Duke University School of Medicine

Doctor of Physical Therapy

Does Physical Activity Decrease Cognitive Decline Among Older Adults with Dementia?

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Background

- Most common type of dementia is Alzheimer's Disease (AD).
- AD affects 1 in 9 people aged 65 and older.
- AD is the 5th leading cause of death in people aged 65 and older in the US.
- Physical activity (PA) has been suggested as a treatment approach to decrease cognitive decline in dementia/AD.
- We defined physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure (as defined by the World Health Organization).

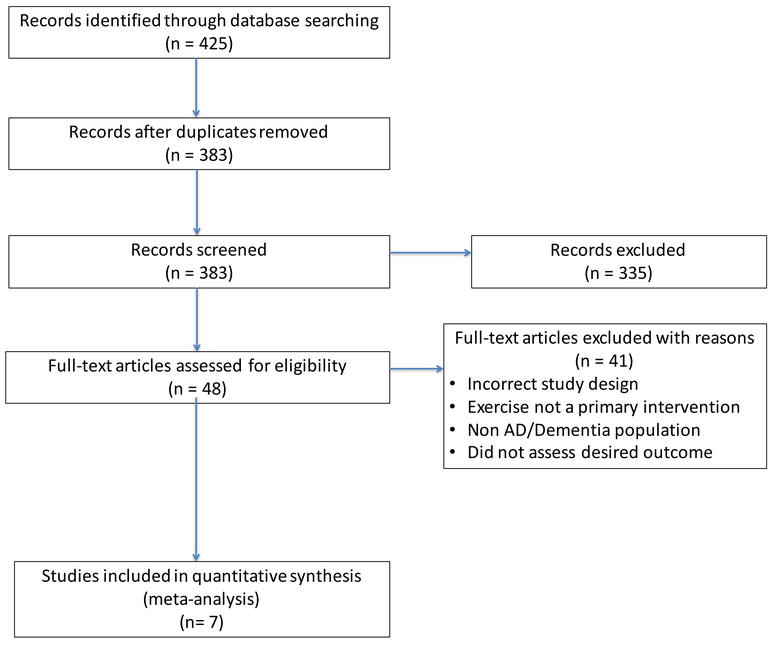
Purpose

To review systematic reviews of the literature to determine if PA decreases cognitive decline among older adults with dementia/AD.

Methods

- We searched PubMed, Scopus, CINAHL, Cochrane Database, and PsycINFO from inception of each database to May 2015.
- Inclusion Criteria:
  - Participants with cognitive decline (i.e. AD, dementia, mild cognitive impairment)
  - Objectively measured PA as intervention
  - Measured cognitive status as an outcome
  - Comparators: any active or inactive control
- Exclusion Criteria:
  - Specific to early onset dementia
  - Not published in English
- We did a duplicate process of screening, eligibility, inclusion, and quality assessment.

Flow of Study Selection



Results

Table 1: Study Characteristics

	Heyn et al, 2004	Littbrand et al, 2011	Hernandez et al, 2014	Farina et al, 2014	Zhu et al, 2015	Balsamo et al, 2013	Eggermont et al, 2006
Study Design	RCTs	RCTs	RCTs, NRCTs, Longitudinal	RCTs	RCTs, NRCTs	RCTs	Experimental, Cohort
Major Outcomes Used	Cognitive tasks (specifics NR)	MMSE, Brief Cognitive Screening Battery, clock drawing test, Rivermead Behavioral Memory Test, Wechsler Memory Scale	MMSE, Rapid Eval. Of Cognitive Functions, Boston Naming Task, Hopkins Verbal Learning Task, Amsterdam Dementia Screening, ADAS-Cog	MMSE, Eval. Of Cognitive Functions, Boston Naming Task, Hopkins Verbal Learning Task, Amsterdam Dementia Screening, ADAS-Cog	MMSE, verbal fluency	MMSE, ADAS-Cognitive, attention and working memory tests, Stroop Test	MMSE, Wechsler Memory Scale, Test of attentional matrix, free recall task, TMT
Quality Assessment	Good	Good	Fair	Good	Good	Fair	Fair
Meta-Analysis Conducted	Yes	No	No	No	Yes	No	Yes

- Six out of seven systematic reviews in this paper included RCT's.
- Common outcome measures used across these studies included MMSE, Boston Naming Task, Hopkins Verbal Learning Task, Amsterdam Dementia Screening, Wechsler Memory Scale, and the ADAS-Cognitive Test
- The quality of reviews was judged to be "good" in the majority of reviews.

Table 2: Participant Characteristics

	Hernandez et al, 2004	Zhu et al, 2015	Farina et al, 2014	Balsamo et al, 2013	Littbrand et al, 2011	Eggermont et al, 2006	Heyn et al, 2004
Number of Studies (Participants), n	5 studies (125 participants)	23 studies (886 participants)	6 studies (171 participants)	8 studies (677 participants)	10 studies (622 participants)	8 studies (264 participants)	12 studies (820 participants)
Age	NR- elderly	Ranged from 54.2-88.23 years old across all studies	NR	Mean age ranged from 68.4 – 85.0 years	NR-87 years	Ranged from 59-99 years across all studies	80+/- 6.1 years (across all 30 studies); 66-83 (across 12 cognitive outcome studies)
Cognitive Status Inclusion Criteria	Diagnosis of Alzheimer's Disease (AD), all other forms of dementia excluded	Diagnosed with AD clinically with no limitation on dementia severity, duration, or age; Lewy body dementia, fronto-temporal dementia, vascular dementia, or other	Diagnosis of AD with no limitation on severity or duration of disorder; Lewy body dementia, fronto-temporal dementia, and other rarer forms of dementia were excluded	Studies retrieved using controlled keywords "cognitive impairment" or "Alzheimer's disease"	People with a diagnosed dementia disorder	Some degree of cognitive impairment or diagnosis of dementia	Baseline MMSE of < 26, or subjects diagnosed by a physician as having some degree of cognitive impairment or preexisting diagnosis of dementia
Baseline Cognitive Status	Mild and Moderate AD	Baseline MMSE Score: ranged from 7.9-29	Baseline MMSE Score: ranged from 10-29	Diagnosis of cognitive impairment or Alzheimer's disease	MMSE mean: 6-13 (5 studies) MMSE mean: 18-20 (3 studies)	NR or MMSE scores ranging from 7-25	22 reported (range: 6 to 25; mean: 16.5+/- 7.0)

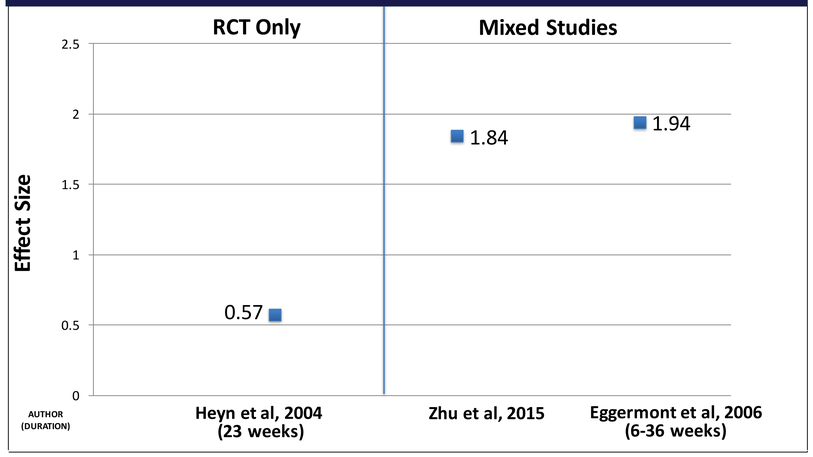
- Included studies ranged from 5-23 (125-820 participants)
- The majority reported a baseline MMSE of 7.9 to 29

Table 3: Physical Activity Characteristics

	Hernandez et al, 2004	Zhu et al, 2015	Farina et al, 2014	Balsamo et al, 2013	Littbrand et al, 2011	Eggermont et al, 2006	Heyn et al, 2004
Inclusion Criteria of Physical Activity	Had to address physical exercise in the treatment of Alzheimer's Disease, any type of exercise, or physical activity mode	General physiotherapy, exercise, aerobic training, Tai Chi intervention, walking, spaced retrieval training, and dance	Lasted a minimum of four weeks and were solely exercise-based	Any of the following themes: physical fitness, aerobic exercise, cardiorespiratory fitness, cardiovascular training, aerobic capacity, aerobic conditioning, muscle strength, exercise, exercise training, strength training, resistance training, resistance exercise, performance, exercise capacity, functional capacity, and physical exercise.	The effect of physical exercise as a single intervention was evaluated and was compared with usual care or a control activity	Had to include a program focused exclusively on exercise, physical activity, or fitness training with no other type of sensory stimulant such as music	Any exercise program or form of rehabilitative exercises, physical activity, fitness or recreation therapy
Mode	Varied	Varied	Varied	Varied	Varied	Varied	Varied
Mean Frequency	Ranged from once every 15 days to 5 times per week	NR	Ranged from 3-7 sessions/week (5.8 sessions/week)	Ranged from 1 day/week to 4 days/week	- 7 studies evaluating combined exercise: 2-7 times/week - 3 studies evaluating walking exercise: 3-5 sessions/week	NR or 3-5x/week	3.6 sessions/week (1-6/week)
Intensity	Moderate	NR	NR	Ranged from 60-85% MHR or moderate intensity or 50% 1 RM	NR or moderate	NR or mild or 70% max HR	NR
Mean Time	Sessions lasting at least 30 min.	NR	Ranged from NR-2 hours (54 minutes)	150 min/week or ranged from 30-60 min sessions	7 studies evaluating combined exercise: 20-75 minutes/session 3 studies evaluating walking exercise: 30 min/session	20-80 minute sessions	45 minutes (2 – 150)
Mean Duration of Exercise Regimen	Ranged from 16-48 weeks	Ranged from 6 weeks-12 months (22.819 weeks)	Ranged from 6-24 weeks (14.167 weeks)	Ranged from 4-6 months	7 studies evaluating combined exercise: 2weeks – 12 mos. 3 studies evaluating walking exercise: 6-16 weeks	Ranged from 6-36 weeks (2 studies NR)	23 weeks (2-112)

- Inclusion criterion and characteristics of PA within each review varied greatly.

Effect Sizes from Meta-Analysis with the outcome of Mini-Mental Status Exam



- In the three studies that included a meta-analysis, the two mixed studies (RCT and observational) had higher effect sizes than the study that included RCT's only.

Table 4. Main outcomes from systematic reviews reporting qualitative summary findings

Type of Studies Included in Systematic Review	RCTs Only			Mixed Studies
Systematic Review, Year (Reference)	Farina et al, 2014 (3)	Balsamo et al, 2013 (1)	Littbrand et al, 2011 (6)	Hernandez et al, 2004 (4)
Change in MMSE score	NR	No Significant Difference between groups (NS) seen in 2 studies. Significant higher average values than control group (@) seen in 1 study. A significant decline in MMSE compared to baseline in the control group was seen in 2 studies (1 study that found NS and 1 study that found @.)	Of the 4 studies that focused on cognition as an outcome only 1 low quality study found a positive effect, the other 3 studies found no effect.	NR **(For all of the studies included it was only stated whether a positive or negative change in cognition occurred with exercise. A positive change was found in 4 of 5 studies. A negative was found in 1 study.)
Other Cognitive Changes	Global Cognitive Performance: 0.75 (95% CI=0.32-1.17, p<0.001)	Executive Cognitive Activities: significant change in 2 studies, significant change in women only in 1 study. ADAS-Cog: NS in 1 study Cognitive Tests: significant change in 1 study	NR	NR

- Significant changes in MMSE scores were seen in Balsamo, Littbrand, and Hernandez, and significant changes were seen in other cognitive measures in Farina and Balsamo.

Conclusions

The majority of reviews were of good quality and found that PA was a promising intervention for preventing cognitive decline among older adults with dementia / AD. Substantial variability was noted in the mode, frequency, and duration of PA interventions. The effect sizes were consistently stronger among the reviews that included mixed designs. This may be due to the longer duration of the intervention conducted in the included observational studies.

Clinical Relevance

- As little as 2/week of PA has been associated with decreased cognitive decline among dementia/AD patients
- Physical therapists should consider PA activities with older adults with dementia/AD
- PA may positively impact functional performance and ability to perform ADL's

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