sectional study	19 PWD	<p>Investigates the effects of three types of horticultural therapy (HT) activities on engagement and affect for PWD.</p> <p>HT activities consisted of planting, cooking with garden produce or horticultural craft activities.</p> <p>Intervention consisted of opportunity to perform three HT activities during each of nine weeks for approximately 30 minutes at a time in a group setting, or to participate in 'traditional' group activities such as cognitive stimulation</p>	<p>MMSE</p> <p>Researcher developed tool for measuring affect and engagement</p> <p>Modified version of Dementia Care Mapping (DCM)</p>	<p>No significant differences in between the various HT groups were found for affect.</p> <p>No significant differences were found in average levels of engagement between the three HT groups.</p> <p>Mean percentage of time spent doing nothing was observed to be significantly lower during HT compared to 'traditional' activities.</p> <p>Mean affect score for the HT activities was significantly more positive than average affect for the more traditional activities.</p>	USA

			games, exercise, crafts, and current events discussion.			
(Gonzalez & Kirkevold, 2014)	Literature review (descriptive)	N/A	Reviews studies examining the benefits associated with the use of sensory gardens and horticultural activities in dementia care.	N/A	<p>Sixteen studies were included (2 case studies; 1 survey; 11 intervention studies with pre-test/post-test design and 2 RCTs).</p> <p>The authors conclude that evidence for the effectiveness of horticultural approaches is limited.</p> <p>The findings on behavioural issues, well-being and affect related to participating (passive or active) in sensory garden, horticultural therapy and indoor use of plants are fairly consistent and are suggestive of their potential benefit for dementia care.</p>	Norway

14. ANIMAL ASSISTED INTERVENTIONS AND PET THERAPY

14.1. DEFINITIONS

There are no consistent definitions of animal assisted or pet therapy and a number of synonyms are regularly used within the literature (assisted animal therapy/activities/interactions; animal visitation; pet therapy; human-animal bond therapy). The interventions may include a short visit from animals, or situation where they are resident within a setting and are generally expected to have a beneficial effect on the behavioural and neuropsychiatric/psychological symptoms of dementia. The interventions may be delivered by certified providers, volunteers or existing health and social care professionals. There are also some studies examining the use of robotic substitutes for animals as a means of therapy.

14.2. EVIDENCE FOR ANIMAL ASSISTED INTERVENTIONS

No systematic reviews examining AAT were identified but 30 papers addressing this topic were considered including; three papers reporting four Level I studies (RCTs), five Level II studies (case control and non-randomised controlled designs), fourteen Level IV studies (a range of pretest-posttest, multiple baseline and other observational designs), and eight Level IV papers (4 descriptive literature reviews and 4 case studies and qualitative studies). Summary information for these papers is presented in [Table 20, p.158](#).

14.3. CONCLUSIONS

Existing descriptive literature reviews are accurate in noting the consistently favourable evidence from a high number of studies in which quasi-experimental and observational designs have been used, which report favourably on AAT as a way of reducing behavioural and psychological symptoms and increasing quality of life for people living with dementia, predominantly in residential and institutional settings. More recent experimental studies however have presented mixed and inconclusive results and while the preliminary evidence for AAT is promising it cannot be said to be conclusive.

Table 20: Summary of studies examining animal assisted interventions

Study	Design	Population	Intervention or aim	Outcomes/data used	Results	Country
(Valenti Soler et al., 2015)	2 RCTs and one group pre-post study	117 PWD \bar{x} age = 85y (RCT) ; 78-79y (pre-post)	Examines the effect of an experimental robot-based therapeutic intervention for patients with dementia.		RCT Phase one (n=101) All groups showed a statistically significant increase in GDS scores (decreasing function) at follow-up.	Spain
			Randomised block assignment. Blinded assessment. Two separate intervention phases conducted. Phase one comparing: - Humanoid robot - Animal shaped robot - Control (conventional therapy) Phase 2 comparing: - Animal shaped robot - Therapy dogs - Control (conventional therapy) All sessions conducted for 30-40 mins, two days a week for three weeks according to a standard protocol and stratified for dementia severity. Concurrent one group pretest-posttest design conducted in two phases. The first with the Humanoid Robot	Global Deterioration Scale Severe Mini Mental State Examination (SMMSE) Mini Mental State Examination (MMSE) Neuropsychiatric Inventory (NPI) Apathy Scale for Institutionalized Patients with Dementia Nursing Home version (APADEM-NH) Apathy Inventory (AI) Quality of Life in Late-stage Dementia (QUALID)	No between-group differences were observed on the QUALID, SMMSE and NPI at follow-up. Statistically significant differences were found at follow up in: - MMSE scores (the Humanoid Robot group showed greater decline than control) - APADEM-NH scores (both the Animal Robot and the Humanoid Robot groups had significant decreases in apathy scores) - NPI item scores for; delusions (increase in the Humanoid Robot group), apathy (decrease in the Humanoid Robot group) and irritability/lability (increase in the Animal Robot group).	
					RCT Phase two (n=110) All groups showed a statistically significant increase in GDS scores (decreased function) at follow-up. There were no statistically significant differences in MMSE, SMMSE, APADEM-NH and Total NPI scores between groups at	

			and the second with the Animal Robot to the same protocol and duration as above.		<p>follow-up.</p> <p>Statistically significant differences were found at follow up in:</p> <ul style="list-style-type: none"> - QUALID scores (significant improvement in the Animal Robot group) - NPI item scores: hallucinations (increase in the Animal Robot and the dog groups), disinhibition (increase in the Animal Robot group), irritability/lability (increase in the Animal Robot and dog groups) and night-time behaviour disturbances (increase in the Animal Robot group) <p>Pretest-posttest Phase One (n = 20)</p> <p>Following Humanoid Robot sessions an increase in GDS scores were observed.</p> <p>No statistically significant changes in sMMSE and MMSE scores were observed.</p> <p>Pretest-posttest Phase 2 (n =17)</p> <p>Following Animal Robot sessions GDS scores increased .</p> <p>There were no statistically significant changes in sMMSE, MMSE or any other variable.</p>	
(Friedmann et al., 2015)	RCT (multicentre)	40PWD \bar{x} age = 80.72y \bar{x} MMSE = 14.3/30	Examines the effects of a pet assisted intervention to support physical, behavioural, and emotional function in assisted living residents with cognitive impairment.	Apathy Evaluation Scale (AES) Cornell Scale for Depression in Dementia (CSDD) Cohen-Mansfield	Attrition at outcome = 3/22 (intervention group), 0/18 (control group). Physical activity was observed to increase slightly over time for the intervention group and decrease for the control group over the course of the intervention period.	USA

			<p>Two group RCT.</p> <p>Intervention group (n=32) received 60 to 90-minute sessions with a therapy dog twice per week for 12 weeks.</p> <p>Control group (n = 28) received reminiscence therapy as an attentional control receiving equal amounts of attention from the interventionist and the same schedule as the intervention group.</p>	<p>Agitation Inventory (CMAI)</p> <p>Barthel Index</p> <p>Actigraph Activity Monitor (to record physical function for 24h)</p>	<p>No significant change to ADL performance on the Barthel index was observed.</p> <p>Depression decreased significantly over time in the intervention group but not the control group.</p> <p>No significant changes in apathy, behavioural functioning, or medication usage were observed for the two groups.</p> <p>The authors conclude that the results are promising and suggest the potential for AAT interventions to lead to improvement in physical, behavioural, and emotional function.</p>	
(Travers et al., 2013)	RCT (multicentre)	55 PWD \bar{x} age = 85y	<p>Examines the effects of dog assisted therapy for residents of care homes with dementia.</p> <p>2 group RCT at 3 facilities.</p> <p>Blinded assessment.</p> <p>AAT intervention consisted of an introductory activity, general discussion, the opportunity for each participant to individually interact with the dog through play, petting and/or feeding it, and concluded by reading a short story to the group.</p> <p>Control (human only) only intervention adopted the same format but instead of a dog, an article was brought into each therapy session to</p>	<p>Modified Mini-Mental State Exam (MSE-3MS)</p> <p>Quality of Life-Alzheimer's Disease (QOL-AD)</p> <p>Short Form Health Survey Version 1.0 (SF-36)</p> <p>Geriatric Depression Scale Short Form (GDS-SF)</p> <p>Multidimensional Observational Scale for Elderly Subjects (MOSES)</p>	<p>Attendance = 88% for AAT intervention and 90% for control.</p> <p>At outcome mean QOL-AD score in the intervention group was significantly higher than the control group in 1/3 facilities but was significantly lower in another (the authors note that an outbreak of gastroenteritis during the final week of the intervention in this facility may have negatively influenced outcome scores).</p> <p>Depression subscale scores from the MOSES were better in participants in the dog-assisted therapy group with higher (worse) baseline scores, but not in those with low baseline scores.</p> <p>No other significant results were observed.</p> <p>The authors suggest that the study results provide some evidence that dog-assisted therapy may be beneficial for some</p>	Australia

			<p>stimulate discussion (e.g., an unusual insect in a bottle, a plant cutting).</p> <p>Interventions conducted sequentially over an 18-month period.</p> <p>Sessions were conducted three times a week in Facility A but only twice a week in Facilities B and C.</p> <p>Sessions conducted on two non-consecutive days for 11 consecutive weeks, with each session lasting 40 to 50 minutes.</p>		residents of aged care facilities with dementia.	
(Majic et al., 2013)	Case control study (matched pairs)	54 PWD \bar{x} age = 81.8y \bar{x} MMSE = 7.1/30	<p>Examines the effects of animal-assisted therapy (AAT) on agitation/aggression and depression in nursing home residents with dementia.</p> <p>Blinded assessment at baseline and up to 4 weeks post intervention.</p> <p>Intervention cases received care as usual plus 10 weekly sessions of AAT with visiting dogs.</p> <p>Control cases received care as usual.</p>	<p>Mini Mental State Examination (MMSE)</p> <p>Cohen-Mansfield Agitation Inventory (CMAI)</p> <p>Dementia Mood Assessment Scale</p>	<p>Symptoms of agitation/aggression and depression significantly increased in the control group.</p> <p>In the intervention group frequency and severity of symptoms of agitation/aggression and depression remained stable during the intervention period.</p> <p>Improvements to symptoms did not occur in either group.</p> <p>The authors conclude that the results suggest AAT may delay progression of neuropsychiatric symptoms in demented nursing home residents.</p>	Germany
(Moretti et al., 2011)	Non-randomised controlled	21 older people (10 with dementia)	Examines the effects of pet therapy on cognitive function, mood and perceived quality	<p>Mini-Mental State Examination (MMSE)</p> <p>Geriatric Depression</p>	Significant improvements in GDS scores were observed for both groups but no significant between group difference was	Italy

	trial	<p>\bar{x} age = 84.7y</p> <p>\bar{x} MMSE = 15-18/30</p>	<p>of life on elderly inpatients with dementia, depression and psychosis.</p> <p>2 group non-randomised design.</p> <p>Blinded assessment.</p> <p>Intervention (n = 10) lasted for 6 weeks and consisted of pet activity for 90 mins, once a week during which participants came into contact with the therapy dogs and could hold, stroke, walk, talk to and play with the animals.</p> <p>Conversely, the control group (n=11) could see the animals coming into the nursing home, but were not allowed to interact with them, although informal and unstructured contacts were not prohibited.</p>	<p>Scale (GDS)</p> <p>Non-validated questionnaire regarding quality of life</p>	<p>observed after intervention.</p> <p>No significant changes to MMSE score were observed for either group.</p> <p>Positive effects on self-perceived quality of life were observed in five subjects belonging to the intervention group and in two participants in the control group (no data or analysis reported).</p> <p>All intervention group participants reported the experience as enjoyable and interesting with 9/10 reporting that the animals had a calming effect and one subject reported recalling past memories.</p>	
(Walsh et al., 1995)	Non-randomised controlled trial	13 PWD	<p>Examines the effect of a dog on a group of long-term, ward-bound patients with dementia residing in a psychiatric hospital.</p> <p>7 participants selected and allocated to the intervention group and matched with 6 controls.</p> <p>Intervention group had a dog introduced to their ward for 3</p>	<p>London Psycho-Geriatric Rating Scale (LPRS)</p> <p>Brighton Clinic Adaptive Behaviour Scale (BCABS)</p> <p>Diastolic Blood Pressure</p> <p>Heart rate</p> <p>Ward noise levels</p>	<p>LPRS and BCABS scores showed no significant differences between groups from pre to post assessment.</p> <p>No significant differences between groups from pre to post assessment were observed for blood pressure.</p> <p>A significant reduction in heart rate was observed from pre to post assessment for the intervention group only.</p> <p>Ward noise levels decreased significantly in</p>	Australia

			hours, twice a week over twelve weeks.		the intervention group as the number of spontaneous vocalizations and aggressive verbal outbursts decreased. The authors suggest that the findings indicate the presence of a therapy dog can have a generalised palliative effect on resident with dementia.	
(Nordgren & Engström, 2014b)	Cohort study	33 PWD \bar{x} age = 81y – 83y	Examines the effects of a dog-assisted intervention on the behavioural and psychological symptoms of residents with dementia during a six-month period. Residents from four nursing homes already using AAT (n = 20) and four control homes (n = 13) were included. Resident in the AAT groups received 10 sessions with therapy dogs with a protocol tailored to each participant's present state and condition following referral from physicians, occupational therapists or physiotherapists. Typical protocols prescribed the intended duration of each session (45-60 minutes); frequency (once or twice a week); and ability to be trained (cognitive, physical or psychosocial).	Cohen-Mansfield Agitation Inventory (CMAI) Multi-Dimensional Dementia Assessment Scale (MDDAS)	Median duration of AAT intervention = 12 weeks. Attrition at outcome = 7/20 (AAT group), 5/13 (control group). Significant baseline differences in psychological symptoms on the MDDAS were observed with more severe symptomology in the AAT group. At post-test and 3 months follow up, for the AAT group no significant differences were observed for any outcome measured. At 6 month follow up only verbal agitation showed a significant difference having increased. For the control group, no significant differences on any outcomes were observed at 3 or 6 months.	Sweden
(Kanamori et al., 2001)	Non-equivalent	27 PWD	Examines the effects of AAT on dementia patients'	Mini-Mental State Exam (MMSE)	No significant changes to MMSS score or N-ADL performance were observed for either	Japan

	group design	\bar{x} age = 79.43y \bar{x} MMSE = 10.2-11.4/30	cognitive and physical function, and endocrinological stress evaluation. Non-randomised two group design. Intervention (n = 7) received six AAT sessions biweekly. Control (n =20) received care as usual	Nishimura's ADL (N-ADL) Behavioural pathology in Alzheimer's disease (Behave-AD) Levels of salivary chromogranin A (Cg A)	the intervention or control group at outcome. Total scores on the BEHAVE-AD improved significantly for those receiving AAT but not for those in the control group at outcome. Significant changes on several subscales of the BEHAVE-AD were noted in the intervention group: - Reduced aggressiveness - Reduced anxiety and phobias - Reduced global carer burden	
(Edwards, Beck, & Lim, 2014)	Pretest-posttest design	71 PWD \bar{x} age = 80.3y \bar{x} MMSE = 6.4/30 71 care staff (21 nurses, 18 nurse aides, 15 dietary staff, 12 housekeeping personnel, and 5 individuals in administration)	Examines the effect of an aquarium on resident behaviour and staff job satisfaction in three dementia units. Data collected at baseline and 10 weeks after installation of an aquarium specifically designed for use with individuals with dementia in long-term care settings.	Nursing Home Disruptive Behaviour Scale Assessment of Work Environment Schedule	At 10 week post-intervention significant changes were observed in: - Reduction of uncooperative behaviours - Reduction in irrational behaviours - Improvements in sleep behaviours - Reduction in inappropriate behaviours No changes were seen in dangerous or annoying behaviours. Overall staff satisfaction score in work environment was significantly improved after intervention.	USA
(Nordgren & Engström, 2014a)	Pretest-posttest design	20 PWD \bar{x} age = 83y \bar{x} MMSE = 10.5/30	Examines the effects of animal assisted interventions AAI on quality of life (QoL) in people living with dementia in nursing homes. AAI consisted of tailored	Mini-mental state examination (MMSE) Quality of Life in Late Stage Dementia Scale (QUALID)	Attrition at outcome = 11/30. Significant improvements in QUALID score at outcome were observed.	Sweden

			therapy, prescribed by an OT to meet specific needs of participants (e.g. walking, teaching, feeding). Each prescription included 10 AAI sessions for 45-60 mins, 1-2 times a week			
(Mossello et al., 2011)	Single group repeated measures design	10 PWD \bar{x} age = 79y \bar{x} MMSE = 3.3/30	Examines the effect of animal assisted activities (AAA) with dogs on cognition, behavioural and psychological symptoms, emotional status and motor activity in severe Alzheimer's disease. Baseline = two weeks of usual day care activity Phase 1 = three weeks of control activity (CA, provision of a soft toy), 100 mins three times a week. Phase 2 = three weeks' AAA (interaction with dogs), 100 mins three times a week.	Mini-Mental State Examination (MMSE) Severe Impairment Battery (SIB) Katz Activities of Daily Living scale (K-ADL) Cohen Mansfield Agitation Inventory (CMAI) Neuropsychiatric Inventory (NPI) Cornell Scale for Depression in Dementia (CSDD) Observed Emotion Rating Scale (OERS) Agitated Behaviour Mapping Instrument (ABMI) Researcher developed Motor Behaviour Observation Form (MoBOF) 4 items, 4-point Likert scale.	No significant changes were observed for cognition and NPI. Non-significant declines in the CMAI and CSDD scores following AAA were noted. Scores for the NPI anxiety item decreased following AAA in comparison with the control activity. OERS item measuring sadness also decreased significantly. Significant increases were observed on OERS items for pleasure and general alertness during AAA compared with control activities. Observed sadness remained significantly lower three hours after AAA. Motor activity increased significantly during AAA. The authors conclude that animal assisted activities may be associated with a decrease in anxiety and sadness and an increase in positive emotions and motor activity.	Italy

(Kramer, Friedmann, & Bernstein, 2009)	One group alternating treatment design	17 PWD	<p>Compares the effects of visitation by a person, a person accompanied by a live dog, and a person accompanied by a robotic pet, on behavioural indicators of social interaction among female nursing home residents with dementia.</p> <p>Each participant received one visit for each condition (person only, person and animal, person on robot) on consecutive weeks (duration of visits approximately 3 minutes).</p>	Number of occurrences of social behaviours recorded	<p>All three types of visit stimulated social behaviours from the participating residents.</p> <p>Both the live dog and robot dog stimulated resident social interaction more than that achieved by the visitor alone.</p> <p>The robot dog induced longer looks and more resident-initiated conversation than the live dog and provided a positive source of social interaction.</p> <p>The authors suggest that the findings related to the robotic dog in terms of its ability to stimulate social interaction by dementia residents suggests that it may provide a viable alternative to live animal visitations.</p>	USA
(Peterson & Loy, 2008)	Single subject alternating treatment design	4 PWD	<p>Examines the effects of three psychosocial interventions on the Galvanized Skin Response (GSR), a measure often used to indicate the physiological response to stress, of individuals with AD.</p> <p>Phase 1 = Baseline (no treatment)</p> <p>Phase 2 = Humour stimulation (watching a video)</p> <p>Phase 3 = Music-visual stimulation (observing fish in a digital aquarium)</p>	MMSE Galvanised Skin Response	Interaction with animals demonstrated decreasing trends of GSR in three of the four participants.	USA

Phase 4 = Animal physical contact (interacting with dog).						
(Kawamura, Niiyama, & Niiyama, 2007)	One group repeated measures design	10 PWD	Examines the psychological and behavioural effects of AAT on elderly residents of a nursing home on a long-term basis. Intervention consisted of visits twice a month by three or four dogs and residents allowed to freely feed, hold and play with them. Each participant was able to play with a dog for approximately 30 min during each 2 hour visit. Data collected at baseline, 6 months and 12 months.	GBS Scale Japanese Version (GBSS-J) Mental Function Impairment Scale (MENFIS)	No significant changes to GBSS-J scores were observed at 6 or 12 months. Item by item comparisons of the GBSS-J showed: - Significant decreases in impaired spatial orientation and emotional lability during the first 6 months - Significant increases in motor insufficiency in eating over 12-months - Significant increases in impaired wakefulness, impaired concentration, and impaired thinking in abstractions during the last 6 months. No significant changes to the MENFIS scores were observed at 6 months to 12 months Item by item comparison showed: - Significant decreases in impaired suitability of emotional expression and impaired stability of emotional expression over the 12-month period only.	Japan
(Sellers, 2005)	Single-group multiple-baselines design	4 PWD \bar{x} age = 87y \bar{x} MMSE = 9/30	Examines the effects of animal assisted therapy (AAT) on the social and agitated behaviours of people living with dementia residing in long-term care.	Mini-Mental Status Examination (MMSE) Agitation Behaviour Mapping Instrument (ABMI)	Significantly higher mean social behaviour scores were noted after intervention compared to the baseline phases. A significant decrease in agitated behaviours was also observed during	USA

			<p>ABAB design with each phase lasting 5 days with a 2-day wash-out period.</p> <p>Intervention phases consisted of five, fifteen minute long AAT sessions.</p> <p>Assessment conducted by two raters for agreement.</p>	<p>Social Behaviour Observation Checklist (SBOC)</p>	<p>intervention compared with baseline.</p> <p>The author notes that the summary statistical analysis and the individual analysis of mean scores indicate that the AAT intervention was effective in increasing social behaviours and decreasing agitated behaviours in the four participants.</p>	
(Libin & Cohen-Mansfield, 2004)	One group repeated alternating treatment design	<p>9 PWD</p> <p>\bar{x} age = 90y</p>	<p>Compares the benefits of a robotic cat and a plush toy cat as interventions for elderly persons with dementia.</p> <p>Robotic cat based on communication robot design and included enhanced artificial intelligence and built-in sensors to initiate various responses during interactions (verbal and non-verbal).</p> <p>All participants received two 10 minute sessions, one with each stimuli, on separate days. Order of stimuli randomised across participants.</p> <p>Observations made at baselines and during sessions by two raters.</p>	<p>Agitated Behaviours Mapping Instrument (ABMI)</p> <p>Lawton's Modified Behaviour Stream</p> <p>Observations of attention, attitude, intensity of manipulation with the stimuli, and duration of engagement</p>	<p>Levels of agitation decreased significantly when using the toy cat but not the robotic cat, however no significant differences between stimuli were observed for this outcome.</p> <p>The robotic cat led to significant increases in pleasure and interest but the toy cat did not.</p> <p>No significant changes to anger and anxiety were observed for either stimulus.</p> <p>No significant changes to engagement were observed.</p>	USA
(Motomura, Yagi,	One group	8 PWD	Examines the effects of	Researcher developed	No significant differences at outcome were	Japan

& Ohyama, 2004)	pretest-posttest	\bar{x} age = 84.8y	<p>animal assisted therapy on patients with dementia.</p> <p>Intervention consisted of 1 hour of therapy over four consecutive days.</p> <p>Two therapy dogs were used for three types of activities:</p> <ul style="list-style-type: none"> - Communication (e.g. instructing them to sit down or wait, then participants could touch the dogs or call dog's name) - Observe the dog's exercise (e.g. watching dogs jumping into rings) - Interaction with participants (no further details reported) 	<p>apathy scale</p> <p>Researcher developed irritability scale</p> <p>Geriatric Depression Scale (GDS)</p> <p>Physical Self-Maintenance Scale (PSMS)</p> <p>Mini Mental State Examination (MMSE)</p>	<p>observed for irritability depression scale, ADL or MMSE.</p> <p>Apathy was significantly reduced following intervention.</p>	
(Richeson, 2003)	One group pretest-posttest study	<p>15 PWD</p> <p>\bar{x} age = 86.6y</p> <p>\bar{x} MMSE = 3.9/30</p>	<p>Examines the effects of an intervention using animal-assisted therapy (AAT - therapy dogs) on the agitated behaviours and social interactions of older adults with dementia in a nursing home.</p> <p>Quasi-experimental time-series design with three phases: baseline, post-test (after the three-week intervention), and follow-up</p>	<p>Mini-Mental Status Examination (MMSE)</p> <p>Cohen Mansfield Agitation Inventory (CMAI)</p> <p>AAT flow sheet (observational measure of social interaction)</p>	<p>Statistically significant decrease in the mean CMAI scores were observed between baseline and post-test. This was followed by a significant increase in mean scores between post-test and follow-up.</p> <p>Mean scores on the AAT flow sheet were significantly higher at the end of 9 weeks (end of follow up stage) than at the start of the baseline phase.</p> <p>The study indicates that an AAT intervention may decrease the agitated behaviours and increase the social interactions of people living with dementia.</p>	USA

			(three weeks after intervention cessation). Intervention duration = 1 hour per day, 5 days per week for three weeks.			
(Greer et al., 2002)	Multi-condition with withdrawal design	6 PWD \bar{x} age = 87.8 \bar{x} MMSE = 15/30	Examines the effect of a toy versus live cat stimuli on the verbal communication of elderly nursing home residents with dementia. ABACA withdrawal design with counterbalancing across two groups. Baseline and withdrawal phases consisted of three 10-minute sessions. Interventions conditions were provision of toy cat stimuli or a live cat.	Total number of words Number of meaningful information units (MIU) Number of verbal initiations	Average total words were greater during the live cat intervention than in the toy cat intervention. In the presence of live cats, average MIU (6.2/min) increased from baseline (5/min) and showed a slight decrease upon withdrawal (5.8/min). Overall subject performance showed greater number of MIU when the live cats were present. In the presence of live cats, average initiations (2.5/min) increased from baseline (1.8/min) and decreased during withdrawal (1.7/min). Average initiations were greater during the live cat intervention than in the toy cat intervention.	USA
(Ruckdeschel & Van Haitsma, 2001)	One group longitudinal study	26 PWD \bar{x} age = 87.1y \bar{x} MMSE = 22.8/30	Examines the effects of a 'living habitat' intervention on residents of care home with dementia. Intervention consists of environmental adaptation through the provision of numerous plants. Residents were provided a parakeet on	Mini Mental Status Exam (MMSE) Pet Attitude Survey (PAS) Researcher designed satisfaction with care survey Quality of Life in	For the total sample a significant reduction in anxiety was observed. No other differences on any variables were observed for the full sample. No significant changes on any variables were observed for residents with lower cognitive status. Residents with higher cognitive status were	USA

			request. Parakeets and a cockatiel were kept in the unit's common area, and two cats and a dog stayed on the unit. Data collected at baseline and after 6 months.	Dementia Scale (QoLAD) 4-point Likert scale for boredom Pearlin and Schooler's Mastery Scale UCLA Loneliness Scale Behavioural observations Lawton's Apparent Affect Rating Scale	observed to have significantly higher levels of positive engagement following intervention, but also a significant decrease in their feelings of control. During behavioural observations pleasure scores were significantly higher when animals were present.	
(Churchill et al., 1999)	Within-subject repeated-measures design	28 PWD \bar{x} age = 83.8y	Examines the effects of a therapy dog on agitation and socialization in persons with Alzheimer's disease or related disorders who display behaviours consistent with sundown syndrome (behavioural changes and disorientation associated with low light levels). Six-15 second long observations made every five minutes during two 30 min session, one with the dog present and one without.	Burke Dementia Behavioural Rating Scale (BDBRS) Agitation Behaviour Mapping Instrument (ABMI) Daubemire's Data Coding Protocol (DDCP)	The presence of the therapy dog was associated with significantly lower levels of agitation. Significant improvements were observed for the frequency of indicators of socialisation when the dog was present.	USA
(Marx et al., 2010)	Observational study – cross sectional	56 PWD	Examines the effects of animal-assisted therapy in nursing home residents with	Observational Measurement of Engagement	Mean engagement duration and mean attitude score was related to dog size with the amount of time engaged and attitude	USA

			<p>dementia.</p> <p>Systematic observations taken as residents provided with opportunity to engage with a range of stimuli including:</p> <ul style="list-style-type: none"> - A puppy video - A dog-colouring activity - A plush dog - A robotic dog - A small dog - A medium dog - A large dog <p>Maximum engagement time with each option was 15 mins with trials separated by a 5 min period.</p>	<p>Self-identity questionnaire (SIQ)</p> <p>Mini Mental Status Exam (MMSE)</p>	<p>responses with the small dog significantly lower than the other two presented.</p> <p>The highest mean engagement duration was observed for the puppy video.</p> <p>Positive attitudes were found toward the real dogs, robotic dog, the puppy video, and the plush dog.</p> <p>No significant differences were found in engagement duration among the dog-related stimuli.</p> <p>The author concludes that the study suggests residents with dementia can be successfully engaged with dog-related stimuli which may or may not include real dogs.</p>	
(Kawamura, Niiyama, & Niiyama, 2009)	Qualitative study	8 PWD Ages 67-94	<p>Examines the perceptions of institutionalized elderly Japanese women on animal-assisted activity (AAA) and how their perceptions may be relevant to clinical nursing practices.</p> <p>All participants had been receiving AAA for two years prior to data collection.</p> <p>Phenomenological analysis used.</p>	Semi structured interviews	<p>Six major themes identified:</p> <ul style="list-style-type: none"> - Positive feeling about the dogs - Self confidence - Recalling memories about dogs - Break from daily routines - Interacting with other residents about the dogs - Improved communication with volunteers <p>The authors suggest that participants were positively influenced by AAA.</p>	Japan
(Nordgren & Engström, 2012)	Case study with pre-post	1 PWD	Examines the effects of an 8 week dog therapy	Mini Mental State Exam (MMSE)	Positive effects on MMSE score were noted and attributed to a greater willingness to	Sweden

	measures	Age = 84y	intervention. Intervention involved grooming and walking a therapy dog once a week, for approximately one hour over 8 weeks. Data collected at baseline, intervention end (8 weeks) and at 3 month post-intervention follow up.	Cohen Mansfield Agitation Inventory (CMAI) Multi-Dimensional Dementia Assessment scale (MDDAS) ADL taxonomy Quality of Life in Late-stage Dementia scale (QUALID)	cooperate with assessors after AAT (rather than genuine cognitive change). There was a slight increase in frequency of behavioural symptoms at post-test and follow-up though psychiatric symptoms decreased over the same period. There was a decrease in orientation from baseline to 3 month follow up. Quality of life improved immediately after AAT but reverted to near baseline levels at 3 month follow up.	
(Tamura et al., 2004)	Case study	12 PWD \bar{x} age = 84y Gottfries-Bråne-Steen scale = 66	Entertainment robot dog compared with stuffed animal as an alternative to animal assisted therapy	Experiment 1 – Exposure conditions unclear but appears to be 5 minutes of control (toy dog) for 2 days followed by 5 minutes of intervention (entertainment robot) Experiment 2 – Exposure conditions also unclear. 3 days of interventions with robot dog clothed on day 2 but not days 1 and 3.	The entertainment robot required more prompting from OT to stimulate engagement than the control (stuffed toy) 749 vs 374. Dressing the robot had no effect on engagement.	Japan
(Curtright & Turner, 2002)	Case study	1 PWD Age = 80y	Compares the effect of a stuffed and live animal on the communication of one participant with AD.	Number of: - Complete information units - Incomplete	No significant differences between the types of stimulation offered were observed. Both live and stuffed animal stimuli were	USA

		Stimuli (stuffed or live animal) introduced in turn into the participant's environment and observation of communications made.	- information units Non-information units	associated with a slight increase in total and complete information units and no change in incomplete and non-information units.	
(Bernabei, 2013)	Literature review (descriptive)	Reviews studies examining the effects of Animal-Assisted Interventions (AAI) on elderly (Bernabei et al., 2013) patients with dementia or various psychiatric disorders		18 articles on dementia (5 case control studies and 13 repeated measures designs) and 5 on psychiatric disorders (4 case control studies and 1 repeated measures design) were reviewed. Studies suggests that AAI can reduced agitation in PWD and increase their degree and quality of social interaction. There is no evidence that AAI can improve cognitive performance. There is some limited preliminary evidence that AAI can improve mood, communication and coping abilities in people living with dementia.	Italy
(Williams & Jenkins, 2008)	Literature review (descriptive)	Reviews studies examining the effectiveness of dog visitation therapy in dementia care.		The authors note that there is a general lack of empirical research into animal assisted therapies with much literature presented based on anecdote. Despite the lack of studies contributing to a convincing evidence base, repeated reports that dog visitations provide positive outcomes, including stimulation in patients with dementia are suggestive of its benefit as an approach. Therapeutic responses to dog visits tend to be transient, occurring only in the presence	UK

			of the animal however.	
(Perkins et al., 2008)	Literature review (descriptive)	Summarises and critiques the published literature regarding dog therapy for older people living with dementia living in residential aged care facilities.	<p>Reviews nine studies of varied methodology.</p> <p>The most frequently reported findings were an increase in social behaviour and a decrease in agitated behaviour during dog contact.</p> <p>Improvement in social behaviour was found to be unrelated to the severity of dementia.</p> <p>Various improvements on measures of global function were also reported.</p> <p>The literature suggests that dog therapy may hold some promise for managing behavioural and psychological symptoms of people living with dementia but a lack of experimental designs leave the results open to the effects of bias.</p>	Australia
(Filan & Llewellyn-Jones, 2006)	Literature review (descriptive)	Reviews studies investigating AAT for PWD, specifically behavioural and psychological symptoms.	<p>Thirteen papers in which AAT was found to have an impact on behavioural and psychological symptoms.</p> <ul style="list-style-type: none"> - 6 examined anxiety and aggression - 4 examined social behaviour - 1 examined effects on nutrition - 2 papers examined the effects of using robotic pet substitutes <p>Some small studies suggest that dogs can reduce aggression and agitation, and promote social behaviours.</p>	Australia

There is limited preliminary evidence that robotic pets may provide pleasure and interest to people living with dementia.

The authors conclude that literature suggests that AAT may ameliorate behavioural and psychological symptoms in dementia, but there is not enough evidence to make conclusions about the duration beneficial effects or the relative benefits of “resident” versus “visiting” animals.

15. MUSIC THERAPY

15.1. DEFINITIONS OF MUSIC THERAPY

Music therapy is typically understood to be the use of music and/or its musical elements (such as sound, rhythm, melody and harmony) to facilitate and promote communication, relationships, learning, mobilisation, expression, organisation and other relevant therapeutic objectives

Receptive music therapy usually consists of listening to music either live or recorded. Interventions often use specific types of music (e.g. classical or relaxing) and may also aim to use types of music preferred by the therapy recipients.

Active music therapy typically involves including participants in music-making by facilitating them to play instruments. The participants may be encouraged to participate in musical improvisation with instruments or voice, with dance, movement activities or singing.

15.2. SYSTEMATIC REVIEWS OF THE EFFECTIVENESS OF MUSIC THERAPY FOR DEMENTIA¹

15.2.1. MUSIC THERAPY FOR PEOPLE LIVING WITH DEMENTIA (VINK, BRUINSMA AND SCHOLTEN, 2011)

Cochrane review assessing the effect of music therapy on behavioural and cognitive symptoms of dementia problems, and social and emotional function.

Ten RCTs (3 cross-over and 7 parallel group designs) were included. The review authors rated methodological quality as generally poor and could not be pooled for meta-analysis.

3 RCTs examined individual receptive music therapy, all examining the effect of to preferred music. Outcomes in terms of reduced aggressive behaviour during bathing and reduced general agitation and reduced anxiety and depression.

7 RCTs examined active group music therapy for a range of different outcomes including

- Reducing wandering behaviours
- Social, cognitive and emotional functioning
- Language function
- Stimulating movement
- Behavioural and psychological symptoms

All of the studies reported moderately positive short-term (4-month max) results in favour of the music therapy interventions.

¹ The four systematic reviews refer to 35 individual studies, once papers which appear in more than one review have been considered.

15.2.2. EFFECTS OF MUSIC THERAPY ON BEHAVIORAL AND PSYCHOLOGICAL SYMPTOMS OF DEMENTIA: A SYSTEMATIC REVIEW AND META-ANALYSIS (UEDA ET AL., 2013)

Systematic review of 20 studies including ten RCTs and 10 controlled clinical trials.

Average intervention duration and frequency was 36 minutes per day, on two-to-three days a week, for 10 weeks.

Meta analysis of pooled data indicated that music-related interventions were associated with small but statistically significant reductions in:

- Depression (n=250) Standardised mean difference (SMD) -0.32, 95% CI -0.68 to -0.04
- Anxiety (n=258) SMD -0.64, 95% CI -1.05 to -0.24 and;
- Moderate statistically significant reductions in behavioural or neuropsychological symptoms (n=397) SMD -0.49, 95% CI -0.82 to -0.17

Results are promising but cannot be approached as conclusive due to some methodological issues with the studies.

15.2.3. THE USE OF MUSIC INTERVENTION IN NURSING PRACTICE FOR ELDERLY DEMENTIA PATIENTS: A SYSTEMATIC REVIEW (YI-HUI ET AL., 2014)

Systematic review¹ of 18 RCTs examining the effectiveness of music therapy for people living with dementia.

Most studies (61.1%) used songs familiar to or preferred by the participants.

Typical delivery frequency and intensity was for 30-minutes twice weekly for a total therapy duration of 6 hours.

Music therapy was found effective at improving cognitive functions, mental symptoms, and eating problems.

No effects for improving irritable behavior were detected.

15.2.4. MUSICAL INTERVENTION FOR PATIENTS WITH DEMENTIA: A META-ANALYSIS (VASIONYTÉ AND MADISON, 2013)

Systematic review of 19 studies examining the effect of active and receptive music therapy, and music listening on the affective, behavioural, cognitive and physiological problems associated with dementia.

Analysis of pooled results from 8 studies (n=217) found no significant effect of music therapy for behavioural symptoms: mean effect size (ES) 1.16 CI (95%) (-0.65; 2.98).

Analysis of pooled results from 6 studies (n=109) found no significant effect of music therapy on affective symptoms: mean ES: 0.38 CI (95%): (-0.56; 1.32).

¹ The systematic review was published in Chinese language but with an English language abstract and quality assessment from DARE, hence its inclusion in this review.

Analysis of pooled results from 4 studies (n=63) found a large and significant effect of music therapy on cognitive function: mean ES: 1.56 CI (95%): (1.11; 2.01).

Analysis of pooled results from 4 studies (n=88) found a large and significant effect for music therapy on physiological indicators of function behavioural symptoms (as measured by heart rates, adrenaline levels and salivary chromogranin): Mean ES: 0.72 CI (95%): (0.36; 1.08).

Analysis of pooled results from all 19 studies (n=478) indicated large and beneficial effects from music therapy: mean ES: 1.04 CI (95%): (0.81; 1.27).

The review authors also examined effects of music therapy by intervention type. Listening to music recorded music, group- based music interventions, individual interventions, self-selected music and classical or relaxation music all reported positive effects from analysis of pooled results. Analysis of pooled data for active music therapy, live music, individualised music and popular/native music were not found to be significant.

Music interventions may be effective and have the potential to increasing the quality of life for patients with dementia by reducing associated symptomology. The authors note that studies suffer from poor methodological quality, which limits the reach of meta-analysis and the strength and generalizability of these conclusions.

15.2.5. MUSIC THERAPY IN DEMENTIA: A NARRATIVE SYNTHESIS SYSTEMATIC REVIEW (MCDERMOTT ET AL., 2013)

Reviews 18 studies examining the effect of music therapy on behavioural and psychological symptoms, hormonal and physiological functions, and social and relational outcomes for people living with dementia. Both quantitative and qualitative designs were included in the review (6 RCTs, 4 Controlled studies, 5 Before-and-after studies/within subject designs, 3 Qualitative or mixed methods; total n = 589 PWD and 29 family carers).

The 6 RCTs included in this narrative synthesis have all been considered in the meta-analytic reviews described above.

The authors note that results reported in these RCTs and the other quasi and non-experimental studies are in agreement with existing systematic reviews and point towards evidence supporting music therapy as a way of realising short-term improvements in behavioural and psychological symptoms of dementia. There is insufficient quality literature to allow conclusions to be made about the longer term impacts of music therapy.

15.2.6. IS MUSIC THERAPY AN EFFECTIVE INTERVENTION FOR DEMENTIA? A META-ANALYTIC REVIEW OF LITERATURE (KOGER, CHAPIN & BROTONS 1999)

Reviews 23 studies (21 within subject designs and two controlled trials total n = 336) examining the effect of music therapy interventions on behavioural social and cognitive symptoms of dementia.

Analysis of pooled data from all 23 studies indicated a statistically significant beneficial effect of music therapy; mean effect size, 0.79 (95% CI 0.62 to 0.95).

No effect size inconsistencies were detected when studies were analysed according to type of therapeutic intervention (active versus passive music, live versus recorded music professional music therapist versus other professional, or type of dependent variable assessed).

No correlation between duration of treatment and outcome was detected.

15.3. STUDIES NOT INCLUDED IN PRECEDING REVIEWS

Three RCTs have been published since the most recent systematic review was completed as described in [Table 21, p.181](#).

One multicentre RCT investigating active music therapy and individualized listening to music found no evidence that these approaches reduced behavioral and psychological symptoms of dementia.

A parallel group RCT examining a multicomponent approach (consisting primarily of singing/listening familiar songs coupled occasionally with vocal exercises and rhythmic movements (singing group) and reminiscence and discussions (music listening group) with regular musical exercises at home) reported benefits in comparison to a usual care control group. Improvements to mood, orientation, remote episodic memory, attention, executive function and general cognition were observed. Singing appeared to enhance short-term and working memory and carer well-being. Music listening had a positive effect on QOL.

The final RCT compared music therapy with cooking interventions. Both interventions led to improvements in emotional state, decreased the severity of behavioral disorders and reduced carer distress. No benefit on the cognitive status of the participants was observed.

15.4. CONCLUSIONS

There is preliminary evidence from a range of experimental and quasi-experimental studies which indicate that music therapies may have beneficial effects of a range of outcomes associated with dementia. There are a range of methodological issues and a lack of consistent results that prevent conclusive statements being made about effect.

Table 21: Summary of studies examining music therapies

Study	Design	Population	Intervention or aim	Outcomes/data used	Results	Country
Narme et al., 2014	RCT (parallel group)	48 PWD \bar{x} age = 87y \bar{x} MMSE = 10/30	Examines the effect of music therapy in comparison to cooking activities on emotional, cognitive, functional, and behavioural outcomes in dementia.		No difference from baseline was noted for the discourse content outcomes for either the music therapy group or the cooking group.	France
			Random allocation Blinded evaluation MT consisted of group work (n=8 max) during which music was played on a CD player. Different styles of music (e.g., classical instrumental; familiar songs from the 1950–80 s) including major and minor keys) were played with calming slow or moderate tempo at the beginning and the end of the session and higher tempo at the middle of the session. Participants were asked to listen and to participate by singing and/or by using percussion instruments to accompany the musical track. The same playlist was used in the same order for each music session. Cooking sessions comprised of participants making a different recipe for each session (e.g., chocolate cake;	MMSE Semi-structured interviews to determine discourse content and emotional facial expressions State-Trait Anxiety Inventory (STAI) Sever Impairment battery (SIB) Neuropsychiatric Inventory (NPI) Cohen Mansfield Agitation Index (CMAI)	Between baseline and midpoint emotional facial expressions improved in the music group but this was not maintained at end point of follow up. No improvements to emotional facial expressions were noted in the cooking group. Mood was noted to improve in the cooking group at mid-point, endpoint and follow up. No improvements to mood were noted in the music group. No significant changes to cognition were measured in the music group or the cooking group. Agitated behaviours (CMAI score) reduced between baseline and mid point in the music group but his was not maintained at end point of follow up. The cooking group improved agitation at mid point, end and follow up. NPI sores decreased in both groups with the music intervention showing change at mid point but not end pint or follow up. The cooking groups scores had decreased at end point but not at mid point and were not maintained at follow up. Professional carer distress decreased in the music group at mid point and follow up and	

			<p>French pancakes). Each session commenced with a game about ingredients where participants were asked to collectively prepare a given recipe. Roles were distributed according to patients' abilities (e.g., cutting, peeling, measuring quantities, mixing, or cooking).</p> <p>Interventions took place for a duration of one hour, twice a week, for a period of 4 weeks (total 8 hours).</p> <p>Data collected at baseline, mid point, intervention cessation and follow up</p>		<p>in the cooking group and end point only.</p>	
Särkämö et al., 2014	RCT (three group)	89 PWD-carer dyads (59 family member and 30 nurses)	<p>Examines the effect of a novel music intervention based on coaching the carers of PWDs to use either singing or music listening regularly as a part of everyday care.</p> <p>Dyads randomized to a singing group (SG), a music listening group (MLG), and a usual care control group (CG), and were followed for 9 months.</p> <p>SG sessions consisted of group singing accompanied by the music teacher on the piano, guitar, or kantele (Finnish zither). Occasional physically activating vocal exercises and</p>	<p>Clinical Dementia Rating (CDR)</p> <p>MMSE</p> <p>Wechsler Memory Scale III (WMS)</p> <p>Wechsler Adult Intelligence Scale III (WAIS)</p> <p>Consortium to Establish a Registry for Alzheimer's Disease battery (CERAD)</p> <p>Boston Naming Test (BNT)</p> <p>Western Aphasia</p>	<p>Attrition at follow up 1= 5/89 (5.6%)</p> <p>Attrition at follow up 2= 15/89 (16.8%)</p> <p>Improvements to general cognition, attention and executive function were found in the music groups compared to control but these did not remain statistically significant after group baseline differences were taken into account. Working memory was observed to have improved in the SG compared to both the MLG and controls.</p> <p>Both music interventions demonstrated short term effects in reducing depressive symptoms compared to controls.</p> <p>Both music groups showed improved self-reported quality of life scores compared to</p>	Finland

<p>rhythmical movements during the singing (e.g., clapping, playing maracas) were performed . Sessions followed the Finnish KeyToSong method (www.keytosong.fi), which is designed for persons with no singing background and which puts a special emphasis on a supportive, engaging, and fun singing atmosphere.</p> <p>MLG session consisted of listening to songs from CD and discussing about the emotions, thoughts, and memories (e.g., personal events, people, and places) that they evoked. Also visual cues (e.g., album covers) were used to stimulate reminiscence and discussion.</p> <p>SL and MLG lasted for 1.5 hours, once a week for 10 weeks in groups of 5 dyads.</p> <p>Control group participants were not given any additional activities and were instructed to continue with their normal everyday activities and hobbies throughout the follow-up. Typically, this consisted of common group-based physical or social activities (e.g., physical</p>	<p>Battery (WAB)</p> <p>Trail Making Test (TMT)</p> <p>Frontal Assessment Battery (FAB)</p> <p>Cornell Brown Scale for Quality of Life in Dementia (CBS)</p> <p>General health Questionnaire (GHQ)</p> <p>Quality of Life in Alzheimer’s Disease (QoL-AD)</p> <p>Zarit Burden Interview (ZBI)</p>	<p>the control group.</p> <p>The SG demonstrated improvements to carers psychological well being and burden compared to both the MLG and controls.</p>
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			<p>exercise, handicraft, reading, and discussion) held at each centre a couple of times per week.</p> <p>Data collected at baseline, at intervention end (10 weeks), and 3 months from base line and at 9 months from baseline.</p>			
Raglio et al., 2015	RCT (multicentre = 9)	<p>120 PWD</p> <p>\bar{x} age = 81y</p> <p>\bar{x} MMSE = 11/30</p>	<p>Music therapy participants received 20 individualized 30-minute sessions, twice a week for 10 weeks. Intervention comprised of PWD being presented with a similar group of instruments at each session and encouraged to pick them up and interact with them. The music therapist followed the PWDs' rhythm and music production (also introducing variations) to create nonverbal communication. During the session, the music therapist built a relationship with the PWD by singing and using melodic and rhythmic instruments (improvisation), facilitating the expression and modulation of the PWD's emotions and promoting "affect attunement" moments.</p> <p>Those in the listening to music group received 30-minute</p>	<p>Clinical Dementia Rating (CDR)</p> <p>Mini-Mental State Examination (MMSE)</p> <p>Neuropsychiatric Inventory (NPI)</p> <p>Barthel Index (BI)</p> <p>Cornell Brown Scale—Quality of Life (CBSQoL)</p> <p>Cornell Scale Depression in Dementia (CSDD)</p>	<p>Attrition by follow up = 22/120 (18.3%)</p> <p>All groups improved over time in behavioural symptoms, depression, and quality of life, as shown by the statistically significant reductions in NPI global score, CSDD score and CBS-QoL score.</p>	Italy

sessions, twice a week for 10 weeks. During the session, the PWD listened to music from a preferred playlist without any interaction with a music therapist or formal carer. The PWDs did not wear earphones and remained in their rooms or in a quiet, private place during the session.

Standard care included educational and occupational (e.g. reading newspapers, playing cards, personal care) and physical (motor rehabilitation sessions) activities performed daily with the supervision of specialized professionals. Standard care did not include music exposure.

Data was collected at baseline, intervention end and 2 months post treatment.

16. ART THERAPY

16.1. DEFINITIONS OF ART THERAPY

Art therapies are generally understood to be approaches in which drawings, paintings, or other art forms are used to facilitate communication, or as adjunctive therapy in the treatment of neurological, mental, or behavioural disorders. However many authors attempting to review art therapies broaden this definition to include other creative activities such as music (which appears as its own section in this scoping review), dance and drama. Consequently the reviews reported below include reference to other forms of creative therapy alongside information about the main focus of this section visual art.

16.2. SYSTEMATIC REVIEWS OF THE EFFECTIVENESS OF ART THERAPY

16.2.1. EFFICACY OF CREATIVE ARTS THERAPY IN TREATMENT OF ALZHEIMER'S DISEASE AND DEMENTIA: A SYSTEMATIC LITERATURE REVIEW (COWL & GAUGLER 2014)

Reviews 112 studies examining creative arts therapies (including music therapy, visual art therapy, drama therapy, or poetry) for people living with dementia and their carers. Both quantitative and qualitative studies were included (14 RCTs, 46 quasi-experimental studies 49 case studies, and three descriptive studies, total n = 1699 PWD, 403 professional carers 94 family carers).

39 studies used visual art interventions (including painting, drawing, and sculpting), 53 used music (including playing and listening), 3 used drama (including storytelling, dance, and movement), 2 used poetry, and 15 included an intervention in which some combination of art, music, drama, or poetry was used.

Meta-analysis was not conducted.

The majority of studies reporting quantitative data measuring agitation, behaviour, depression, and mood found that creative arts therapy influenced significant improvements in these outcomes. The majority of studies measuring cognition did not find a significant improvement after participation in a creative arts therapy intervention.

34/39 music therapy studies (87%), 8/12 (67%) visual art therapy studies, 1/2 (50%) drama therapy studies, and 5/5 (100%) combination therapy studies reported statistically significant positive outcomes for at least one outcome measured.

Results from 62 studies reporting qualitative data were categorised into 10 themes:

- a) Improved socialization, participation, and communication among participants
- b) Amelioration of behavioural symptoms
- c) Emotional improvements such as happiness, enjoyment, improved mood, decreased depression, and positive affect
- d) Improved staff attitudes and enthusiasm and understanding and humanization of patients;

- e) Fostering family relationships between the person with dementia and family carers
- f) The capacity for self-expression of emotions and feelings despite language and cognitive deficits
- g) Mental and sensory stimulation from the art-making process and materials
- h) Mental and emotional benefits for carers such as relaxation and reduction in burden or stress
- i) A personal sense of control, life meaning, and personal satisfaction for participants
- j) Evoking memories and encouraging reminiscence

16.2.2. ART THERAPIES AND DEMENTIA CARE: A SYSTEMATIC REVIEW (BEARD 2011)

Non-meta-analytic review of arts therapies for people with Alzheimer's disease including music, visual arts, drama, and dance/movement therapies.

Author conclusions for each type of therapy examined are summarised below. It should be noted that the author approaches reporting with a focus on arts therapies for elements of quality of life and may downplay the effect on empirically observed/measured outcome in her conclusions.

a) Music therapy

The evidence base on MT provides promising data on its potential benefit for people living with dementia. Most studies focus on biomedical outcomes, such as reducing and managing symptoms, rather than person-centred outcomes, such as enrichment.

b) Visual arts therapies

Existing literature suggests that visual arts therapies can play a meaningful role in the lives of individuals with dementia. The predominant focus is on using visual arts as a part of a treatment regimen, with improvements in clinical scores and perceived problematic behaviours. The potential of visual arts to provide opportunities for non-verbal communication and in-the-moment communication is clear.

c) Drama therapy

Studies on drama therapy are less common and benefits are less focused on quantifiable clinical measurements. Several studies report beneficial effects of communication.

d) Dance/movement therapy

Dance/movement therapy (DMT) studies report small reductions in behavioural and psychological symptoms of dementia, increases in self-care practices, and improved cognitive performance or procedural learning. More commonly outcomes are reported in relation to DMT as an alternative or adjunct method for communication.

e) Mixed miscellaneous and general activity interventions

There is some promising but disparate evidence for a range of other creative activities for use in dementia care.

16.3. EVIDENCE FOR ART THERAPY NOT INCLUDED IN PRECEDING REVIEWS

Two further studies were identified addressing visual arts therapies which did not feature in the reviews noted above (see [Table 22, p.189](#)). Both used mixed methods although only one presented data from standardised measures. No statistically significant effects of art therapy were noted from these standardised measures but qualitative results from both papers report positively on other aspects including quality of life and feelings of self capacity.

16.4. CONCLUSIONS

Although not subject to meta-analysis there is some preliminary repeated evidence from studies employing a range of different designs which indicate possible benefits from art therapies. The evidence base is presently inconclusive.

Table 22: Summary of studies examining art therapy

Study	Design	Population	Intervention or aim	Outcomes/data used	Results	Country
Camic, Tischler & Pearman 2014	Mixed methods pre-post study	13 PWD-carer dyads \bar{x} age PWD = 78.3y \bar{x} MMSE PWD = 20/30	Examines the effect of an eight-week art-gallery-based intervention on social inclusion, carer burden, and quality of life and daily living activities for a person with dementia. Intervention consisted of eight two-hour sessions over an eight-week period. Sessions were divided into two sections: one hour of art viewing and discussion followed by one hour of art making. During session the groups visited a gallery room where chairs were arranged in front of an artwork. An art educator began with a brief introduction to the work followed by a discussion based upon a series of different questions which varied depending on the artwork. Over the first four weeks two artworks per session were explored in this manner; on two occasions a third work was added and on two other occasions each PWD-carer	Addenbrooks Cognitive Examination- Revised (ACE-R) MMSE Neuropsychiatric Inventory (NPI) Dementia Quality of Life (DEMQL-4) Zarit Burden Interview (ZBI) Bristol Activities of Daily Living scale (BADLS) Semi-structured interviews	1 dyad dropped out before study completion. No significant pre-post difference was found between the traditional or contemporary gallery groups on any quantitative measures. A non-significant trend towards reduction in carer burden over the course of the intervention was noted in both groups Thematic analysis of qualitative data revealed well-being benefits from both traditional and contemporary art gallery sites that included positive social impact resulting from feeling more socially included, self-reports of enhanced cognitive capacities for people living with dementia, and an improved quality of life.	UK

			<p>pair was asked to choose and discuss a third work with each other.</p> <p>After art viewing the group moved to a studio for art making which was facilitated by a professional artist with experience in community-arts programmes.</p> <p>8 dyads attended traditional picture gallery.</p> <p>5 dyads attended a contemporary art gallery.</p>			
Ullán et al., 2013	Mixed methods (observation and qualitative)	<p>21 PWD</p> <p>Age range = 67-93y</p> <p>\bar{x} MMSE = 19/30</p> <p>6 professional day centre carers</p>	<p>Examines the impact of a artistic education programme for PWD.</p> <p>Five workshops (duration 60-90 mins) were completed during which participants were given an audio-visual presentation of artistic work. Following this they created a personal cyanotype¹.</p>	<p>Participant observation (independent observers and therapy providers)</p> <p>Focus groups x 5 including 3 PWD, 2 therapy providers and 1 observer</p> <p>Focus group x 1 with professional carers</p>	<p>Participation in workshops was variable (range 5 – 22).</p> <p>The authors conclude that participants demonstrated high levels of commitment to the activity and interest in learning new things.</p> <p>Participants were also felt to be satisfied during the creative process and with their results.</p> <p>Artistic activities were interpreted as reinforcing participants' feelings of capacity.</p>	Spain

¹ Cyanotype is relatively quick and simple procedure used to create a monochrome photograph.

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18. APPENDIX A- SEARCH TERMS

18.1. PHASE 1 TERMS

18.1.1. COCHRANE LIBRARY

MeSH descriptor: [Dementia] explode all trees

18.1.2. TRIP DATABASE

(dementia or Alzheimer's) ("Occupational therapy")

(dementia or Alzheimer's) ("Physiotherapy")

18.1.3. OT SEEKER

- a) [Any Field] like 'dementia' AND [Any Field] like 'occupational therapy' AND [Method] like 'Systematic Review'
- b) [Any Field] like 'dementia' AND [Any Field] like 'occupational therapy' AND [Method] like 'Randomised controlled trial'

18.1.4. PEDRO

Dementia AND Systematic Review

18.2. PHASE 2 TERMS

18.2.1. CINAHL

- a) (MH "Occupational Therapy") OR (MH "Occupational Therapy Practice, Evidence-Based") OR (MH "Occupational Therapy Practice, Research-Based") AND dementia
- b) (MH "Physical Therapy+") AND MH "Dementia+/TH/RH/PF/PC" NOT (PT Proceedings OR PT Abstract OR PT Editorial)

18.2.2. MEDLINE

- a) (MH "Occupational Therapy") AND MH "Dementia+/TH/RH/PC"
- b) (MH "Physical Therapy Modalities+" OR MH "Physical Therapy Specialty" OR MH "Physical Therapy Department, Hospital" OR MH "Motion Therapy, Continuous Passive") AND MH "Dementia+/TH/RH/PC"

18.2.3. PSYCINFO

- a) DE "Occupational Therapy" AND SU "dementia"+

b) DE "Physical Therapy" AND SU "dementia"+

18.2.4. EMBASE

- a) occupational therapy/ or occupational therapy practice/ AND exp dementia/rh, th, dm [Rehabilitation, Therapy, Disease Management]
- b) exp dementia/dm, pc, rh, th [Disease Management, Prevention, Rehabilitation, Therapy] and exp physiotherapy/ or exp physiotherapy practice/

18.3. PHASE 3 TERMS

18.3.1. EMBASE

Dementia terms: exp dementia/dm, pc, rh, th [Disease Management, Prevention, Rehabilitation, Therapy]

Topic terms: exp assistive technology/
motor performance/
exp animal assisted therapy/
gardening/
("individualization"/ OR personalized medicine/)

18.3.2. CINAHL

Dementia terms : (MH "Dementia+")

Topic terms: (MH "Assistive Technology Devices+") OR (MH "Assistive Technology Services") OR (MH "Assistive Technology")

MH "Horticulture"

MH "Pet Therapy"

MH "Individualized Medicine"

18.3.3. MEDLINE

Dementia terms: Dementia/nu, pc, px, rh, tu, th, ec [Nursing, Prevention & Control, Psychology, Rehabilitation, Therapeutic Use, Therapy, Economics]

Topic terms: MH "Gardening"
MH "Animal Assisted Therapy+"
MH "Individualized Medicine+ "
(MH "Motor Activity") OR (MH "Motor Skills")
MH "Self-Help Devices+ "
MH "Art therapy"
MH "Music therapy"

18.3.4. PsycINFO

Dementia terms: SU dementia

Topic terms: DE "Assistive technology"
DE "Horticulture Therapy"
DE "Animal Assisted Therapy"
DE "Art therapy"
DE "Music therapy"