Evidence Portfolio – Aging Subcommittee, Question 3

What is the relationship between physical activity and physical function in older individuals with selected chronic conditions?

Sources of Evidence: Existing Systematic Reviews and Meta-Analyses

Conclusion Statements and Grades

Limited evidence suggests that physical activities such as muscle-strengthening, tai chi, and qigong improve physical function among older people with **cardiovascular disease**. **PAGAC Grade: Limited.**

Limited evidence suggests that tai chi and qigong exercise improves one aspect of physical function (walking ability) in individuals with **chronic obstructive pulmonary disease**. **PAGAC Grade: Limited.**

Limited evidence suggests that for individuals with **cognitive impairment**, physical activity programs improve physical function, including measures of activities of daily living. **PAGAC Grade: Limited.**

Strong evidence demonstrates that physical activity improves measures of physical function in older people with **frailty**. **PAGAC Grade: Strong.**

Moderate evidence indicates that for community-dwelling older adults who sustain a **hip fracture**, extended exercise programs (which begin after formal hip fracture rehabilitation ends) are effective for improving physical function. **PAGAC Grade: Moderate.**

Limited evidence suggests that muscle-strengthening and agility (balance) activities performed on two or more days per week improves physical function in older people who are at risk of fragility fractures due to **osteoporosis or osteopenia**. **PAGAC Grade: Limited.**

Strong evidence demonstrates that physical activity improves a number of physical function outcomes, including walking, balance, strength, and disease-specific motor scores in individuals with **Parkinson's disease**. **PAGAC Grade: Strong.**

Moderate evidence indicates that that mobility-oriented physical activity improves walking function for individuals after a **stroke**. **PAGAC Grade: Moderate.**

Insufficient evidence is available to determine the effects of physical activity on older adults with **visual impairments**. **PAGAC Grade: Not assignable**.

Description of the Evidence

An initial search for systematic reviews, meta-analyses, pooled analyses, and reports identified sufficient literature to answer the research question as determined by the Aging Subcommittee. Additional searches for original research were not needed.

CARDIOVASCULAR DISEASE

Existing Systematic Review and Meta-Analyses

Overview

Four existing reviews that examined the association between physical activity and physical function among older individuals with cardiovascular disease were included: 1 systematic review[1] and 3 meta-analyses.[2-4] All the reviews were published in 2016.

The systematic review[1] included 12 studies and covered a timeframe from 2002 to December 2015.

The meta-analyses included a range of 22 to 35 studies and covered timeframes from inception to 2014[2, 4] and from 1957 to January 2015.[3]

Exposures

The included reviews examined different types of physical activity including any form of Tai-Chi,[2] Traditional Chinese Exercise,[3] and resistance training.[4] Floegel and Perez[1] examined a wide range of physical activity or exercise interventions from sitting exercises to high intensity training conducted in different settings.

Outcomes

All the included reviews examined physical function outcomes. Measures included a 6-minute walk test, a Timed Up and Go test, and other physical performance tests to assess household physical activity and functional mobility.

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Existing Meta-Analyses

Overview

Two meta-analyses that examined the association between physical activity and physical function among older individuals with chronic obstructive pulmonary disease were included.[5, 6] The meta-analyses were published in 2014 and 2016.

The meta-analyses included 14[5] and 23[6] studies and covered timeframes from inception to 2012 and 2015, respectively.

Exposures

Both meta-analyses examined Traditional Chinese Exercise. Ding et al[5] focused on Tai Chi and Qigong, and Ngai et al[6] focused only on Tai Chi.

Outcomes

All the included reviews examined physical function outcomes. Measures included a 6-minute walk test and various strength and balance tests.

COGNITIVE IMPAIRMENT

Existing Systematic Reviews and Meta-Analyses

Overview

A total of 14 existing reviews that examined the association between physical activity and physical function among older individuals with cognitive impairment were included: 8 systematic reviews,[7-14] and 6 meta-analyses.[15-20] The existing reviews were published from 2010 to 2017.

The systematic reviews included a range of 2 to 20 studies and covered the following timeframes: from inception to 2010,[7, 9, 13] inception to 2014 and 2015,[10, 12] 1800 to September 2015,[11] and inception to 2011.[14]

The meta-analyses included a range of 5 to 17 studies and covered the following timeframes: from inception to 2009,[15, 19] inception to 2013 and 2016,[16, 18] and from 1990 to 2013.[17] Rao et al[20] did not report a specific timeframe.

Exposures

The majority of included reviews examined multiple modes of physical activity or exercise including aerobic, strength, and balance training. Two reviews focused on specific types of physical activity: aerobic exercise[9] and motor-cognitive dual-task training.[10]

Outcomes

All the included reviews examined physical function outcomes. Measures included activities of daily living; 6-minute walk tests; and various mobility, strength, and balance tests.

FRAILTY

Existing Systematic Reviews and Meta-Analyses

Overview

A total of 15 existing reviews that examined the association between physical activity and physical function among older individuals with frailty were included: 12 systematic reviews,[21-32] and 3 meta-analyses.[33-35] The existing reviews were published from 2008 to 2015.

The systematic reviews included a range of 6 to 47 studies and covered the following timeframes: from 1990 to 2011 and 2012,[21, 22] 1995 to 2007,[23] inception to 2010,[24] 2000 to 2013,[25] inception to 2007 and 2009,[26, 29] 2003 to 2015,[27] 2007 to 2010,[28] inception to 2011,[30] 1975 to 2010,[31] and 1955 to 2008.[32]

The meta-analyses included a range of 8 to 21 studies and covered the following timeframes: from 2001 to 2010,[33] and from inception to 2011 and 2013.[34, 35]

Exposures

The majority of included reviews examined multiple modes of physical activity or exercise including aerobic, strength, and balance training. Three reviews focused on specific types of physical activity: chair-based exercise interventions,[21] home-based exercise interventions,[24] and progressive resistance training.[30]

Outcomes

All the included reviews examined physical function outcomes. Measures included activities of daily living, 6-minute walk tests, and various mobility, strength, and balance tests.

OSTEOPOROSIS/OSTEOPENIA

Existing Systematic Reviews and Meta-Analyses

Overview

Four existing reviews that examined the association between physical activity and physical function among older individuals with osteoporosis/osteopenia were included: 2 systematic reviews,[36, 37] and 2 meta-analyses.[38, 39] The reviews were published from 2009 to 2016.

The systematic reviews included 5[36] and 17[37] studies and covered timeframes from 1966 to 2011 and inception to 2013, respectively.

The meta-analyses included 2[38] and 4[39] studies and covered timeframes from inception to 2011 and 1966 to March 2007, respectively.

Exposures

The majority of included reviews examined multiple modes of physical activity or exercise, including aerobic, strength, and balance training. Wilhelm et al[36] focused on resistance exercise.

Outcomes

All the included reviews examined a variety of physical function outcomes, including different self-report questionnaires or sub-scales and/or performance-based measures such as 6-minute walk test, Timed Up and Go test, functional reach test, walking speed, and balance test. Zanotto et al[37] focused on dual-task performance and balance.

PARKINSON'S DISEASE

Existing Systematic Reviews and Meta-Analyses

Overview

A total of 20 existing reviews that examined the association between physical activity and physical function among older individuals with Parkinson's Disease were included: 3 systematic reviews,[10, 40, 41] and 17 meta-analyses.[42-59] The existing reviews were published from 2008 to 2016.

The systematic reviews included a range of 5 to 14 studies and covered timeframes from inception to 2012 and 2014.[10, 40] Crizzle and Newhouse[41] covered from inception but did not specify the upper limit of the search timeframe.

The meta-analyses included a range of 4 to 18 studies and covered the following timeframes: from 1946 to 2014,[43] inception to 2014,[44, 53, 55, 56, 58, 59] inception to 2011,[45, 51] inception to 2016,[46, 48] 1974 to 2006,[47] 1990 to 2014,[49, 50] inception to 2015,[52] and inception to 2013.[54, 57] Alves Da Rocha et al[42] did not report a specific timeframe.

Exposures

The included reviews examined multiple modes of physical activity or exercise including different types of resistance training,[40, 43, 44, 51, 55, 58] dance,[45, 52, 56] Tai Chi or other mind-body exercise,[48, 54, 59] virtual

reality interventions combined with physiotherapy,[46] endurance training,[49, 50] and motor-cognitive dual-task training.[10]

Outcomes

All the included reviews examined a variety of physical function outcomes. Measures included activities of daily living; gait; and various mobility, strength, and balance tests.

POST-HIP FRACTURE

Existing Meta-Analyses

Overview

Two meta-analyses that examined the association between physical activity and physical function among older individuals after a hip fracture were included.[60-62] The meta-analyses were published in 2012 and 2016.

The meta-analyses included 11[60] and 13[61, 62] studies and covered timeframes from inception to 2012 and 2014, respectively.

Exposures

Auais et al[60] examined the effects of extended exercise rehabilitation programs, whereas Diong et al[61, 62] assessed different types of structured exercise, including progressive resistance training.

Outcomes

Both reviews examined a variety of physical function outcomes, although Diong et al[61, 62] focused on mobility.

STROKE

Existing Meta-Analyses

Overview

Two meta-analyses that examined the association between physical activity and physical function among older individuals after a stroke were included.[63, 64] The meta-analyses were published in 2007 and 2015.

The meta-analyses included 47[63] and 6[64] studies and covered timeframes from 1950 to 2007 and from inception to 2013, respectively.

Exposures

Both meta-analyses examined the effect of walking/gait training. Eng and Tang[63] examined the effect of gait training strategies to improve walking ability, such as neurodevelopmental techniques, muscle strengthening, treadmill training, and intensive mobility exercises. Nascimento et al[64] compared the effects of walking training with cueing of cadence to walking training alone.

Outcomes

Both meta-analyses examined walking ability.

VISUAL IMPAIRMENT

Existing Meta-Analysis

Overview

One meta-analysis that examined the association between physical activity and physical function among older individuals with visual impairment was included.[65] The meta-analysis was published in 2014.

Gleeson et al[65] conducted a systematic review that included 4 studies, of which 2 were included in the meta-analysis. The search covered a timeframe from inception to 2013.

Exposures

The meta-analysis examined the effect of individual or group exercise/physical training classes.

Outcomes

The meta-analysis included studies with physical function outcomes assessing mobility, balance, and ability to stand from a chair.

Populations Analyzed

The table below lists the populations analyzed in each article.

Table 1. Populations Analyzed by All Sources of Evidence

	Sex	Age	Chronic Conditions
Alves Da Rocha, 2015		Adults >18	Parkinson's disease
Anthony, 2013		Adults 70–99	Frailty
Auais, 2012		Adults Mean age range 73–84	Hip fracture
Blankevoort, 2010		Older adults	Dementia
Brett, 2016		Adults Mean age 82.6	Dementia
Brienesse, 2013		Adults >18	Parkinson's disease
Burge, 2012		Adults ≥75	Dementia
Cadore, 2013		Adults ≥70	Frailty
Chen, 2016		Adults Mean 53.9–72.3	Cancer, Chronic obstructive pulmonary disease (COPD), Osteoarthritis, Heart failure
Chin, 2008		Adults Mean age 77–88	Frailty
Chou, 2012		Adults 75.3– 86.8	Frailty
Chung, 2016		Adults Mean age 58	Parkinson's disease
Clegg, 2012		Adults Mean age range 78–88	Frailty
Crizzle, 2006			Parkinson's disease
Cruickshank, 2015			Parkinson's or Multiple sclerosis
Cruz-Jentoft, 2014		Adults >50	
Daniels, 2008		Adults Mean age 76–83	Frailty
de Dreu, 2012		Older adults	Parkinson's disease
de Labra, 2015		Mean age 82.5	Frailty
de Vries, 2012		Adults 60–85	Frailty
Ding, 2014		Average age >60	Chronic obstructive pulmonary disease (COPD)

	Sex	Age	Chronic Conditions
Diong, 2016		Adults	
Dockx, 2016		Adults	Parkinson's disease
Eng, 2007		Adults	Stroke
Fang, 2011		Older adults	Alzheimer's disease
Floegel, 2016		Older adults	Heart failure
Forbes, 2015		Older adults	Dementia
Fox, 2014		Adults Mean age 70.0–89.60	Dementia
Fritz, 2015		Adults >18	Central Neurologic Disorder
Giangregorio, 2013		Adults >40	History of non-traumatic osteoporotic fracture of one or more vertebrae
Gine-Garriga, 2014		Adults ≥65	Frailty
Gleeson, 2014		Adults ≥60	Visual impairments
Goodwin, 2008			Parkinson's disease
Inskip, 2016		Adults 57–98	Parkinson’s disease, dementia, Dementia with Lewy Bodies
Kwok, 2016		Adults Mean age 60.8–74.9	Parkinson’s disease
Lamotte, 2015			Parkinson’s disease
Laver, 2016		Adults Mean age 70–80	Dementia, Alzheimer's disease
Lewis, 2017		Older adults	Cognitive impairment
Li, 2009	Female	Adults	Osteoporosis, Post-menopausal osteopenia
Lima, 2013		Adults Mean age 57–75.7	Parkinson's disease
Littbrand, 2011		Adults Mean age 74–87	Dementia
Lotzke, 2015		Adults Mean age 63–86	Parkinson's disease
Mehrholz, 2015		Adults 58–74	Parkinson's disease
Nascimento, 2015		Adults >18	Stroke

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	Sex	Age	Chronic Conditions
Nash, 2012		Older adults	Frailty
Ngai, 2016		Adults Mean age 61–74	Chronic obstructive pulmonary disease (COPD)
Ni, 2014			Parkinson's disease
Pitkala, 2013		Older adults	Dementia
Potter, 2011		Adults ≥60	Dementia
Rao, 2014		Adults ≥65	Alzheimer's disease
Saltychev, 2016		Adults Mean age 59–71	Parkinson’s disease
Sharp, 2014			Parkinson’s disease
Shu, 2014		Adults 20–85	Parkinson’s disease
Theou, 2011		Adults 71–90 (Mean age 81.5)	Frailty
Tillman, 2015		Adults 20–85	Parkinson’s disease
Valenzuela, 2012		Adults Mean age 70–90	
Vermeulen, 2011		Adults ≥65	
Wang, 2016		Adults	Heart disease
Weening-Dijksterhuis, 2011		Adults ≥70	Frailty
Wilhelm, 2012		Older adults	Osteoporosis/Osteopenia
Yamamoto, 2016		Adults <65; ≥65	Coronary artery disease OR history of myocardial infarction, coronary revascularization, angina pectoris
Yang, 2014			Parkinson's disease
Zanotto, 2014		Adults >59	Stroke, Parkinson's disease, Dementia, Frail elderly

Supporting Evidence

Existing Systematic Reviews and Meta-Analyses

Table 2. Existing Systematic Reviews and Meta-Analyses Individual Evidence Summary Tables

Parkinson's Disease	
Meta-Analysis **Citation:** Alves Da Rocha P, McClelland J, Morris ME. Complementary physical therapies for movement disorders in Parkinson's disease: a systematic review. *Eur J Phys Rehabil Med.* 2015;51(6):693-704.	
Purpose: To evaluate the effects of complementary physical therapies aimed at improving motor disabilities in people living with Parkinson's Disease.	**Abstract:** BACKGROUND: The growth and popularity of complementary physical therapies for Parkinson's disease (PD) attempt to fill the gap left by conventional exercises, which does not always directly target wellbeing, enjoyment and social participation. AIM: To evaluate the effects of complementary physical therapies on motor performance, quality of life and falls in people living with PD. DESIGN: Systematic review with meta-analysis. POPULATION: Outpatients--adults diagnosed with idiopathic PD, male or female, modified Hoehn and Yahr scale I-IV, any duration of PD, any duration of physical treatment or exercise. METHODS: Randomized controlled trials, non-randomized controlled trials and case series studies were identified by systematic searching of health and rehabilitation electronic databases. A standardized form was used to extract key data from studies by two independent researchers. RESULTS: 1210 participants from 20 randomized controlled trials, two non-randomized controlled trials and 13 case series studies were included. Most studies had moderately strong methodological quality. Dancing, water exercises and robotic gait training were an effective adjunct to medical management for some people living with PD. Virtual reality training, mental practice, aerobic training, boxing and Nordic walking training had a small amount of evidence supporting their use in PD. CONCLUSION: On balance, alternative physical therapies are worthy of consideration when selecting treatment options for people with this common chronic disease. CLINICAL REHABILITATION IMPACT: Complementary physical therapies such as dancing, hydrotherapy and robotic gait training appear to afford therapeutic benefits, increasing mobility and quality of life, in some people living with PD.
Timeframe: Not reported	
Total # of Studies: 35 in systematic reviews; several meta-analyses of 20 randomized control trials only, numbers varied.	
Exposure Definition: Alternative therapies practiced 2–5 times per week for 20–90+ minutes per session. Therapies included activities such as dance, hydrotherapy, tai chi, aerobic exercise, and Nordic walking. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No	
Outcomes Addressed: Balance: Berg Balance Scale, ABC Scale, others. Mobility: Timed Up and Go, sit to stand, functional reach test. Gait: walking speed, step length, stride length, others. Activities of daily living: Barthel Index, others. Quality of life: SF 36, Nottingham's Scale, others. Disease severity: Unified Parkinson's Disease Ration Scale. **Examine Cardiorespiratory Fitness as Outcome:** No	
Populations Analyzed: Adults >18, Parkinson's Disease	**Author-Stated Funding Source:** CAPES Foundation.

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Anthony K, Robinson K, Logan P, Gordon AL, Harwood RH, Masud T. Chair-based exercises for frail older people: a systematic review. Biomed Res Int. 2013;2013:309506. doi:10.1155/2013/309506.</td></tr>
<tr><td>Purpose: To examine the beneficial and harmful effects of exercise programs performed primarily in the seated position for frail older people who are unable to perform standard evidence-based exercise programs.</td><td rowspan="4">Abstract: INTRODUCTION: Frail older people are often unable to undertake high-intensity exercise programmes. Chair-based exercises (CBEs) are used as an alternative, for which health benefits are uncertain. OBJECTIVE: To examine the effects of CBE programmes for frail older people through a systematic review of existing literature. METHOD: A systematic search was performed for CBE-controlled trials in frail populations aged >/=65 years published between 1990 and February 2011 in electronic databases. Quality was assessed using the Jadad method. RESULTS: The search identified 164 references: with 42 duplicates removed, 122 reviewed, 116 excluded, and 6 analysed. 26 outcome measures were reported measuring 3 domains: mobility and function, cardiorespiratory fitness, mental health. All studies were of low methodological quality (Jadad score </=2; possible range 0-5). Two studies showed no benefit, and four reported some evidence of benefit in all three domains. No harmful effects were reported; compliance was generally good. CONCLUSION: The quality of the evidence base for CBEs is low with inconclusive findings to clearly inform practice. A consensus is required on the definition and purpose of CBEs. Large well-designed randomised controlled trials to test the effectiveness of CBE are justified.</td></tr>
<tr><td>Timeframe: 1990–February 2011</td></tr>
<tr><td>Total # of Studies: 6</td></tr>
<tr><td>Exposure Definition: Chair-based exercise interventions ranged from 6 weeks to 6 months, with frequency of exercise sessions ranging from daily to 3 times a week. The duration of each session also varied, with one study reporting 20 minutes per session and 2 others reporting up to 60 minutes per session.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Mobility and function: Timed Up and Go scores, 30-second chair stand, Berg Balance scale. Physical outcomes: gait speed, stability, 6-minute walk test, Functional Limitations Profile. Fear of falling: Falls Efficacy Scale.
Examine Cardiorespiratory Fitness as Outcome: Yes</td></tr>
<tr><td>Populations Analyzed: Adults 70–99 years, Frailty</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Post-Hip Fracture</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Auais MA, Eilayyan O, Mayo NE. Extended exercise rehabilitation after hip fracture improves patients' physical function: a systematic review and meta-analysis. Phys Ther. 2012;92(11):1437-1451. doi:10.2522/ptj.20110274.</td></tr>
<tr><td>Purpose: To review and quantify the reported effects of an extended exercise rehabilitation program offered beyond the regular rehabilitation period on improving physical functioning for patients with hip fractures.</td><td rowspan="5">Abstract: BACKGROUND: Although the principal goal of hip fracture management is a return to the pre-event functional level, most survivors fail to regain their former levels of autonomy. One of the most effective strategies to mitigate the fracture's consequences is therapeutic exercise. PURPOSE: The purpose of this study was to review and quantify the reported effects of an extended exercise rehabilitation program offered beyond the regular rehabilitation period on improving physical functioning for patients with hip fractures. SOURCES: The Cochrane libraries, PubMed, CINAHL, PEDro, and EMBASE were searched to April 2012. STUDY SELECTION: All randomized controlled trials comparing extended exercise programs with usual care for community-dwelling people after hip fracture were included in the review. DATA EXTRACTION AND SYNTHESIS: Two reviewers conducted each step independently. The data from the included studies were summarized, and pooled estimates were calculated for 11 functional outcomes. RESULTS: Thirteen trials were included in the review and 11 in the meta-analysis. The extended exercise program showed modest effect sizes (ESs), which reached significance, under random theory, for knee extension strength for the affected and nonaffected sides (ES=0.47, 95% confidence interval [CI]=0.27-0.66, and ES=0.45, 95% CI=0.16-0.74, respectively), balance (ES=0.32, 95% CI=0.15-0.49), physical performance-based tests (ES=0.53, 95% CI=0.27-0.78), Timed "Up & Go" Test (ES=0.83, 95% CI=0.28-1.4), and fast gait speed (ES=0.42, 95% CI=0.11-0.73). Effects on normal gait speed, Six-Minute Walk Test, activities of daily living and instrumental activities of daily living, and physical function subscale of the 36-Item Short-Form Health Survey (SF-36-PF) did not reach significance. Community-based programs had larger ESs compared with home-based programs. CONCLUSIONS: To the authors' knowledge, this is the first meta-analysis to provide evidence that an extended exercise rehabilitation program for patients with hip fractures has a significant impact on various functional abilities. The focus of future research should go beyond just effectiveness and study the cost-effectiveness of extended programs.</td></tr>
<tr><td>Timeframe: Inception–April 2012</td></tr>
<tr><td>Total # of Studies: 11</td></tr>
<tr><td>Exposure Definition: Extended exercise rehabilitation program offered beyond the regular rehabilitation period, including community and home-based programs. Supervised sessions ranged from 30 to 135 minutes, 2–3 times per week, over 1–12 months. Intensity of strengthening exercises ranged from a fixed 1 kg, regardless of patients' abilities, to 100% of the 1-repetition maximum (1RM), and there were 2 to 3 sets for each muscle.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical function: Timed Up and Go Test, fast gait speed, normal gait speed, six-minute walk test, knee extension strength, balance, physical performance-based tests, activities of daily living and instrumental activities of daily living, and physical function subscale of the 36-Item Short-Form Health Survey.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults Mean age range 73–84, Hip fracture</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Blankevoort CG, van Heuvelen MJ, Boersma F, Luning H, de Jong J, Scherder EJ. Review of effects of physical activity on strength, balance, mobility and ADL performance in elderly subjects with dementia. Dement Geriatr Cogn Disord. 2010;30(5):392-402. doi:10.1159/000321357.</td></tr>
<tr><td>Purpose: To investigate whether PA can improve mobility, lower-extremity strength, balance, walking endurance, and basic activities of daily living in elderly individuals with dementia.</td><td rowspan="4">Abstract: BACKGROUND/AIMS: Elderly individuals with dementia are vulnerable for a decline in physical functioning and basic activities of daily living (BADL) which can lead to a decline in autonomy and participation. This study reviews the effect of physical activity on physical functioning and BADL in elderly subjects with dementia. METHODS: A systematic search of the literature was performed. Key words related to the elderly, dementia, exercise interventions and physical outcome measures were used. RESULTS: Sixteen studies were included. It was found that physical activity was beneficial in all stages of dementia. Multicomponent interventions (e.g. a combination of endurance, strength and balance) led to larger improvements in gait speed, functional mobility and balance, compared to progressive resistance training alone. BADL and endurance improved but were only assessed in multicomponent interventions. Lower-limb strength improved equally in multicomponent interventions and progressive resistance training. CONCLUSION: Multicomponent interventions can improve physical functioning and BADL in elderly subjects regardless of the stage of dementia. The best results were obtained in the interventions with the largest training volume. However, the small number of high-quality studies, and heterogeneity of the participants and interventions prevent us from drawing firm conclusions. Recommendations are given with respect to methodological issues, further research and practical guidelines.</td></tr>
<tr><td>Timeframe: Inception–March 2010</td></tr>
<tr><td>Total # of Studies: 16</td></tr>
<tr><td>Exposure Definition: Interventions included aerobic, resistance, balance, or a combination of training types. Duration ranged from 3 weeks to 12 months, with session duration and frequency ranging from 2 to 5 times per week.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Functional outcomes: gait speed, endurance, functional mobility, lower-extremity, balance (ADL, 6-minute walk test, sit-to-stand test, Berg balance scale, Timed Up and Go test).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Older adults, Dementia</td><td>Author-Stated Funding Source: Open Ankh.</td></tr>
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<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Brett L, Traynor V, Stapley P. Effects of physical exercise on health and well-being of individuals living with a dementia in nursing homes: a systematic review. J Am Med Dir Assoc. 2016;17(2):104-116. doi:10.1016/j.jamda.2015.08.016.</td></tr>
<tr><td>Purpose: To evaluate evidence from randomized controlled trials (RCTs) and cluster RCTs measuring the effects of physical exercise on the health and well-being of individuals living with dementia in nursing homes.</td><td rowspan="5">Abstract: BACKGROUND: Physical exercise interventions have benefits for older individuals and improve the health and well-being of individuals living with a dementia, specifically those living in nursing homes. PURPOSE: Report evidence from randomized controlled trials and cluster randomized control trials that evaluated the effects of physical exercise interventions on individuals living with a dementia in nursing homes. DATA SOURCES: Web of Science, Scopus, Science Direct, Academic Search Complete, Proquest Central, British Medical Journal Database, PubMed, Cochrane Library, PEDro, Informit, Informa, and Nursing Consult were searched for relevant clinical trials and snowballing of recommended studies. STUDY SELECTION: One reviewer screened articles on inclusion criteria and identified relevant studies. DATA EXTRACTION: Data extraction was performed by 1 reviewer and checked by second and third reviewers. Two authors assessed the methodological quality and risk of bias of the relevant studies. DATA SYNTHESIS: Twelve study populations consisting of individuals living with a dementia in nursing homes were included (n = 901). Different types of physical exercises were undertaken: multimodal (n = 6), walking (n = 5), music and movement (n = 2), and hand exercises (n = 1). The parameters of the interventions varied across the studies. Most of the studies reported significant positive effects of physical exercise on cognition, agitation, mood, mobility, and functional ability for individuals living with dementia in nursing homes. LIMITATIONS: The main limitations were the heterogeneity of design, small samples, and short interventions. CONCLUSIONS: There is emerging evidence that physical exercise significantly benefits individuals living with a dementia in nursing homes. Higher quality research is required adopting more rigorous methods, including longer interventions and larger samples to determine optimum parameters of the physical exercise interventions evaluated.</td></tr>
<tr><td>Timeframe: Not reported</td></tr>
<tr><td>Total # of Studies: 12 total (7 only addressing mobility, balance, and/or functional ability)</td></tr>
<tr><td>Exposure Definition: Multi-modal, walking, or hand exercise interventions. Duration ranged from 4 to 52 weeks, and the mean frequency was 4.5 times per week, with interventions lasting 49.3 minutes on average.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Mobility: 6-meter walk test, 6-minute walk test. Balance: Get up and Go Test. Functional ability: Barthel Index.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults Mean age 82.6, Dementia</td><td>Author-Stated Funding Source: University of Wollongong PhD Scholarship and the Illawarra Health and Medical Research Institute Dementia Summer Scholarship.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson‘s Disease</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Brienesse LA, Emerson MN. Effects of resistance training for people with Parkinson’s disease: a systematic review. J Am Med Dir Assoc. 2013;14(4):236-241. Doi:10.1016/j.jamda.2012.11.012.</td></tr>
<tr><td>Purpose: To provide a synthesis of the evidence from controlled trials to determine whether resistance training is effective for the treatment of Parkinson’s disease.</td><td rowspan="5">Abstract: BACKGROUND: Parkinson‘s disease (PD) is a debilitating chronic progressive neurodegenerative disorder. Currently, the treatments for PD are medications to control symptoms, however, the consequences of these motor symptoms cannot be fully eliminated and disability remains. Resistance exercise programs may be an effective strategy to delay or reverse functional decline for people with PD. The aim of this systematic review was to provide a synthesis of the evidence from controlled trials to determine whether resistance training is effective for the treatment of PD. METHOD: A comprehensive systematic database search was performed including Medline, Embase, Cinahl, SportDiscus, AMED, Pedro, and PreMedline. Studies were then assessed for potential inclusion. Study quality indicators, cohort characteristics, interventions, and muscle strength and functional performance outcomes were extracted. RESULTS: Five studies were reviewed; three were randomized controlled trials (RCTs) and two were nonrandomized controlled trials. In general, the quality of the studies was moderately robust, with the three RCTs scoring 7-9, whereas the other two studies scored 4 and 6 out of 11 quality criteria. Resistance training was shown to have a positive effect in both muscle strength outcomes as well as functional outcomes related to mobility in this population. Resistance training was shown to increase fat free mass, muscle strength, and endurance as well as improve mobility and performance in functional tasks in this population. CONCLUSION: RCTs of robust design prescribing resistance training using thorough, standardized reporting of interventions and outcomes are needed. Further research is needed to identify the ideal prescription of resistance training needed to elicit improvements in strength and functional outcomes.</td></tr>
<tr><td>Timeframe: Inception–September 2012</td></tr>
<tr><td>Total # of Studies: 5</td></tr>
<tr><td>Exposure Definition: Upper and lower body resistance training using weight machines, free weights, and resistance bands at a moderate to high intensity that varied in rep/set schemes. Program length ranged from 8–12 weeks performed 1–3 times per week for 45–60 minutes.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Functional tasks: 6-minute walk test, stair descent, chair stand, stride length, Timed Up and Go test, Activities-Specific Balance Confidence balance score.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age >18, Parkinson’s disease</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Burge E, Kuhne N, Berchtold A, Maupetit C, von Gunten A . Impact of physical activity on activity of daily living in moderate to severe dementia: a critical review. Eur Rev Aging Phys Act. 2012;9(1):27-39.</td></tr>
<tr><td>Purpose: To describe the different types of PA programs designed for patients with moderate to severe dementia and to identify the impact of these activities on functional independence in activities of daily living.</td><td rowspan="4">Abstract: The objectives of this study were to describe the different modalities of physical activity programs designed for moderate to severe dementia and to identify their impact on functional independence in activities of daily living (ADL). A critical review of randomized controlled trials related to the impact of physical activity programs in moderately to severely demented persons on ADL performance and meta-analysis of the identified studies were performed. Among the 303 identified articles, five responded to the selection criteria. Four out of the five studies demonstrated limited methodological quality. In one high-quality study, physical activity programs significantly delayed deterioration of ADL performance. The program components and ADL assessment tools vary widely across studies. Although the proposed treatments have not proven their efficiency in improving the ADL status of the patients, they were able to limit the decline in ADL functioning. Future research is warranted in order to identify clinically relevant modalities for physical activity programs for people with moderate to severe dementia.</td></tr>
<tr><td>Timeframe: Inception–2009</td></tr>
<tr><td>Total # of Studies: 5</td></tr>
<tr><td>Exposure Definition: The most frequent interventions were strength training, balance, gait, and endurance training. Intervention duration varied from 7 weeks to 12 months and session duration ranged from 20 to 75 minutes. Frequency ranged from biweekly to daily.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Activities of daily living: most commonly assessed using the Katz Index.
Examine Cardiorespiratory Fitness as Outcome: No</td><td></td></tr>
<tr><td>Populations Analyzed: Adults ≥75, Dementia</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Cadore EL, Rodriguez-Manas L, Sinclair A, Izquierdo M. Effects of different exercise interventions on risk of falls, gait ability, and balance in physically frail older adults: a systematic review. Rejuvenation Res. 2013;16(2):105-114. doi:10.1089/rej.2012.1397.</td></tr>
<tr><td>Purpose: To recommend training strategies that improve the functional capacity in physically frail older adults based on scientific literature, focusing specially on supervised exercise programs that improved muscle strength, fall risk, balance, and gait ability.</td><td rowspan="5">Abstract: The aim of this review was to recommend training strategies that improve the functional capacity in physically frail older adults based on scientific literature, focusing specially in supervised exercise programs that improved muscle strength, fall risk, balance, and gait ability. Scielo, Science Citation Index, MEDLINE, Scopus, Sport Discus, and ScienceDirect databases were searched from 1990 to 2012. Studies must have mentioned the effects of exercise training on at least one of the following four parameters: Incidence of falls, gait, balance, and lower-body strength. Twenty studies that investigated the effects of multi-component exercise training (10), resistance training (6), endurance training (1), and balance training (3) were included in the present revision. Ten trials investigated the effects of exercise on the incidence of falls in elderly with physical frailty. Seven of them have found a fewer falls incidence after physical training when compared with the control group. Eleven trials investigated the effects of exercise intervention on the gait ability. Six of them showed enhancements in the gait ability. Ten trials investigated the effects of exercise intervention on the balance performance and seven of them demonstrated enhanced balance. Thirteen trials investigated the effects of exercise intervention on the muscle strength and nine of them showed increases in the muscle strength. The multi-component exercise intervention composed by strength, endurance and balance training seems to be the best strategy to improve rate of falls, gait ability, balance, and strength performance in physically frail older adults.</td></tr>
<tr><td>Timeframe: 1990–September 2012</td></tr>
<tr><td>Total # of Studies: 20</td></tr>
<tr><td>Exposure Definition: Resistance training, endurance training, and balance training such as tai chi. Resistance training interventions included 1–3 sets of 6–15 repetitions, with intensity ranging from 10–90% of 1 repetition maximum. Endurance training included treadmill walking, step ups, stair climbing, and stationary cycling. Sessions ranged from 1 to 3 times per week, and lasted from 10 weeks to 1 year.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Gait was assessed with the 6-meter walk test and the Timed Up and Go Test. Balance was assessed with tandem and semi-tandem tests, Berg Balance scale, one leg stand test, and clinical test of sensory interaction and balance. Falls: validated questionnaires.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults ≥70, Frailty</td><td>Author-Stated Funding Source: Spanish Department of Health and Institute Carlos III of the Government of Spain, Department of Health of the Government of Navarre and Economy and Competitivity Department of the Government of Spain, European Commission.</td></tr>
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<table>
<tr><th colspan="2">Cardiovascular Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Chen YW, Hunt MA, Campbell KL, Peill K, Reid WD. The effect of tai chi on four chronic conditions—cancer, osteoarthritis, heart failure and chronic obstructive pulmonary disease: a systematic review and meta-analyses. Br J Sports Med. 2016;50(7):397-407. doi:10.1136/bjsports-2014-094388.</td></tr>
<tr><td>Purpose: To determine whether tai chi is an effective PA that improves symptoms, physical function, quality of life, and depression in cancer, osteoarthritis, heart failure, and obstructive pulmonary disease.</td><td rowspan="5">Abstract: BACKGROUND: Many middle-aged and older persons have more than one chronic condition. Thus, it is important to synthesise the effectiveness of interventions across several comorbidities. The aim of this systematic review was to summarise current evidence regarding the effectiveness of Tai Chi in individuals with four common chronic conditions-cancer, osteoarthritis (OA), heart failure (HF) and chronic obstructive pulmonary disease (COPD). METHODS: 4 databases (MEDLINE, EMBASE, CINAHL and SPORTDiscus) were searched for original articles. Two reviewers independently screened the titles and abstracts and then conducted full-text reviews, quality assessment and finally data abstraction. 33 studies met the inclusion criteria. Meta-analyses were performed on disease-specific symptoms, physiological outcomes and physical performance of each chronic condition. Subgroup analyses on disease-specific symptoms were conducted by categorising studies into subsets based on the type of comparison groups. RESULTS: Meta-analyses showed that Tai Chi improved or showed a tendency to improve physical performance outcomes, including 6-min walking distance (6MWD) and knee extensor strength, in most or all four chronic conditions. Tai Chi also improved disease-specific symptoms of pain and stiffness in OA. CONCLUSIONS: The results demonstrated a favourable effect or tendency of Tai Chi to improve physical performance and showed that this type of exercise could be performed by individuals with different chronic conditions, including COPD, HF and OA.</td></tr>
<tr><td>Timeframe: Inception–December 2014</td></tr>
<tr><td>Total # of Studies: 33 (21 included in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Any form of tai chi; for example, modified tai chi or qigong tai chi. Sessions ranged from 6 to 24 weeks in duration. Session length ranged from 30 to 90 minutes and sessions were usually offered 2–3 times per week.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Six-minute walk distance. Timed Up and Go. Quality of life. Symptoms of chronic conditions.
Examine Cardiorespiratory Fitness as Outcome: Yes</td></tr>
<tr><td>Populations Analyzed: Adults Mean age 53.9–72.3, Cancer, Chronic obstructive pulmonary disease (COPD), Osteoarthritis, Heart failure</td><td>Author-Stated Funding Source: University of British Columbia and British Columbia Lung Association.</td></tr>
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<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Chin A Paw MJ, van Uffelen JG, Riphagen I, van Mechelen W. The functional effects of physical exercise training in frail older people: a systematic review. Sports Med. 2008;38(9):781-793.</td></tr>
<tr><td>Purpose: To examine the effects of individual high-intensity resistance training in laboratory settings.</td><td rowspan="4">Abstract: This systematic review describes the effect of exercise training on physical performance in frail older people. Randomized controlled trials were identified from searches in PubMed, EMBASE and CENTRAL from January 1995 through August 2007. Two reviewers independently screened the trials for eligibility, rated their quality, and extracted data. Randomized controlled trials that examined the effects on performance-based measures of physical function among frail older adults were included. The systematic search identified 20 studies, examining 23 different exercise programmes. The methodological quality score (0-9) of the trials ranged from 2 to 7 points. Sixteen of the studies were scored as high quality. There was a large variety in the studies concerning sample size, degree of frailty, types of interventions and types of assessments. The majority of the programmes were facility-based, group-exercise programmes that were performed three times a week for 45-60 minutes. The intervention programmes comprised resistance training (n = 9), Tai Chi training (n = 2), or multi-component training (n = 12). Six of the total selected 20 studies did not find a beneficial exercise effect on functional performance. This systematic review suggests that older adults with different levels of abilities can improve their functional performance by regular exercise training. To determine the most appropriate design of the exercise programme (type, intensity, frequency and duration of exercise) for functional improvement or prevention of loss of function, more high-quality trials are needed in which different training protocols are compared.</td></tr>
<tr><td>Timeframe: 1995–August 2007</td></tr>
<tr><td>Total # of Studies: 20</td></tr>
<tr><td>Exposure Definition: Resistance training (RT), tai chi, or multi-component training (RT with endurance, flexibility, and balance exercises). The majority or the programs were performed 3 times a week and lasted between 10 weeks and 28 months.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Balance (Berg Balance Scale), gait (6-minute timed walk test), and others (Get-Up-and-Go test, chair stands, box steps).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults Mean age 77–88, Frail</td><td>Author-Stated Funding Source: EMGO Institute, Department of Public and Occupational Health, VU University Medical Center, Amsterdam, the Netherlands, and Body@Work, Research Center Physical Activity, Work and Health, TNO-VU University Medical Center, Amsterdam, the Netherlands.</td></tr>
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<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Chou CH, Hwang CL, Wu YT. Effect of exercise on physical function, daily living activities, and quality of life in the frail older adults: a meta-analysis. Arch Phys Med Rehabil. 2012;93(2):237-244. doi:10.1016/j.apmr.2011.08.042.</td></tr>
<tr><td>Purpose: To determine the effects of exercise training on frail older adult subjects, specifically on physical functions, performance on activities of daily living, and quality of life.</td><td rowspan="5">Abstract: OBJECTIVES: To determine the effect of exercise on the physical function, activities of daily living (ADLs), and quality of life (QOL) of the frail older adults. DATA SOURCES: Relevant articles published between 2001 and June 2010 were searched in PubMed, MEDLINE, EMBASE, the Chinese Electronic Periodical Service, CINAHL, and the Cochrane Library databases. STUDY SELECTION: The participants were selected based on the predetermined frailty criteria and randomly assigned to either an exercise or control group. The intervention for the exercise group was a single or comprehensive exercise training program, whereas usual care was provided to the control group. DATA EXTRACTION: The characteristics and outcome measures of the included studies were identified independently by 2 investigators. DATA SYNTHESIS: The effect sizes of physical function assessed by the timed up and go test, gait speed, the Berg Balance Scale (BBS), the ADL questionnaires, and QOL measured by the Medical Outcomes Study 36-Item Short-Form Health Survey were calculated, using a weighted mean difference (WMD) and a 95% confidence interval (CI) to represent the results. Compared with the control group, the exercise group increased their gait speed by .07 m/s (95% CI .02-.11), increased their BBS score (WMD=1.69; 95% CI .56-2.82), and improved their performance in ADLs (WMD=5.33; 95% CI 1.01-9.64). The exercise intervention had no significant effects on the Timed Up & Go test performance and the QOL between the groups. CONCLUSIONS: Exercise is beneficial to increase gait speed, improve balance, and improve performance in ADLs in the frail older adults.</td></tr>
<tr><td>Timeframe: 2001–June 2010</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Flexibility, resistance training, aerobics, balance, tai chi, repetitive performance of activities of daily living, and task oriented or gait training. Most programs were 60–90 minute sessions, repeated daily or weekly for 3 to 12 months. These sessions took place under supervision in facilities, communities, or under home-based exercise training.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Weighted mean difference of physical function (Timed Up and Go, gait speed, Berg Balance Scale) and Activities of Daily Living (questionnaire or reliability inventory).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age 75.3–86.8, Frail</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Chung CL, Thilarajah S, Tan D. Effectiveness of resistance training on muscle strength and physical function in people with Parkinson's disease: a systematic review and meta-analysis. Clin Rehabil. 2016;30(1):11-23. doi:10.1177/0269215515570381.</td></tr>
<tr><td>Purpose: To identify the exclusive effects of resistance training on physical function and balance in people with Parkinson's Disease.</td><td rowspan="4">Abstract: OBJECTIVES: To systematically review the evidence investigating the effectiveness of resistance training on strength and physical function in people with Parkinson's disease. DATA SOURCES: Seven electronic databases (COCHRANE, CINAHL, Medline ISI, Psycinfo, Scopus, Web of Science ISI and Embase) were systematically searched for full-text articles published in English between 1946 and November 2014 using relevant search terms. REVIEW METHODS: Only randomized controlled trials investigating the effects of resistance training on muscle strength and physical function in people with Parkinson's disease were considered. The PEDro scale was used to assess study quality. Studies with similar outcomes were pooled by calculating standardized mean differences (SMD) using fixed or random effects model, depending on study heterogeneity. RESULTS: Seven studies, comprising of 401 participants with early to advanced disease (Hoehn & Yahr stage 1 to 4), were included. The median quality score was 6/10. The meta-analyses demonstrated significant SMD in favour of resistance training compared to non-resistance training or no intervention controls for muscle strength (0.61; 95% CI, 0.35 to 0.87; P <0.001), balance (0.36; 95% CI, 0.08 to 0.64; P = 0.01) and parkinsonian motor symptoms (0.48; 95% CI, 0.21 to 0.75; P < 0.001) but not for gait, balance confidence and quality of life. CONCLUSION: This review demonstrates that moderate intensity progressive resistance training, 2-3 times per week over 8-10 weeks can result in significant strength, balance and motor symptoms gains in people with early to moderate Parkinson's disease.</td></tr>
<tr><td>Timeframe: 1946–November 2014</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Exercise included was resistance training. Resistance training was supervised for most programs. There were varying levels of intensity and repetitions used in the exercise programs. Programs ranged from 8 weeks to 2 years, with most exercises performed 2–3 times per week.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Balance: maximum balance range and self reported balance confidence. Gait: gait speed and Timed Up and Go. Parkinson's motor symptoms: Unified Parkinson's Disease Rating Scale; Quality of Life: Parkinson's Disease Questionnaire. Strength: lower limb strength and various measures.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults Mean age 58, Parkinson's disease</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Clegg AP, Barber SE, Young JB, Forster A, Iliffe SJ. Do home-based exercise interventions improve outcomes for frail older people? Findings from a systematic review. Rev Clin Gerontol. 2012;22(1):68-78. doi:10.1017/S0959259811000165.</td></tr>
<tr><td>Purpose: To evaluate whether home-based exercise interventions improve outcomes for frail older people.</td><td rowspan="5">Abstract: Background
Frailty is common in older age, and is associated with important adverse health outcomes including increased risk of disability and long-term care admission.
Objectives
To evaluate whether home-based exercise interventions improve outcomes for frail older people.
Data sources
We searched systematically for randomised controlled trials (RCTs) and cluster RCTs, with literature searching to February 2010.
Study selection
All trials that evaluated home-based exercise interventions for frail older people were eligible. Primary outcomes were mobility, quality of life and daily living activities. Secondary outcomes included long-term care admission and hospitalisation.
Results
Six RCTs involving 987 participants met the inclusion criteria. Four trials were considered of high quality. One high quality trial reported improved disability in those with moderate but not severe frailty. Meta-analysis of long-term care admission rates identified a trend towards reduced risk. Inconsistent effects on other primary and secondary outcomes were reported in the other studies.
Conclusions
There is preliminary evidence that home-based exercise interventions may improve disability in older people with moderate, but not severe, frailty. There is considerable uncertainty regarding effects on important outcomes including quality of life and long-term care admission. Home-based exercises are a potentially simple, safe and widely applicable intervention to prevent dependency decline for frail older people.</td></tr>
<tr><td>Timeframe: Inception–February 2010</td></tr>
<tr><td>Total # of Studies: 6 total (1 only addressing quality of life outcome)</td></tr>
<tr><td>Exposure Definition: Home-based exercise interventions including progressive resistance training, combined program with resistance and aerobic training, and multi-modal programs. Modal treatment frequency was three times per week (range 3–21 sessions per week). Modal treatment duration was 6 months (mean 28 weeks, range 6 weeks–18 months).
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Mobility (Timed Up and Go), Activities of Daily Living, falls, muscle strength, balance, bone strength, and balance. Risk ratio of long-term care admission.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults Mean age range 78–88, Frail</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Crizzle AM, Newhouse IJ. Is physical exercise beneficial for persons with Parkinson's disease?. Clin J Sport Med. 2006;16(5):422-425.</td></tr>
<tr><td>Purpose: To review existing studies evaluating the effectiveness of physical exercise on mortality, strength, balance, mobility, and activities of daily living for sufferer's of Parkinson's Disease.</td><td rowspan="5">Abstract: OBJECTIVE: To review existing studies evaluating the effectiveness of physical exercise on mortality, strength, balance, mobility, and activities of daily living (ADL) for sufferers of Parkinson's disease (PD). DATA SOURCES: The following databases were searched (1) Cochrane Database of Systematic Reviews, (2) Cumulative Index to Nursing and Allied Health Literature (CINAHL), (3) PubMed and (4) Medline/NARIC (National Rehabilitation Information Center) using combinations of key words Parkinson's disease and physical exercise. Only articles written in English were included. References cited were also examined. STUDY SELECTION: Studies were eligible if (1) only patients with PD were included in the intervention study (there were many studies that evaluated the benefits of exercise after stroke, cardiac arrest, sports injuries, surgery, and arthritis, but only a few for patients with PD), (2) the intervention included some form of physical or therapeutic exercise, (3) the effects of the physical exercise were evaluated, and (4) the studies were published in a refereed journal. Because few studies were found that dealt with PD patients exclusively, all studies that evaluated the effectiveness of physical exercise for only PD patients were included. Seven studies met our criteria and were selected. Three of the selected studies were randomized controlled studies, 1 was an open trial, and the other 3 relied on patients' own assessments. DATA SYNTHESIS: Outcomes in the studies were measured in terms of physical improvements in patients with PD, such as improved axial rotation, functional reach, flexibility, balance, muscle strength, short-step gait, and mobility. All studies reviewed show that exercise improves overall performance in PD patients. Improvements were measured using standardized tests and other measurement scales. CONCLUSIONS: The results of the present research synthesis support the hypothesis that patients with PD improve their physical performance and activities of daily living through exercise. Future studies should include the development of standardized exercise programs specific for problems associated with PD as well as standardized testing methods for measuring improvements in PD patients. There is also a need for longer term studies (over 1 year) to assess if improvements achieved during the intervention stage are retained long term.</td></tr>
<tr><td>Timeframe: Not reported</td></tr>
<tr><td>Total # of Studies: 7</td></tr>
<tr><td>Exposure Definition: Exercise varied from exercise, balance, resistance training, pole striding, and body weight supported treadmill training. Length of program varied from 4 to 14 weeks, or up to 4 years. Duration and frequency of exercise varied between programs.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed:
Physical function: Unified Parkinson's Disease Rating Scale, Parkinson's disease questionnaire, ambulation speed, gait velocity, Basic Motor Test, and Sickness Impact Profile.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed:
Parkinson's disease</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Cruickshank TM, Reyes AR, Ziman MR. A systematic review and meta-analysis of strength training in individuals with multiple sclerosis or Parkinson disease. Medicine (Baltimore). 2015;94(4):e411. doi:10.1097/MD.0000000000000411.</td></tr>
<tr><td>Purpose: To explore whether differences in response to strength training exist between individuals with multiple sclerosis or Parkinson's Disease.</td><td rowspan="5">Abstract: Strength training has, in recent years, been shown to be beneficial for people with Parkinson disease and multiple sclerosis. Consensus regarding its utility for these disorders nevertheless remains contentious among healthcare professionals. Greater clarity is required, especially in regards to the type and magnitude of effects as well as the response differences to strength training between individuals with Parkinson disease or multiple sclerosis. This study examines the effects, magnitude of those effects, and response differences to strength training between patients with Parkinson disease or multiple sclerosis. A comprehensive search of electronic databases including Physiotherapy Evidence Database scale, PubMed, EMBASE, Cochrane Central Register of Controlled Trials, and CINAHL was conducted from inception to July 2014. English articles investigating the effect of strength training for individuals with neurodegenerative disorders were selected. Strength training trials that met the inclusion criteria were found for individuals with Parkinson disease or multiple sclerosis. Individuals with Parkinson disease or multiple sclerosis were included in the study. Strength training interventions included traditional (free weights/machine exercises) and nontraditional programs (eccentric cycling). Included articles were critically appraised using the Physiotherapy Evidence Database scale. Of the 507 articles retrieved, only 20 articles met the inclusion criteria. Of these, 14 were randomized and 6 were nonrandomized controlled articles in Parkinson disease or multiple sclerosis. Six randomized and 2 nonrandomized controlled articles originated from 3 trials and were subsequently pooled for systematic analysis. Strength training was found to significantly improve muscle strength in people with Parkinson disease (15%-83.2%) and multiple sclerosis (4.5%-36%). Significant improvements in mobility (11.4%) and disease progression were also reported in people with Parkinson disease after strength training. Furthermore, significant improvements in fatigue (8.2%), functional capacity (21.5%), quality of life (8.3%), power (17.6%), and electromyography activity (24.4%) were found in individuals with multiple sclerosis after strength training. The limitations of the study were the heterogeneity of interventions and study outcomes in Parkinson disease and multiple sclerosis trials. Strength training is useful for increasing muscle strength in Parkinson disease and to a lesser extent multiple sclerosis.</td></tr>
<tr><td>Timeframe: Inception–July 2014</td></tr>
<tr><td>Total # of Studies: 20 (12 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Strength training; training protocols ranged from 2 to 24 months, 2–5 times per week.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Strength, functional mobility, balance, functional capacity, quality of life, and falls.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Parkinson's disease or multiple sclerosis</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Cruz-Jentoft AJ, Landi F, Schneider SM, et al. Prevalence of and interventions for sarcopenia in ageing adults: a systematic review. Report of the International Sarcopenia Initiative (EWGSOP and IWGS). Age Ageing. 2014;43(6):748-759. doi:10.1093/ageing/afu115.</td></tr>
<tr><td>Purpose: To review interventions with nutrition and exercise that used both muscle mass and muscle function as outcomes.</td><td rowspan="5">Abstract: OBJECTIVE: to examine the clinical evidence reporting the prevalence of sarcopenia and the effect of nutrition and exercise interventions from studies using the consensus definition of sarcopenia proposed by the European Working Group on Sarcopenia in Older People (EWGSOP). METHODS: PubMed and Dialog databases were searched (January 2000-October 2013) using pre-defined search terms. Prevalence studies and intervention studies investigating muscle mass plus strength or function outcome measures using the EWGSOP definition of sarcopenia, in well-defined populations of adults aged >/=50 years were selected. RESULTS: prevalence of sarcopenia was, with regional and age-related variations, 1-29% in community-dwelling populations, 14-33% in long-term care populations and 10% in the only acute hospital-care population examined. Moderate quality evidence suggests that exercise interventions improve muscle strength and physical performance. The results of nutrition interventions are equivocal due to the low number of studies and heterogeneous study design. Essential amino acid (EAA) supplements, including approximately 2.5 g of leucine, and beta-hydroxy beta-methylbutyric acid (HMB) supplements, show some effects in improving muscle mass and function parameters. Protein supplements have not shown consistent benefits on muscle mass and function. CONCLUSION: prevalence of sarcopenia is substantial in most geriatric settings. Well-designed, standardised studies evaluating exercise or nutrition interventions are needed before treatment guidelines can be developed. Physicians should screen for sarcopenia in both community and geriatric settings, with diagnosis based on muscle mass and function. Supervised resistance exercise is recommended for individuals with sarcopenia. EAA (with leucine) and HMB may improve muscle outcomes.</td></tr>
<tr><td>Timeframe: 2000–October 2013</td></tr>
<tr><td>Total # of Studies: 7 exercise</td></tr>
<tr><td>Exposure Definition: Exercise interventions: resistance training, combined exercise/PA interventions (with different blends of aerobic, resistance, flexibility, and/or balance training).
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical performance: stair climbing, chair rise, 12-minute walk, Timed Up and Go.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults >50</td><td>Author-Stated Funding Source: Abbott Nutrition.</td></tr>
</table>

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Daniels R, van Rossum E, de Witte L, Kempen GI, van den Heuvel W. Interventions to prevent disability in frail community-dwelling elderly: a systematic review. BMC Health Serv Res. 2008;8:278. doi:10.1186/1472-6963-8-278.</td></tr>
<tr><td>Purpose: To assess the content, the methodological quality, and the effectiveness of intervention studies for the prevention of disability in community-dwelling physically frail elderly.</td><td rowspan="5">Abstract: Background: There is an interest for intervention studies aiming at the prevention of disability in community-dwelling physically frail older persons, though an overview on their content, methodological quality and effectiveness is lacking. Methods: A search for clinical trials involved databases PubMed, CINAHL and Cochrane Central Register of Controlled Trials and manually hand searching. Trials that included community-dwelling frail older persons based on physical frailty indicators and used disability measures for outcome evaluation were included. The selection of papers and data-extraction was performed by two independent reviewers. Out of 4602 titles, 10 papers remained that met the inclusion criteria. Of these, 9 were of sufficient methodological quality and concerned 2 nutritional interventions and 8 physical exercise interventions. Results: No evidence was found for the effect of nutritional interventions on disability measures. The physical exercise interventions involved 2 single-component programs focusing on lower extremity strength and 6 multi-component programs addressing a variety of physical parameters. Out of 8 physical exercise interventions, three reported positive outcomes for disability. There was no evidence for the effect of single lower extremity strength training on disability. Differences between the multi-component interventions in e.g. individualization, duration, intensity and setting hamper the interpretation of the elements that consistently produced successful outcomes. Conclusion:There is an indication that relatively long-lasting and high-intensive multicomponent exercise programs have a positive effect on ADL and IADL disability for community-living moderate physically frail older persons. Future research into disability prevention in physical frail older persons could be directed to more individualized and comprehensive programs.</td></tr>
<tr><td>Timeframe: Inception–May 2007</td></tr>
<tr><td>Total # of Studies: 10 (8 only addressing PA exposure)</td></tr>
<tr><td>Exposure Definition: Multi-component (endurance, flexibility, balance, and strength) or single component interventions (lower extremity strength). Most interventions lasted from 10 weeks to 18 months.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Disability status, activities of daily living, instrumental activities of daily living, strength, mobility, and balance. Sub groups: moderate and severe frailty.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults Mean age 76–83, Frail</td><td>Author-Stated Funding Source: Zuyd University of Applied Sciences.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: de Dreu MJ, van der Wilk AS, Poppe E, Kwakkel G, van Wegen EE. Rehabilitation, exercise therapy and music in patients with Parkinson's disease: a meta-analysis of the effects of music-based movement therapy on walking ability, balance and quality of life. Parkinsonism Relat Disord. 2012;18(suppl 1):S114-S119. doi:10.1016/S1353-8020(11)70036-0.</td></tr>
<tr><td>Purpose: To assess the efficacy of music-based movement (MbM) therapy in people with Parkinson's disease (PD).</td><td rowspan="5">Abstract: Recent evidence suggests that music-based movement (MbM) therapy may be a promising intervention to improve gait and gait-related activities in Parkinson's disease (PD) patients, because it naturally combines cognitive movement strategies, cueing techniques, balance exercises and physical activity while focussing on the enjoyment of moving on music instead of the current mobility limitations of the patient. A meta-analysis of RCTs on the efficacy of MbM-therapy, including individual rhythmic music training and partnered dance classes, was performed. Identified studies (K = 6) were evaluated on methodological quality, and summary effect sizes (SES) were calculated. Studies were generally small (total N= 168). Significant homogeneous SESs were found for the Berg Balance Scale, Timed Up and Go test and stride length (SESs: 4.1,2.2,0.11; P-values <0.01; I(2) 0,0,7%, respectively). A sensitivity analysis on type of MbM-therapy (dance- or gait-related interventions) revealed a significant improvement in walking velocity for gait-related MbM-therapy, but not for dance-related MbM-therapy. No significant effects were found for UPDRS-motor score, Freezing of Gait and Quality of Life. Overall, MbM-therapy appears promising for the improvement of gait and gait-related activities in PD. Future studies should incorporate larger groups and focus on long-term compliance and follow-up.</td></tr>
<tr><td>Timeframe: Inception–August 2011</td></tr>
<tr><td>Total # of Studies: 6</td></tr>
<tr><td>Exposure Definition: Music-based movement therapies consisting of dance, walking to music, or tai chi for typically 1–2 hours per week over the course of 10–13 weeks.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Walking ability: walking velocity, Unified Parkinson's Disease Rating Scale - Motor Score, and stride length. Balance: assessed by the Berg Balance Scale, and Timed Up and Go.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Older adults, Parkinson's disease</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

Frailty	
Systematic Review **Citation:** de Labra C, Guimaraes-Pinheiro C, Maseda A, Lorenzo T, Millán-Calenti JC. Effects of physical exercise interventions in frail older adults: a systematic review of randomized controlled trials. *BMC Geriatr.* 2015;15:154. doi:10.1186/s12877-015-0155-4.	
Purpose: To investigate the benefits of exercise programs in frail elderly people, considering only those studies where frailty had been defined. **Timeframe:** 2003–June 2015 **Total # of Studies:** 9 **Exposure Definition:** Aerobic fitness (including functional walking, daily mobility, tai chi) or resistance training (including weight bearing for better balance, progressive resistance training, balance and strength exercises, and functional-based circuit training) for the intervention. All interventions lasted at least 6 months, ranged from 2 to 3 times per week, and sessions ranged from 20 to 90 minutes long. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No **Outcomes Addressed:** Cohen's d of falls, mobility (Timed Up and Go, performance oriented mobility), balance (static balance tests), functional ability (Barthel Index, Groningen Activity Restriction Scale), muscle strength, body composition (total body fat, fat-free mass, muscle tissue attenuation), and frailty status (Fried's criteria). **Examine Cardiorespiratory Fitness as Outcome:** No	**Abstract:** BACKGROUND: Low physical activity has been shown to be one of the most common components of frailty, and interventions have been considered to prevent or reverse this syndrome. The purpose of this systematic review of randomized, controlled trials is to examine the exercise interventions to manage frailty in older people. METHODS: The PubMed, Web of Science, and Cochrane Central Register of Controlled Trials databases were searched using specific keywords and Medical Subject Headings for randomized, controlled trials published during the period of 2003-2015, which enrolled frail older adults in an exercise intervention program. Studies where frailty had been defined were included in the review. A narrative synthesis approach was performed to examine the results. The Physiotherapy Evidence Database (PEDro scale) was used to assess the methodological quality of the selected studies. RESULTS: Of 507 articles, nine papers met the inclusion criteria. Of these, six included multi-component exercise interventions (aerobic and resistance training not coexisting in the intervention), one included physical comprehensive training, and two included exercises based on strength training. All nine of these trials included a control group receiving no treatment, maintaining their habitual lifestyle or using a home-based low level exercise program. Five investigated the effects of exercise on falls, and among them, three found a positive impact of exercise interventions on this parameter. Six trials reported the effects of exercise training on several aspects of mobility, and among them, four showed enhancements in several measurements of this outcome. Three trials focused on the effects of exercise intervention on balance performance, and one demonstrated enhanced balance. Four trials investigated functional ability, and two showed positive results after the intervention. Seven trials investigated the effects of exercise intervention on muscle strength, and five of them reported increases; three trials investigated the effects of exercise training on body composition, finding improvements in this parameter in two of them; finally, one trial investigated the effects of exercise on frailty using Fried's criteria and found an improvement in this measurement. Exercise interventions have demonstrated improvement in different outcome measurements in frail older adults, however, there were large differences between studies with regard to effect sizes. CONCLUSIONS: This systematic review suggested that frail older adults seemed to benefit from exercise interventions, although the optimal program remains unclear. More studies of this topic and

	with frail populations are needed to select the most favorable exercise program.
Populations Analyzed: Adults Mean age 82.5, Frailty	**Author-Stated Funding Source:** Not reported.

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: de Vries NM, van Ravensberg CD, Hobbelen JS, Olde Rikkert MG, Staal JB, Nijhuis-van der Sanden MW. Effects of physical exercise therapy on mobility, physical functioning, physical activity and quality of life in community-dwelling older adults with impaired mobility, physical disability and/or multi-morbidity: a meta-analysis. Ageing Res Rev. 2012;11(1):136-149. doi:10.1016/j.arr.2011.11.002.</td></tr>
<tr><td>Purpose: To give an overview of physical exercise therapy interventions and to assess the effect of these interventions on mobility, physical functioning, physical activity, and quality of life in elderly patients with mobility problems, disability, and/or multi-morbidity.</td><td rowspan="4">Abstract: This is the first meta-analysis focusing on elderly patients with mobility problems, physical disability and/or multi-morbidity. The aim of this study is to assess the effect of physical exercise therapy on mobility, physical functioning, physical activity and quality of life. A broad systematic literature search was performed in the databases PubMed, CINAHL, Embase, PEDro and The Cochrane Library. Relevant study characteristics were reviewed and meta-analyses using standardized mean differences (SMDs) were performed. The results show that physical exercise therapy has a positive effect on mobility (SMD final value: 0.18; 95% CI: 0.05, 0.30; SMD change value: 0.82; 95% CI: 0.54, 1.10) and physical functioning (SMD final value: 0.27; 95% CI: 0.08, 0.46; SMD change value: 2.93; 95% CI: 2.50, 3.36). High-intensity exercise interventions seem to be somewhat more effective in improving physical functioning than low-intensity exercise interventions (SMD final value: 0.22; 95% CI: -0.17, 0.62; SMD change value: 0.38; 95% CI: -0.48, 1.25). These positive effects are of great value for older adults who are already physically impaired. The effect on physical activity and quality of life was not evident and no definite conclusions on the most effective type of physical exercise therapy intervention can be drawn.</td></tr>
<tr><td>Timeframe: Inception–May 2011</td></tr>
<tr><td>Total # of Studies: 21</td></tr>
<tr><td>Exposure Definition: Interventions with exercises aimed at improving levels of mobility, strength, endurance, and balance. These included multi-component exercise programs, strength training programs, functional exercise training, and balance training. Duration of the intervention ranged from 5 weeks to 18 months.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical function: physical performance test, MacArthur scale, clinical outcomes variable scale, physical function and disability instrument. Quality of Life: 36-Item Short Form Survey physical scale. Mobility: 6-minute walk test, habitual walking speed, rapid walking speed, chair rise analysis, Timed Up and Go.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults 60–85, Frailty</td><td>Author-Stated Funding Source: Royal Dutch Society for Physical Therapy.</td></tr>
</table>

<table>
<tr><th colspan="2">Chronic Obstructive Pulmonary Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Ding M, Zhang W, Li K, Chen X. Effectiveness of t’ai chi and qigong on chronic obstructive pulmonary disease: a systematic review and meta-analysis. J Altern Complement Med. 2014;20(2):79-86. doi:10.1089/acm.2013.0087.</td></tr>
<tr><td>Purpose: To summarize and critically evaluate clinical trial evidence for the effectiveness of tai chi and qigong as complementary therapy for chronic obstructive pulmonary disease.</td><td rowspan="4">Abstract: PURPOSE: The purpose of this study is to determine the effects of Chinese traditional exercise such as t’ai chi and qigong (TCQ) on patients with chronic obstructive pulmonary disease (COPD). METHODS: All prospective, randomized, controlled clinical trials, published in English or Chinese and involving the use of TCQ by patients with COPD, were searched in 10 electronic databases from their respective inceptions to July 2012. The methodological quality of all studies was assessed using the Jadad score. The selection of studies, data extraction, and quality assessment were performed independently by two raters. RESULTS: In the results, 10 trials met the inclusion criteria and were reviewed. The meta-analysis demonstrated that compared with no exercise, TCQ had significant effects on 6-minute walk distance, forced expiratory volume in 1 second (FEV1), predicted FEV1 percentage, and St. George’s Respiratory Questionnaire score. There were no significant differences in all outcomes between TCQ and other exercise training except 6-minute walk distance. CONCLUSIONS: In conclusion, TCQ might be beneficial with respect to physical performance, lung function, remission of dyspnea, and quality of life in patients with COPD; however, caution is needed to draw a firm conclusion because of the low methodological quality of the included trials.</td></tr>
<tr><td>Timeframe: Inception–July 2012</td></tr>
<tr><td>Total # of Studies: 14</td></tr>
<tr><td>Exposure Definition: Qigong, t’ai chi, or a combination of the two, with a program duration of 3–6 months , with exercise sessions performed once to twice per day for 2–7 days per week. Each session ranged from 20 to 60 minutes.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical performance: 6-minute walking test distance.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Average age >60, Chronic obstructive pulmonary disease (COPD)</td><td>Author-Stated Funding Source: Taishan scholars project, Shandong University, Chinese General Administration of Sport.</td></tr>
</table>

<table>
<tr><th colspan="2">Post-Hip Fracture</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Diong J, Allen N, Sherrington C. Structured exercise improves mobility after hip fracture: a meta-analysis with meta-regression. Br J Sports Med. 2016;50(6):346-355. doi:10.1136/bjsports-2014-094465.
Erratum: Diong J, Allen N, Sherrington C. Correction: Structured exercise improves mobility after hip fracture: a meta-analysis with meta-regression. Br J Sports Med. 2016;50:346–355. doi: 10.1136/bjsports-2014-094465corr1</td></tr>
<tr><td>Purpose: To determine the effect of structured exercise on overall mobility (primary outcome) and particular aspects of mobility (secondary outcomes) in people after hip fracture, and to explore the association between trial-level characteristics and effects of interventions on overall mobility.</td><td rowspan="5">Abstract: OBJECTIVES: To determine the effect of structured exercise on overall mobility in people after hip fracture. To explore associations between trial-level characteristics and overall mobility. DESIGN: Systematic review, meta-analysis and meta-regression. DATA SOURCES: MEDLINE, EMBASE, CINAHL, the Cochrane Central Register of Controlled Trials, the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register and the Physiotherapy Evidence Database to May 2014. STUDY ELIGIBILITY CRITERIA, PARTICIPANTS AND INTERVENTIONS: Randomised controlled trials of structured exercise, which aimed to improve mobility compared with a control intervention in adult participants after surgery for hip fracture were included. DATA EXTRACTION AND SYNTHESIS: Data were extracted by one investigator and checked by an independent investigator. Standardised mean differences (SMD) of overall mobility were meta-analysed using random effects models. Random effects meta-regression was used to explore associations between trial-level characteristics and overall mobility. RESULTS: 13 trials included in the meta-analysis involved 1903 participants. The pooled Hedges' g SMD for overall mobility was 0.35 (95% CI 0.12 to 0.58, p=0.002) in favour of the intervention. Meta-regression showed greater treatment effects in trials that included progressive resistance exercise (change in SMD=0.58, 95% CI 0.17 to 0.98, p=0.008, adjusted R2=60%) and delivered interventions in settings other than hospital alone (change in SMD=0.50, 95% CI 0.08 to 0.93, p=0.024, adjusted R2=49%). CONCLUSIONS AND IMPLICATIONS: Structured exercise produced small improvements on overall mobility after hip fracture. Interventions that included progressive resistance training and were delivered in other settings were more effective, although the latter may have been confounded by duration of interventions.</td></tr>
<tr><td>Timeframe: Inception–May 2014</td></tr>
<tr><td>Total # of Studies: 19 (13 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Structured exercise such as high-intensity progressive resistance training, physiotherapy, aerobic exercise, and weight-bearing exercise.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Mobility, gait speed, activities of daily living, self-reported mobility, Timed Up and Go, and Berg Balance Scale.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

Parkinson's Disease	
Meta-Analysis **Citation:** Dockx K, Bekkers EM, Van den Bergh V, et al. Virtual reality for rehabilitation in Parkinson's disease. *Cochrane Database Syst Rev.* 2016;12:Cd010760. doi:10.1002/14651858.CD010760.pub2.	
Purpose: To determine the effect of virtual reality (VR) training on gait and balance and to examine the effects of VR on global motor function, activities of daily living, quality of life, cognitive function, exercise adherence, and the occurrence of adverse events. **Timeframe:** Inception–November 26, 2016 **Total # of Studies:** 7 **Exposure Definition:** Virtual reality (VR) interventions combined with physiotherapy. VR interventions consisted of computerized simulation allowing users to interact with images and virtual objects simulating exercise and/or motor rehabilitation. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No **Outcomes Addressed:** Physical function: 1) gait (both direct measures of gait, such as gait speed or step length, and clinical measures of gait, such as the Dynamic Gait Index or the Two- or Six-Minute Walk Test); 2) balance (direct measures: center of pressure behavior, and clinical measures such as the Berg Balance Scale, Timed Up and Go Test,	**Abstract:** BACKGROUND: Parkinson's disease (PD) is a neurodegenerative disorder that is best managed by a combination of medication and regular physiotherapy. In this context, virtual reality (VR) technology is proposed as a new rehabilitation tool with a possible added value over traditional physiotherapy approaches. It potentially optimises motor learning in a safe environment, and by replicating real-life scenarios could help improve functional activities of daily living. OBJECTIVES: The objective of this review was to summarise the current best evidence for the effectiveness of VR interventions for the rehabilitation of people with PD in comparison with 1) active interventions, and 2) passive interventions. Our primary goal was to determine the effect of VR training on gait and balance. Secondary goals included examining the effects of VR on global motor function, activities of daily living, quality of life, cognitive function, exercise adherence, and the occurrence of adverse events. SEARCH METHODS: We identified relevant articles through electronic searches of the Cochrane Movement Disorders Group Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL) (the Cochrane Library), MEDLINE, Embase, CINAHL, the Physiotherapy Evidence Database (PEDro), online trials registers, and by handsearching reference lists. We carried out all searches up until 26 November 2016. SELECTION CRITERIA: We searched for randomised and quasi-randomised controlled trials of VR exercise interventions in people with PD. We included only trials where motor rehabilitation was the primary goal. DATA COLLECTION AND ANALYSIS: Two review authors independently searched for trials that corresponded to the predefined inclusion criteria. We independently extracted and assessed all data for methodological quality. A third review author was responsible for conflict resolution when required. MAIN RESULTS: We included 8 trials involving 263 people with PD in the review. Risk of bias was unclear or high for all but one of the included studies. Study sample sizes were small, and there was a large amount of heterogeneity between trials with regard to study design and the outcome measures used. As a result, we graded the quality of the evidence as low or very low. Most of the studies intended to improve motor function using commercially available devices, which were compared with physiotherapy. The interventions lasted for between 4 and 12 weeks.In comparison to physiotherapy, VR may lead to a moderate improvement in step and stride length (standardised mean difference (SMD) 0.69, 95% confidence interval (CI) 0.30 to 1.08; 3 studies; 106 participants; low-quality evidence). VR and physiotherapy interventions may have similar effects on gait (SMD 0.20, 95% CI -0.14 to 0.55; 4 studies; 129 participants; low-quality evidence), balance (SMD 0.34, 95% CI -0.04 to

and Mini-Balance Evaluation Systems Test. Secondary outcomes: global motor function, activities of daily living, and quality of life. **Examine Cardiorespiratory Fitness as Outcome:** No	0.71; 5 studies; 155 participants; low-quality evidence), and quality of life (mean difference 3.73 units, 95% CI -2.16 to 9.61; 4 studies; 106 participants). VR interventions did not lead to any reported adverse events, and exercise adherence did not differ between VR and other intervention arms.The evidence available comparing VR exercise with a passive control was more limited. The evidence for the main outcomes of interest was of very low quality due to the very small sample sizes of the two studies available for this comparison. AUTHORS' CONCLUSIONS: We found low-quality evidence of a positive effect of short-term VR exercise on step and stride length. VR and physiotherapy may have similar effects on gait, balance, and quality of life. The evidence available comparing VR with passive control interventions was more limited. Additional high-quality, large-scale studies are needed to confirm these findings.
Populations Analyzed: Adults, Parkinson's disease	**Author-Stated Funding Source:** European Commission; Israel and Italy.

<table>
<tr><th colspan="2">Stroke</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Eng JJ, Tang PF. Gait training strategies to optimize walking ability in people with stroke: a synthesis of the evidence. Expert Rev Neurother. 2007;7(10):1417-1436. doi:10.1586/14737175.7.10.1417.</td></tr>
<tr><td>Purpose: To evaluate common gait training strategies (neurodevelopmental techniques, muscle strengthening, treadmill training, intensive mobility exercises) to improve walking ability.</td><td rowspan="5">Abstract: Stroke is a leading cause of long-term disability. Impairments resulting from stroke lead to persistent difficulties with walking and, subsequently, improved walking ability is one of the highest priorities for people living with a stroke. In addition, walking ability has important health implications in providing protective effects against secondary complications common after a stroke such as heart disease or osteoporosis. This paper systematically reviews common gait training strategies (neurodevelopmental techniques, muscle strengthening, treadmill training and intensive mobility exercises) to improve walking ability. The results (descriptive summaries as well as pooled effect sizes) from randomized controlled trials are presented and implications for optimal gait training strategies are discussed. Novel and emerging gait training strategies are highlighted and research directions proposed to enable the optimal recovery and maintenance of walking ability.</td></tr>
<tr><td>Timeframe: 1950–June 2007</td></tr>
<tr><td>Total # of Studies: 47</td></tr>
<tr><td>Exposure Definition: Exercise programs included neurodevelopmental techniques (rehabilitation and normal movement patterns), strength training, task specific training (treadmill and/or intensive mobility training). Programs varied in length and frequency.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Gait: walking speed, Timed Up and Go, 6-minute walk test, functional ambulation profile, and self-reported walking distance scale.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults, Stroke</td><td>Author-Stated Funding Source: Canadian Institutes of Health Research, Michael Smith Foundation for Health Research, and National Health Research Institutes.</td></tr>
</table>

<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Fang Y. Guiding research and practice: a conceptual model for aerobic exercise training in Alzheimer's disease. Am J Alzheimers Dis Other Demen. 2011;26(3):184–194. doi:10.1177/1533317511402317.</td></tr>
<tr><td>Purpose: To develop a conceptual model to guide future aerobic exercise research and practice by synthesizing the current state of the science on aerobic exercise training in older adults with Alzheimer's disease.</td><td rowspan="4">Abstract: Alzheimer's disease is a global, epidemic problem affecting mainly older adults with tremendous social and financial burdens. Older adults with Alzheimer's disease showed reduced physical activity and cognitive changes that are probably amenable to aerobic exercise training. The purpose of this paper is to develop a conceptual model to guide future aerobic exercise research and practice by synthesizing the current state of the science on aerobic exercise training in older adults with AD. The literature review found 12 qualified studies that met the eligibility criteria for inclusion in this review and revealed six constructs (aerobic exercise training, physical fitness, physical performance, activities of daily living limitations, cognition, and psychological and behavioral symptoms), which composed the Functional Impact of aerobic exercise Training in Alzheimer's disease (FIT-AD) model. The state of science on each construct in older adults with Alzheimer's disease is reviewed and summarized. The emerging evidence suggests that aerobic exercise training might positively impacts all five other constructs. The implications of the FIT-AD model for future research and practice are discussed highlighted.</td></tr>
<tr><td>Timeframe: Inception–December 2010</td></tr>
<tr><td>Total # of Studies: 12</td></tr>
<tr><td>Exposure Definition: Aerobic exercise training, defined as repetitive and rhythmic movement of large muscle groups to improve the efficiency of energy-producing systems that use oxygen. At least 2 weeks of any intensity of aerobic exercise as the sole intervention or part of a comprehensive exercise program.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Walking speed, stride length, double limb support time: 6-minute walk test, Dynamic Tinetti test. Hand function: Jebsen Total Time. Physical function: 36-item Short Form Health Survey. Get up and go test and the 1-leg balance test. Activities of daily living.
Examine Cardiorespiratory Fitness as Outcome: Yes</td></tr>
<tr><td>Populations Analyzed: Older adults, Alzheimer's Disease</td><td>Author-Stated Funding Source: National Institutes of Health.</td></tr>
</table>

<table>
<tr><th colspan="2">Cardiovascular Disease</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Floegel TA, Perez GA. An integrative review of physical activity/exercise intervention effects on function and health-related quality of life in older adults with heart failure. Geriatr Nurs. 2016;37(5):340-347. doi:10.1016/j.gerinurse.2016.04.013.</td></tr>
<tr><td>Purpose: To synthesize current tertiary PA/exercise interventions promoting improved physical function and quality of life in older adults with heart failure, and to offer recommendations to promote PA/exercise in this population to improve outcomes.</td><td rowspan="4">Abstract: This paper reviews randomized, controlled trials (RCTs) that have used a physical activity/exercise intervention in older adults with heart failure and reported outcomes of physical function and/or health-related quality of life. An integrative review was necessary because a literature search indicated no reviews have been done regarding these outcomes which are deemed very important by the older adult population. Computerized database search strategies by authors between 2002 and 2015 resulted in 163 studies, with 12 meeting inclusion criteria. Interventions were performed in clinic and home-based, group and/or individual settings with durations from three to 12 months. Interventions were varied. Common methodological weaknesses of the studies include lack of theory guiding the intervention, small sample and low minority representation. Strengths included detailed intervention methods. There was a moderate effect of interventions with no reported adverse effects. Further work is essential to identify successful strategies to support older adults with heart failure to increase their physical activity levels.</td></tr>
<tr><td>Timeframe: 2002–December 2015</td></tr>
<tr><td>Total # of Studies: 12</td></tr>
<tr><td>Exposure Definition: Intervention activities included seated exercises, treadmill use, walking at home, dancing, tai chi, resistance training, and high-intensity training. Frequency ranged from 1 to 3 sessions/week for 15–60 minutes per session. Intervention duration ranged from 3 to 12 months. Interventions were either administered in a clinic or were home-based.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical function: assessed or self-reported. Reported health-related quality of life: measured with a specific heart failure questionnaire—Minnesota Living with Heart Failure Questionnaire or Chronic Heart Failure Questionnaire or Short Form 36.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Older adults, Heart failure</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

Cognitive Impairment	
Meta-Analysis **Citation:** Forbes D, Forbes SC, Blake CM, Thiessen EJ, Forbes S. Exercise programs for people with dementia. *Cochrane Database Syst Rev.* 2015;(4):Cd006489. doi:10.1002/14651858.CD006489.pub4.	
Purpose: To determine whether exercise programs for older people with dementia improve their cognition, activities of daily living (ADLs), neuropsychiatric symptoms, depression, and mortality. **Timeframe:** Inception–October 2013 **Total # of Studies:** 18 (6 addressing ADLs) **Exposure Definition:** Combination of aerobic, strength, or balance training. Frequency ranged from 2 times per week to 7 times per week and sessions lasted 20–75 minutes. Interventions lasted 2 weeks to 18 months. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No **Outcomes Addressed:** ADLs: Barthel ADL Index, Katz Index of ADLs, and Changes in Advanced Dementia Scale. **Examine Cardiorespiratory Fitness as Outcome:** No	**Abstract:** BACKGROUND: This is an update of our previous 2013 review. Several recent trials and systematic reviews of the impact of exercise on people with dementia are reporting promising findings. OBJECTIVES: Primary objectiveDo exercise programs for older people with dementia improve their cognition, activities of daily living (ADLs), neuropsychiatric symptoms, depression, and mortality? Secondary objectivesDo exercise programs for older people with dementia have an indirect impact on family caregivers' burden, quality of life, and mortality?Do exercise programs for older people with dementia reduce the use of healthcare services (e.g. visits to the emergency department) by participants and their family caregivers? SEARCH METHODS: We identified trials for inclusion in the review by searching ALOIS (www.medicine.ox.ac.uk/alois), the Cochrane Dementia and Cognitive Improvement Group's Specialised Register, on 4 September 2011, on 13 August 2012, and again on 3 October 2013. SELECTION CRITERIA: In this review, we included randomized controlled trials in which older people, diagnosed with dementia, were allocated either to exercise programs or to control groups (usual care or social contact/activities) with the aim of improving cognition, ADLs, neuropsychiatric symptoms, depression, and mortality. Secondary outcomes related to the family caregiver(s) and included caregiver burden, quality of life, mortality, and use of healthcare services. DATA COLLECTION AND ANALYSIS: Independently, at least two authors assessed the retrieved articles for inclusion, assessed methodological quality, and extracted data. We analysed data for summary effects. We calculated mean differences or standardized mean difference (SMD) for continuous data, and synthesized data for each outcome using a fixed-effect model, unless there was substantial heterogeneity between studies, when we used a random-effects model. We planned to explore heterogeneity in relation to severity and type of dementia, and type, frequency, and duration of exercise program. We also evaluated adverse events. MAIN RESULTS: Seventeen trials with 1067 participants met the inclusion criteria. However, the required data from three included trials and some of the data from a fourth trial were not published and not made available. The included trials were highly heterogeneous in terms of subtype and severity of participants' dementia, and type, duration, and frequency of exercise. Only two trials included participants living at home.Our meta-analysis revealed that there was no clear evidence of benefit from exercise on cognitive functioning. The estimated standardized mean difference between exercise and control groups was 0.43 (95% CI -0.05 to 0.92, P value 0.08; 9 studies, 409 participants). There was very substantial heterogeneity in this analysis (I(2) value 80%), most of which we were unable to explain, and we rated the quality of this evidence as very low. We found a benefit of exercise programs on the ability of people with dementia to perform ADLs in

	six trials with 289 participants. The estimated standardized mean difference between exercise and control groups was 0.68 (95% CI 0.08 to 1.27, P value 0.02). However, again we observed considerable unexplained heterogeneity (I(2) value 77%) in this meta-analysis, and we rated the quality of this evidence as very low. This means that there is a need for caution in interpreting these findings.In further analyses, in one trial we found that the burden experienced by informal caregivers providing care in the home may be reduced when they supervise the participation of the family member with dementia in an exercise program. The mean difference between exercise and control groups was -15.30 (95% CI -24.73 to -5.87; 1 trial, 40 participants; P value 0.001). There was no apparent risk of bias in this study. In addition, there was no clear evidence of benefit from exercise on neuropsychiatric symptoms (MD -0.60, 95% CI -4.22 to 3.02; 1 trial, 110 participants; P value .0.75), or depression (SMD 0.14, 95% CI -0.07 to 0.36; 5 trials, 341 participants; P value 0.16). We could not examine the remaining outcomes, quality of life, mortality, and healthcare costs, as either the appropriate data were not reported, or we did not retrieve trials that examined these outcomes. AUTHORS' CONCLUSIONS: There is promising evidence that exercise programs may improve the ability to perform ADLs in people with dementia, although some caution is advised in interpreting these findings. The review revealed no evidence of benefit from exercise on cognition, neuropsychiatric symptoms, or depression. There was little or no evidence regarding the remaining outcomes of interest (i.e., mortality, caregiver burden, caregiver quality of life, caregiver mortality, and use of healthcare services).
Populations Analyzed: Older adults, Dementia	**Author-Stated Funding Source:** Canadian Cochrane Centre, Nova Scotia Cochrane Centre.

Cognitive Impairment	
Meta-Analysis **Citation:** Fox B, Hodgkinson B, Parker D. The effects of physical exercise on functional performance, quality of life, cognitive impairment and physical activity levels for older adults aged 65 years and older with a diagnosis of dementia: a systematic review. *Database of Abstracts of Reviews of Effects.* 2014;12(9):158-276.	
Purpose: To determine whether physical exercise affects functional performance, quality of life, and PA levels of older adults with a diagnosis of dementia. **Timeframe:** 1990–2013 **Total # of Studies:** 17 **Exposure Definition:** Physical exercise interventions greatly varied; can be considered aerobicor resistance-based training. Average of 50.18 minutes per session, with an average length of 16 weeks and an average of 3.42 sessions per week. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No **Outcomes Addressed:** Quality of life: Alzheimer's Disease Quality of Related Life Scale. Functional performance: activities of daily living, balance, mobility, gait parameters, flexibility. PA levels. **Examine Cardiorespiratory**	**Abstract:** BACKGROUND Physical inactivity is considered the primary precursor to unmet needs for older adults with dementia and exercise has shown potential to benefit healthy, older adults. While no conclusive evidence is available to suggest these benefits extend to older adults with dementia, a growing body of literature targets this question specifically. OBJECTIVE The primary, overarching question asked by this review was: does physical exercise affect functional performance, quality of life, cognitive impairment and physical activity levels of older adults (>65 years) with a diagnosis of dementia? INCLUSION CRITERIA Types of participants: Participants were older adults, aged 65 years and over, with a confirmed dementia diagnosis. Types of intervention(s): Physical exercise interventions were included Types of studies Randomized and quasi-randomized controlled trials were included. Types of outcomes: Four primary outcome measures were the focus on this review: cognition, functional ability, quality of life and physical activity levels. SEARCH STRATEGY Published material was sourced from the following four databases: MEDLINE, EMBASE, CINAHL, ISI Web of Science. Grey literature was searched for using ALOIS, Google Scholar and ProQuest. Initial keywords included: "cognitive impairment", "dementia", "Alzheimer's disease", "cognitive defect" OR "cognition disorders" AND "exercise", "physical activity", "exertion", OR "functional" AND "intervention", "program", "training" OR "treatment" AND "older adults", "elderly", "old age" OR "geriatric" METHODOLOGICAL QUALITY The methodological quality of included studies was assessed using Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) software. DATA COLLECTION Data was extracted from papers included in the review using the standardized data extraction tool from JBI-MAStARI. DATA SYNTHESIS A quantitative meta-analysis was performed where possible. Otherwise, data-synthesis is in the form of narrative review. RESULTS Seventeen studies were included in this review; they evaluated the effectiveness of aerobic, resistance and multimodal exercise interventions on a wide range of outcome measures, including: cognition, general physical function, mobility, strength, balance, flexibility, cardiovascular fitness, quality of life and physical activity levels. Only three studies were found to be of "good" quality and showed benefits for older adults in the domains of: cognition, activities of daily living, mobility, strength and balance. Results from "moderate" and "poor" quality studies were mixed and inconclusive. CONCLUSIONS While potential exists for exercise to benefit the older adult with dementia, no definitive conclusion can be reached, as the volume of "good" quality literature is limited for this population.

Fitness as Outcome: No	
Populations Analyzed: Adults Mean age 70.0–89.60, Dementia	**Author-Stated Funding Source:** Not reported.

<table>
<tr><th colspan="2">Cognitive Impairment, Parkinson's Disease</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Fritz NE, Cheek FM, Nichols-Larsen DS. Motor-cognitive dual-task training in persons with neurologic disorders: a systematic review. J Neurol Phys Ther. 2015;39(3):142-153. doi:10.1097/NPT.0000000000000090.</td></tr>
<tr><td>Purpose: To examine the literature to determine the effectiveness of dual-task training on mobility and cognition compared to usual care in individuals with neurological disorders.</td><td rowspan="4">Abstract: BACKGROUND AND PURPOSE: Deficits in motor-cognitive dual tasks (eg, walking while talking) are common in individuals with neurologic conditions. This review was conducted to determine the effectiveness of motor-cognitive dual-task training (DTT) compared with usual care on mobility and cognition in individuals with neurologic disorders. METHODS: Databases searched were Biosis, CINAHL, ERIC, PsychInfo, EBSCO Psychological & Behavioral, PubMed, Scopus, and Web of Knowledge. Eligibility criteria were studies of adults with neurologic disorders that included DTT, and outcomes of gait or balance were included. Fourteen studies met inclusion criteria. Participants were subjects with brain injury, Parkinson disease (PD), and Alzheimer disease (AD). Intervention protocols included cued walking, cognitive tasks paired with gait, balance, and strength training and virtual reality or gaming. Quality of the included trials was evaluated with a standardized rating scale of clinical relevance. RESULTS: Results show that DTT improves single-task gait velocity and stride length in subjects with PD and AD, dual-task gait velocity and stride length in subjects with PD, AD, and brain injury, and may improve balance and cognition in those with PD and AD. The inclusion criteria of the studies reviewed limited the diagnostic groups included. DISCUSSION AND CONCLUSIONS: While the range of training protocols and outcome assessments in available studies limited comparison of the results across studies motor-cognitive dual-task deficits in individuals with neurologic disorders appears to be amenable to training. Improvement of dual-task ability in individuals with neurologic disorders holds potential for improving gait, balance, and cognition.Video Abstract available for additional insights from the authors (Supplemental Digital Content, http://links.lww.com/JNPT/A104).</td></tr>
<tr><td>Timeframe: Inception–January 2014</td></tr>
<tr><td>Total # of Studies: 14</td></tr>
<tr><td>Exposure Definition: Motor-cognitive dual-task training with varied protocols, including single-sessions of cueing; multi-session training including various cognitive tasks paired with gait or balance/strength tasks, virtual reality, or gaming; and dual task training used alongside additional therapies (balance or aerobic exercise). Interventions varied from a single session to 16 weeks and varied in session duration and intensity.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Mobility: single task gait (3D motion capture, 2D kinematics, and the GAITRite electronic walkway) and/or static and dynamic balance (center of pressure assessments and Berg Balance Scale).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults >18, Central neurologic disorder</td><td>Author-Stated Funding Source: National Center for Advancing Translational Sciences.</td></tr>
</table>

Osteoporosis/Osteopenia	
Meta-Analysis **Citation:** Giangregorio LM, Macintyre NJ, Thabane L, Skidmore CJ, Papaioannou A. Exercise for improving outcomes after osteoporotic vertebral fracture. *Cochrane Database Syst Rev.* 2013;(1):Cd008618. doi:10.1002/14651858.CD008618.pub2.	
Purpose: To evaluate the effect of exercise interventions of 4 weeks or greater (alone or as part of a physical therapy intervention) versus non-exercise/non-active physical therapy intervention, no intervention, or placebo on health-related outcomes among adults with a history of osteoporotic vertebral fracture.	**Abstract:** BACKGROUND: Vertebral fractures are associated with increased morbidity (e.g., pain, reduced quality of life), and mortality. Therapeutic exercise is a non-pharmacologic conservative treatment that is often recommended for patients with vertebral fractures to reduce pain and restore functional movement. OBJECTIVES: Our objectives were to evaluate the benefits and harms of exercise interventions of four weeks or greater (alone or as part of a physical therapyintervention) versus non-exercise/non-active physical therapy intervention, no intervention or placebo on the incidence of future fractures and adverse events among adults with a history of osteoporotic vertebral fracture(s). We were also examined the effects of exercise on the following secondary outcomes: falls, pain, posture,physical function, balance,mobility, muscle function,quality of life and bone mineral density of the lumbar spine or hip measured using dual-energy X-ray absorptiometry (DXA).We also reported exercise adherence. SEARCH METHODS: We searched the following databases: The Cochrane Library (Issue 11 of 12, November 2011), MEDLINE (2005 to 2011), EMBASE (1988 to November 23, 2011), CINAHL (Cumulative Index to Nursing and Allied Health Literature, 1982 to November 23, 2011), AMED (1985 to November 2011), and PEDro (Physiotherapy Evidence Database, www.pedro.fhs.usyd.edu.au/index.html, 1929 to November 23, 2011. Ongoing and recently completed trials were identified by searching the World Health Organization International Clinical Trials Registry Platform (to December 2009). Conference proceedings were searched via ISI and SCOPUS, and targeted searches of proceedings of the American Congress of Rehabilitation Medicine and American Society for Bone and Mineral Research. Search terms or MeSH headings included terms such as vertebral fracture AND exercise OR physical therapy. SELECTION CRITERIA: We considered all randomized controlled trials and quasi-randomized trials comparing exercise or active physical therapy interventions with placebo/non-exercise/non-active physical therapy interventions or no intervention implemented in individuals with a history of vertebral fracture and evaluating the outcomes of interest. DATA COLLECTION AND ANALYSIS: Two review authors independently selected trials and extracted data using a pre-tested data abstraction form. Disagreements were resolved by consensus, or third party adjudication. The Cochrane Collaboration's tool for assessing risk of bias was used to evaluate each study. Studies were grouped according to duration of follow-up (i.e., a) four to 12 weeks; b) 16 to 24 weeks; and c) 52 weeks); a study could be represented in more than one group depending on the number of follow-up assessments. For continuous data, we report mean differences (MDs) of the change or percentage change
Timeframe: Inception–November 2011	
Total # of Studies: 7 (2 MA)	
Exposure Definition: Mixed-modality exercise that incorporated muscle strengthening, aerobic exercise, balance training, tai chi, posture training, and ROM exercises. Programs were 4 weeks–12 months in duration with sessions conducted 2–3 times per week at variable intensity. In all studies, outcome assessment occurred before and	

immediately after the intervention period. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No	from baseline. Data from two studies were pooled for one outcome using a fixed-effect model. MAIN RESULTS: Seven trials (488 participants, four male participants) were included. Substantial variability across the seven trials prevented any meaningful pooling of data for most outcomes. No trials assessed the effect of exercise on incident fractures, adverse events or incident falls. Individual trials reported that exercise could improve pain, performance on the Timed Up and Go test, walking speed, back extensor strength, trunk muscle endurance, and quality of life. However, the findings should be interpreted with caution given that there were also reports of no significant difference between exercise and control groups for pain, Timed Up and Go test performance, trunk extensor muscle strength and quality of life. Pooled analyses from two studies revealed a significant between-group difference in favour of exercise for Timed Up and Go performance (MD -1.13 seconds, 95% confidence interval (CI) -1.85 to -0.42, P = 0.002). Individual studies also reported no significant between-group differences for posture or bone mineral density. Adherence to exercise varied across studies. The risk of bias across all studies was variable; low risk across most domains in four studies, and unclear or high risk in most domains for three studies. AUTHORS' CONCLUSIONS: No definitive conclusions can be made regarding the benefits of exercise for individuals with vertebral fracture. Although individual trials did report benefits for some pain, physical function and quality of life outcomes, the findings should be interpreted with caution given that findings were inconsistent and the quality of evidence was very low. The small number of trials and variability across trials limited our ability to pool outcomes or make conclusions. Evidence regarding the effects of exercise after vertebral fracture, particularly for men, is scarce. A high-quality randomized trial is needed to inform exercise prescription for individuals with vertebral fractures.
Outcomes Addressed: Physical function: self reported questionnaires and subscales from those questionnaires (Short Form-36, Oswestry Disability Index, Quality of Life Questionnaire of the European Foundation for Osteoporosis), performance-based measures (6-minute walk test, Timed Up and Go test, functional reach test, walking speed), balance (center of pressure variability with force plate). **Examine Cardiorespiratory Fitness as Outcome:** No	
Populations Analyzed: Age >40, History of non-traumatic osteoporotic fracture of one or more vertebrae.	**Author-Stated Funding Source:** Canadian Institutes for Health Research.

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Giné-Garriga M, Roqué-Fíguls M, Coll-Planas L, Sitjà-Rabert M, Salvà A. Physical exercise interventions for improving performance-based measures of physical function in community-dwelling, frail older adults: a systematic review and meta-analysis. Arch Phys Med Rehabil. 2014;95(4):753-769.e3. doi:10.1016/j.apmr.2013.11.007.</td></tr>
<tr><td>Purpose: To integrate the most current evidence on the effect of exercise interventions on improving performance-based measures of physical function and markers of physical frailty in community-dwelling older people.</td><td rowspan="5">Abstract: OBJECTIVE: To conduct a systematic review to determine the efficacy of exercise-based interventions on improving performance-based measures of physical function and markers of physical frailty in community-dwelling, frail older people. DATA SOURCES: Comprehensive bibliographic searches in MEDLINE, the Cochrane Library, PEDro, and CINAHL databases were conducted (April 2013). STUDY SELECTION: Randomized controlled trials of community-dwelling older adults, defined as frail according to physical function and physical difficulties in activities of daily living (ADL). Included trials had to compare an exercise intervention with a control or another exercise intervention, and assess performance-based measures of physical function such as mobility and gait, or disability in ADL. DATA EXTRACTION: Two review authors independently screened the search results and performed data extraction and risk of bias assessment. Nineteen trials were included, 12 of them comparing exercise with an inactive control. Most exercise programs were multicomponent. DATA SYNTHESIS: Meta-analysis was performed for the comparison of exercise versus control with the inverse variance method under the random-effects models. When compared with control interventions, exercise was shown to improve normal gait speed (mean difference [MD]=.07m/s; 95% confidence interval [CI], .04-.09), fast gait speed (MD=.08m/s; 95% CI, .02-.14), and the Short Physical Performance Battery (MD=2.18; 95% CI, 1.56-2.80). Results are inconclusive for endurance outcomes, and no consistent effect was observed on balance and the ADL functional mobility. The evidence comparing different modalities of exercise is scarce and heterogeneous. CONCLUSIONS: Exercise has some benefits in frail older people, although uncertainty still exists with regard to which exercise characteristics (type, frequency, duration) are most effective.</td></tr>
<tr><td>Timeframe: Inception–April 2013</td></tr>
<tr><td>Total # of Studies: 19</td></tr>
<tr><td>Exposure Definition: Exercise interventions including muscular strength (elastic bands, functional circuit training), muscular endurance, aerobic (walking, exercise to music) and flexibility/balance (stretching, tai chi, qigong). Most interventions were more than 10 weeks, 3 times a week for 45–60 minutes.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Mean Differences of Mobility: Timed Up and Go, Short Physical Performance Battery. Balance: Tandem, semi-tandem, one-limb stand, Berg balance scale), endurance, gait test (normal and fast speed). Activities of daily living. Fractures. Muscular strength. Tendinitis. Muscular soreness. Falls. Musculoskeletal injuries. Back pain/injury.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age ≥65, Frail</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Visual Impairment</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Gleeson M, Sherrington C, Keay L. Exercise and physical training improve physical function in older adults with visual impairments but their effect on falls is unclear: a systematic review. J Physiother. 2014;60(3):130-135. doi:10.1016/j.jphys.2014.06.010.</td></tr>
<tr><td>Purpose: To determine if exercise or physical training improves physical function and prevents falls in older adults with visual impairments.</td><td rowspan="5">Abstract: QUESTION: Can exercise or physical training improve physical function and prevent falls in older adults with visual impairments? DESIGN: Systematic review of randomised controlled trials with meta-analysis. PARTICIPANTS: Older adults (>/= 60 years) with visual impairments. INTERVENTION: Individual or group exercise or physical training classes in any settings. OUTCOME MEASURES: Mobility, balance, strength and proprioception measured with performance tests or questionnaires and/or falls with calendars or incident reports. RESULTS: Four eligible trials with a total of 522 participants were identified. Multimodal group exercise (n = 50 and 41) and Tai Chi (n=40) improved physical function among residents of care settings. Meta-analysis of data from two trials indicated a significant positive impact of multimodal exercise on the Berg Balance Score (weighted mean difference 3.9 points, 95% CI 1.8 to 6.0), but not on the Timed Up and Go test (weighted mean difference 1.5seconds, 95% CI -1.7 to 4.6). One trial (n=41) found that multimodal exercise reduced the time to first fall (p=0.049). A factorial trial (n=391) among community dwellers did not find a significant effect on falls from a home-based exercise intervention, although clinically relevant effects in either direction were not excluded by the study (incidence rate ratio=1.15, 95% CI 0.82 to 1.61). CONCLUSION: Exercise interventions in residential care settings improve performance on some tests of physical function that are risk factors for falls but the impact on falls is not yet clear. The impact of exercise and training on physical function and falls in community-dwelling older adults with visual impairments also warrants further investigation.</td></tr>
<tr><td>Timeframe: Inception–February 2013</td></tr>
<tr><td>Total # of Studies: 4 (2 for meta-analysis)</td></tr>
<tr><td>Exposure Definition: Interventions included strength and balance training, and physical training such as tai chi, yoga, dance. Session duration ranged from 30 to 90 minutes and were done 2–3 times per week. Interventions lasted 12 weeks to 12 months.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical function: measured with performance tests such as the Berg Balance Test and the Timed Up and Go test. Number of falls.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults ≥60, Visual impairments</td><td>Author-Stated Funding Source: Australian Federal Government Australian Postgraduate Award Scholarship; Australian Research Council Postdoctoral Fellowship; Australian National Health and Medical Research Council Senior Research Fellowship.</td></tr>
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<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Goodwin VA, Richards SH, Taylor RS, Taylor AH, Campbell JL. The effectiveness of exercise interventions for people with Parkinson's disease: a systematic review and meta-analysis. Mov Disord. 2008;23(5):631-640. doi:10.1002/mds.21922.</td></tr>
<tr><td>Purpose: To assess randomized control trials reporting on the effectiveness of exercise interventions on outcomes (physical, psychological or social functioning, or quality of life) for people with Parkinson's disease.</td><td rowspan="4">Abstract: Parkinson's disease (PD) is a neurodegenerative disorder affecting the physical, psychological, social, and functional status of individuals. Exercise programs may be an effective strategy to delay or reverse functional decline for people with PD and a large body of empirical evidence has emerged in recent years. The objective is to systematically review randomized controlled trials (RCTs) reporting on the effectiveness of exercise interventions on outcomes (physical, psychological or social functioning, or quality of life) for people with PD. RCTs meeting the inclusion criteria were identified by systematic searching of electronic databases. Key data were extracted by two independent researchers. A mixed methods approach was undertaken using narrative, vote counting, and random effects meta-analysis methods. Fourteen RCTs were included and the methodological quality of most studies was moderate. Evidence supported exercise as being beneficial with regards to physical functioning, health-related quality of life, strength, balance and gait speed for people with PD. There was insufficient evidence support or refute the value of exercise in reducing falls or depression. This review found evidence of the potential benefits of exercise for people with PD, although further good quality research is needed. Questions remain around the optimal content of exercise interventions (dosing, component exercises) at different stages of the disease.</td></tr>
<tr><td>Timeframe: 1974–December 2006</td></tr>
<tr><td>Total # of Studies: 14</td></tr>
<tr><td>Exposure Definition: Exercise programs varied, including qigong, seated karate, stretching, progressive exercise training, strength and balance, and treadmill walking. Programs ranged from 6 to 36 hours and spread over 4–12 weeks.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical functioning: Unified Parkinson's Disease Rating Scale, North Western University Disability Scale, and Self Assessment Parkinson's Disease Disability Scale. Health-related quality of life: Sickness Impact Profile, Parkinson's Disease Questionnaire, and the EuroQOL. Gait: not described. Balance: Berg Balance Scale, Functional Reach and Sensory Orientation Test.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Parkinson's disease</td><td>Author-Stated Funding Source: Devon and Cornwall Workforce Development Confederation and Plymouth Teaching Primary Care Trust; National Institutes of Health.</td></tr>
</table>

<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Inskip M, Mavros Y, Sachdev PS, Fiatarone Singh MA. Exercise for individuals with lewy body dementia: a systematic review. PLoS One. 2016;11(6):e0156520. doi:10.1371/journal.pone.0156520.</td></tr>
<tr><td>Purpose: To retrieve any studies that explored the effect of exercise or physical activity on individuals with Lewy Body Dementia in relation to a variety of outcomes including, but not limited to, physical, cognitive, psychiatric, physiological, and quality of life measures, to identify the quantity and quality of the existing evidence base.</td><td rowspan="5">Abstract: BACKGROUND: Individuals with Lewy body Dementia (LBD), which encompasses both Parkinson disease dementia (PDD) and Dementia with Lewy Bodies (DLB) experience functional decline through Parkinsonism and sedentariness exacerbated by motor, psychiatric and cognitive symptoms. Exercise may improve functional outcomes in Parkinson's disease (PD), and Alzheimer's disease (AD). However, the multi-domain nature of the LBD cluster of symptoms (physical, cognitive, psychiatric, autonomic) results in vulnerable individuals often being excluded from exercise studies evaluating physical function in PD or cognitive function in dementia to avoid confounding results. This review evaluated existing literature reporting the effects of exercise interventions or physical activity (PA) exposure on cluster symptoms in LBD. METHODS: A high-sensitivity search was executed across 19 databases. Full-length articles of any language and quality, published or unpublished, that analysed effects of isolated exercise/physical activity on indicative Dementia with Lewy Bodies or PD-dementia cohorts were evaluated for outcomes inclusive of physical, cognitive, psychiatric, physiological and quality of life measures. The protocol for this review (Reg. #: CRD42015019002) is accessible at http://www.crd.york.ac.uk/PROSPERO/. RESULTS: 111,485 articles were initially retrieved; 288 full articles were reviewed and 89.6% subsequently deemed ineligible due to exclusion of participants with co-existence of dementia and Parkinsonism. Five studies (1 uncontrolled trial, 1 randomized controlled trial and 3 case reports) evaluating 16 participants were included. Interventions were diverse and outcome homogeneity was low. Habitual gait speed outcomes were measured in 13 participants and increased (0.18m/s, 95% CI -0.02, 0.38m/s), exceeding moderate important change (0.14m/s) for PD cohorts. Other outcomes appeared to improve modestly in most participants. DISCUSSION: Scarce research investigating exercise in LBD exists. This review confirms exercise studies in PD and dementia consistently exclude LBD participants. Results in this cohort must be treated with caution until robustly designed, larger studies are commissioned to explore exercise efficacy, feasibility and clinical relevance.</td></tr>
<tr><td>Timeframe: 1800–September 2015</td></tr>
<tr><td>Total # of Studies: 5</td></tr>
<tr><td>Exposure Definition: PA interventions were varied and included verbal cueing with movement, motor training, stationary cycling, large amplitude body weight exercise, high intensity functional exercises, and light leisure activities. Duration of sessions ranged from 1 to 180 minutes; frequency ranged from 1 to 5 times/week; total program length ranged from 1 session to 12 weeks; and intensity varied by modality.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical function: gait speed, walking endurance, sit-to-stand function, balance function; Functional status: report of basic activities of daily living and instrumental activities of daily living.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age 57–98, Parkinson's disease, Dementia, Dementia with Lewy bodies</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

Parkinson's Disease	
Meta-Analysis **Citation:** Kwok JY, Choi KC, Chan HY. Effects of mind-body exercises on the physiological and psychosocial well-being of individuals with Parkinson's disease: a systematic review and meta-analysis. *Complement Ther Med.* 2016;29:121-131. doi:10.1016/j.ctim.2016.09.016.	
Purpose: To appraise the current evidence of the effects of mind-body exercises on the physiological and psychological outcomes for the Parkinson's disease population. **Timeframe:** Inception–January 2016 **Total # of Studies:** 12 (9 for meta-analysis) **Exposure Definition:** Mind-body exercises as the main intervention. Included yoga, dance, and tai chi (subgroup analyses completed). Interventions lasted 60 minutes per session. Low dose intervention: once per week. Moderate dose intervention: 2 times per week. High dose intervention: 3 times per week. Total intervention period up to 16 weeks. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No **Outcomes Addressed:** Motor symptoms: Unified Parkinson's Disease Rating Scale III. Postural instability: Berg Balance Scale and Timed Up and Go Test. Functional mobility: 6-minute walk test.	**Abstract:** OBJECTIVES: The effects of mind-body exercises on individuals with chronic illnesses have attracted increasing attention. However, little effort had been made to systematically review the effects of these mind-body exercises on individuals with Parkinson's disease (PD). This review aimed to appraise the current evidence of the effects of mind-body exercises on the physiological and psychological outcomes for the PD population. DESIGN: Systematic review and meta-analysis of randomized controlled trials. DATA SOURCES: Four English databases, namely, the EMBASE, Ovid Medline, Psych Info, and Cochrane Library, were searched on January 2016. REVIEW METHODS: Studies involving participants with idiopathic PD were included if mind-body exercises were applied and compared with a non-exercise control to improve physiological and psychosocial well-being. The Effective Public Health Practice Project quality assessment tool was used for quality appraisal. RevMan 5.3 was employed to perform this meta-analysis. A subgroup analysis regarding the types and the dose of intervention was conducted to explore the sources of heterogeneity. RESULTS: Ten studies met the inclusion criteria for quality appraisal. The overall methodological rating of these studies indicated that one study was strong; five studies were moderate; and four studies were weak. Nine articles comprising five Tai Chi, two yoga, and two dance studies were included in the meta-analysis. The results of this review showed that mind-body exercises had a large, significant beneficial effect in motor symptoms in terms of UPDRS III for people with mild to moderate PD [SMD=-0.91, 95% CI (-1.37, -0.45), p<0.05]. Significant subgroup differences were found among various types of mind-body exercises (p=0.001). Yoga demonstrated the largest and most significant beneficial effect in reducing UPDRS III scores [SMD=-2.35, 95% CI (-3.21, -1.50), p<0.01]. The pooled meta-analysis results showed that mind-body exercises had a large, significant effect in improving postural instability in terms of the Berg Balance Scale [SMD=1.48, 95% CI (0.91, 2.06), p<0.01] and Timed Up and Go test [SMD=-0.97, 95% CI (-1.46, -0.47), p<0.01] and moderate, significant effect in improving functional mobility in terms of the Six-minute Walk test [SMD=0.78, 95% CI (0.35, 1.21), p<0.05]. CONCLUSIONS: This review found that mind-body exercises demonstrated immediate moderate to large beneficial effects on motor symptoms, postural instability, and functional mobility among individuals with mild to moderate PD. However, the effects of mind-body exercises on psychosocial well-being had not been amply investigated, especially for yoga intervention. Future research should address the psychosocial effects of mind-body exercises on the PD population.

Examine Cardiorespiratory Fitness as Outcome: No	
Populations Analyzed: Adults Mean age 60.8–74.9, Parkinson's disease	**Author-Stated Funding Source:** No funding source used.

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Lamotte G, Rafferty MR, Prodoehl J, et al. Effects of endurance exercise training on the motor and non-motor features of Parkinson's disease: a review. J Parkinsons Dis. 2015;5(1):21-41. doi:10.3233/JPD-140425.
Erratum: Lamotte G, Rafferty MR, Prodoehl J, et al. Effects of endurance exercise training on the motor and non-motor features of Parkinson's disease: a review. J Parkinsons Dis. 2015;5(3):621. doi:10.3233/JPD-159001.</td></tr>
<tr><td>Purpose: To conduct a meta-analysis on the effect of endurance exercise training on motor disability in Parkinson's disease.</td><td rowspan="4">Abstract: BACKGROUND: Despite the benefits of medications and surgical interventions for Parkinson's disease (PD), these treatments are not without complications and neuroprotective strategies are still lacking. Therefore, there is a need for effective alternative approaches to treat motor and non-motor symptoms in PD. During the last decade, several studies have investigated endurance exercise training as a potential treatment for individuals with PD. OBJECTIVE: This paper reviews the therapeutically beneficial effects of endurance exercise training on motor and non-motor symptoms in PD. METHODS: First, we performed a systematic review of the literature on the effects of endurance exercise training on motor and non-motor signs of parkinsonism, functional outcomes including gait, balance and mobility, depression and fatigue, quality of life and perceived patient improvement, cardiorespiratory function, neurophysiological measures, and motor control measures in PD. Second we performed a meta-analysis on the motor section of the UPDRS. Then, we focused on several important factors to consider when prescribing endurance exercise training in PD such as intensity, duration, frequency, specificity and type of exercise. In addition, we identified current knowledge gaps regarding endurance exercise training in PD and made suggestions for future research. RESULTS: A total of eight randomized controlled trials met the inclusion criteria and were reviewed. This systematic review synthesizes evidence that endurance exercise training at a sufficiently high level enhances cardiorespiratory capacity and endurance by improving VO2 max and gait in moderately to mildly affected individuals with PD. However, there is not yet a proven effect of endurance exercise training on specific features of PD such as motor signs of parkinsonism. CONCLUSION: Endurance exercise training improves physical conditioning in PD patients; however, to date, there is insufficient evidence to include endurance exercise training as a specific treatment for PD. There is a need for well-designed large-scale randomized controlled trials to confirm benefits and safety of</td></tr>
<tr><td>Timeframe: 1990–August 2014</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Endurance exercise training (exercise that improves cardiorespiratory power and cardiorespiratory endurance) with target exercise intensity between 60% and 85% of maximum heart rate, between 60 and 180 minutes per week for 6 to 64 weeks. Interventions included body weight-supported and non body weight-supported treadmill walking, bicycle or elliptical trainer, stationary tandem bike, or semi-recumbent elliptical devices.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Motor disability: Unified Parkinson's Disease Rating Scale. Systematic review of gait variables (velocity, cadence, double support, base of support, and step length), walking distance (6-minute walk test), balance (single-limb stance, functional reach test), functional mobility (Timed Up and Go test, Continuous Scale-Physical Functional Performance test), quality of life (Parkinson's Disease Questionnaire), activities of daily living.</td></tr>
</table>

Examine Cardiorespiratory Fitness as Outcome: Yes	endurance exercise training in PD and to explore potential benefits on the motor and non-motor signs of PD.
Populations Analyzed: Parkinson's disease	**Author-Stated Funding Source:** French Society of Neurology.

Cognitive Impairment	
Systematic Review **Citation:** Laver K, Dyer S, Whitehead C, Clemson L, Crotty M. Interventions to delay functional decline in people with dementia: a systematic review of systematic reviews. *BMJ Open.* 2016;6(4):e010767. doi:10.1136/bmjopen-2015-010767.	
Purpose: To summarize systematic reviews that assess the effects of interventions for functional decline in people with dementia. **Timeframe:** Inception–April 2015 **Total # of Studies:** 23 (2 PA interventions) **Exposure Definition:** Varied exercise programs as well as dyadic interventions that incorporated exercise alongside other interventions. Exercise programs ranged in frequency from 2 to 5 times per week and lasted at least 7 weeks. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No **Outcomes Addressed:** Physical function: Barthel Activities of Daily Living Index, Katz Index of Activities of Daily Living, Changes in Advanced Dementia Scale, Functional Dependence Scale, Interview for Deterioration in Daily Living Activities, Assessment of Motor and Process Skills. **Examine Cardiorespiratory Fitness as Outcome:** No	**Abstract:** OBJECTIVE: To summarise existing systematic reviews that assess the effects of non-pharmacological, pharmacological and alternative therapies on activities of daily living (ADL) function in people with dementia. DESIGN: Overview of systematic reviews. METHODS: A systematic search in the Cochrane Database of Systematic Reviews, DARE, Medline, EMBASE and PsycInfo in April 2015. Systematic reviews of randomised controlled trials conducted in people with Alzheimer's disease or dementia measuring the impact on ADL function were included. Methodological quality of the systematic reviews was independently assessed by two authors using the AMSTAR tool. The quality of evidence of the primary studies for each intervention was assessed using GRADE. RESULTS: A total of 23 systematic reviews were included in the overview. The quality of the reviews varied; however most (65%) scored 8/11 or more on the AMSTAR tool, indicating high quality. Interventions that were reported to be effective in minimising decline in ADL function were: exercise (6 studies, 289 participants, standardised mean difference (SMD) 0.68, 95% CI 0.08 to 1.27; GRADE: low), dyadic interventions (8 studies, 988 participants, SMD 0.37, 95% CI 0.05 to 0.69; GRADE: low) acetylcholinesterase inhibitors and memantine (12 studies, 4661 participants, donepezil 10 mg SMD 0.18, 95% CI 0.03 to 0.32; GRADE: moderate), selegiline (7 studies, 810 participants, SMD 0.27, 95% CI 0.13 to 0.41; GRADE: low), huperzine A (2 studies, 70 participants, SMD 1.48, 95% CI 0.95 to 2.02; GRADE: very low) and Ginkgo biloba (7 studies, 2530 participants, SMD 0.36, 95% CI 0.28 to 0.44; GRADE: very low). CONCLUSIONS: Healthcare professionals should ensure that people with dementia are encouraged to exercise and that primary carers are trained and supported to provide safe and effective care for the person with dementia. Acetylcholinesterase inhibitors or memantine should be trialled unless contraindicated. TRIAL REGISTRATION NUMBER: CRD42015020179.
Populations Analyzed: Adults Mean age 70–80, Dementia, Alzheimer's disease	**Author-Stated Funding Source:** National Health and Medical Research Council.

<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Lewis M, Peiris CL, Shields N. Long-term home and community-based exercise programs improve function in community-dwelling older people with cognitive impairment: a systematic review. J Physiother. 2017;63(1):23-29. doi:10.1016/j.jphys.2016.11.005.</td></tr>
<tr><td>Purpose: To determine if long-term (>3 months) exercise in the home or community setting improves function and reduces the risk of falls and readmission to the hospital in community-dwelling older people with cognitive impairment.</td><td rowspan="5">Abstract: QUESTION: Do long-term (> 3 months) home or community-based exercise programs improve function, reduce falls and prevent hospital readmissions in older people with cognitive impairment? DESIGN: Systematic review and meta-analysis of randomised, controlled trials. Electronic databases (CINAHL, PubMed, Medline, Embase, AMED) were searched from the earliest date possible until March 2016. PARTICIPANTS: Older adults (>/= 65 years) with cognitive impairment living in the community. INTERVENTION: Supervised home or community-based exercise programs longer than 3 months. OUTCOME MEASURES: The primary outcomes were function (including balance and activities of daily living), falls and hospital readmissions. RESULTS: Of 1011 studies identified, seven trials with 945 participants met the inclusion criteria. Compared with no intervention, long-term exercise programs improved functional independence in basic activities of daily living by a moderate and significant amount (SMD 0.77, 95% CI 0.17 to 1.37, I2=67%), and improved functional independence in instrumental activities of daily living by a small and significant amount (SMD 0.44, 95% CI 0.03 to 0.86, I2=42%). Long-term exercise improved balance (mean difference in functional reach test 5.2cm, 95% CI 0.5 to 9.9, I2=76%). Data from two individual trials suggest that long-term exercise programs also reduce falls in older people with cognitive impairment. However, there was limited reporting of the effect of exercise on hospital readmissions for this group of people. CONCLUSIONS: Long-term home and community-based exercise programs improve function in older adults living in the community with cognitive impairment. Review registration: PROSPERO CRD42015029602.</td></tr>
<tr><td>Timeframe: Inception–March 2016</td></tr>
<tr><td>Total # of Studies: 7 in qualitative (6 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Exercise could include aerobic training, resistance training, balance, walking, stretching, or a combination of exercise types. Interventions were at least 3 months in duration and individual sessions ranged from 15 minutes to 90 minutes.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Activities of daily living: functional independence measure. Balance: (e.g., functional reach test. Strength: sit-to-stand test. Endurance: walking endurance.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Older adults, Cognitive impairment</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

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<tr><th colspan="2">Osteoporosis/Osteopenia</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Li WC, Chen YC, Yang RS, Tsauo JY. Effects of exercise programmes on quality of life in osteoporotic and osteopenic postmenopausal women: a systematic review and meta-analysis. Clin Rehabil. 2009;23(10):888-896. doi:10.1177/0269215509339002.</td></tr>
<tr><td>Purpose: To examine the effect of exercise therapy on quality of life in postmenopausal women with osteoporosis or osteopenia.</td><td rowspan="4">Abstract: OBJECTIVE: To examine the effect of exercise therapy on quality of life in postmenopausal women with osteoporosis or osteopenia. METHODS: We searched MEDLINE, CINAHL, PEDro, EMBASE and the Cochrane library from January 1966 to March 2007. Two reviewers independently selected all studies that met predetermined inclusion criteria. Randomized controlled trials that used the Short Form 36 of the Medical Outcome Study (SF-36) questionnaire or the Quality of Life Questionnaire of the European Foundation for Osteoporosis (QUALEFFO) as outcome measures were selected. The PEDro Scale was applied to rate the quality of each article. All studies had a quality score above 5/10. Meta-analysis was facilitated by RevMan 4.1. RESULTS: Four randomized controlled trials met the inclusion criteria, involving a total of 256 participants. Results revealed that the exercise groups showed significant improvements in the domains of physical function, pain, role physical and vitality (P<0.05). Furthermore, intervention with combined exercise programmes had better effects on physical function, pain and vitality domains than controls. Group exercise programmes also produced better results in these three domains. A short-duration exercise programme produced more improvement in physical function, role physical and vitality, whereas a long-duration exercise programme resulted in more improvement in physical function and pain domains. CONCLUSIONS: This meta-analysis revealed better improvement in physical function, pain, role physical and vitality in the exercise groups. Combined exercise and group exercise programmes showed better outcomes in the physical function, pain and vitality domains, but different durations of exercise programme showed improvement in different domains.</td></tr>
<tr><td>Timeframe: 1966–March 2007</td></tr>
<tr><td>Total # of Studies: 4</td></tr>
<tr><td>Exposure Definition: Exercise programs which included strengthening exercises on the extremities and trunk, agility training, and combined exercise (strengthening, balance, and posture). Programs included both home- and group-based exercise. Lengths of programs varied. Subgroup analysis examined the length (>12 weeks vs ≤12 weeks), type (strengthening vs combined exercise), and model of execution (home based vs group based) of exercise program exposure.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Quality of Life: Short Form 36 (SF-36) or the Quality of Life Questionnaire of the European Foundation for Osteoporosis.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Female, Adults, Osteoporosis, Post-menopausal; Osteopenia</td><td>Author-Stated Funding Source: National Science Council of the Republic of China.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Lima LO, Scianni A, Rodrigues-de-Paula F. Progressive resistance exercise improves strength and physical performance in people with mild to moderate Parkinson's disease: a systematic review. J Physiother. 2013;59(1):7-13. doi:10.1016/S1836-9553(13)70141-3.</td></tr>
<tr><td>Purpose: To determine the extent to which progressive resistance exercise may increase muscle strength and improve functional measures of physical performance in a Parkinson's disease population.</td><td rowspan="5">Abstract: QUESTION: Does progressive resistance exercise improve strength and measures of physical performance in people with Parkinson's disease? DESIGN: Systematic review with meta-analysis of randomised and quasi-randomised controlled trials. PARTICIPANTS: People with Parkinson's disease, regardless of gender or level of disability. INTERVENTION: Progressive resistance exercise, defined as involving repetitive, strong, or effortful muscle contractions and progression of load as the participant's abilities changed. OUTCOME MEASURES: Measures of muscle strength (maximum voluntary force production) - either continuous (force, torque, work, EMG) or ordinal (manual muscle test) - and physical performance measures: sit-to-stand time, fast and comfortable walking speeds, 6-min walk test, stair descent and ascent, the Activities-specific Balance Confidence scale, Timed Up and Go test, and the Short Physical Performance Battery. RESULTS: Four (quasi-) randomised trials were included, three of which reported data that could be pooled in a meta-analysis. Progressive resistance exercise increased strength, with a standardised mean difference 0.50 (95% CI 0.05 to 0.95), and had a clinically worthwhile effect on walking capacity, with a mean difference of 96 metres (95% CI 40 to 152) among people with mild to moderate Parkinson's disease. However, most physical performance outcomes did not show clinically worthwhile improvement after progressive resistance exercise. CONCLUSION: This review suggests that progressive resistance exercise can be effective and worthwhile in people with mild to moderate Parkinson's disease, but carryover of benefit does not occur for all measures of physical performance. The current evidence suggests that progressive resistance training should be implemented in Parkinson's disease rehabilitation, particularly when the aim is to improve walking capacity.</td></tr>
<tr><td>Timeframe: Inception–November 2011</td></tr>
<tr><td>Total # of Studies: 4</td></tr>
<tr><td>Exposure Definition: Progressive resistance exercise, defined as movement against progressively increased resistance. Interventions ranged from 2 to 6 months in duration, with 2 to 3 sessions per week with varied intensity using 1 repetition maximum and effort rating.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical performance: Sit-to-stand time, walking velocity, 6-minute walk test, stair descent and ascent, the Activities-specific Balance Confidence scale, Timed Up and Go test, and the Short Physical Performance Battery.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults Mean age 57–75.7, Parkinson's disease</td><td>Author-Stated Funding Source: Brazilian government funding agencies.</td></tr>
</table>

<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Littbrand H, Stenvall M, Rosendahl E. Applicability and effects of physical exercise on physical and cognitive functions and activities of daily living among people with dementia: a systematic review. Am J Phys Med Rehabil. 2011;90(6):495-518. doi:10.1097/PHM.0b013e318214de26.</td></tr>
<tr><td>Purpose: To investigate the applicability (attendance, achieved intensity, and adverse events) and effects of physical exercise as a single intervention on physical functions, cognitive functions, and activities of daily living among people with dementia.</td><td rowspan="5">Abstract: OBJECTIVE: : The aim of this study was to systematically review the applicability (attendance, achieved intensity, adverse events) and effects of physical exercise on physical functions, cognitive functions, and activities of daily living among people with dementia. DESIGN: : Randomized controlled trials were identified in PubMed, the Cumulative Index to Nursing and Allied Health, the Allied and Complementary Medicine Database, and the Cochrane Library on August 30 and September 1, 2010, according to predefined inclusion criteria. Two reviewers independently extracted predetermined data and assessed methodologic quality. RESULTS: : A qualitative analysis was performed, including ten studies. Most participants were people with Alzheimer disease in residential care facilities. Four studies reached "moderate" methodologic quality, and six reached "low." The studies of moderate quality evaluated the effects of combined functional weight-bearing exercise, combined functional and nonfunctional exercise, and walking exercise. CONCLUSIONS: : Among older people with Alzheimer disease in residential care facilities, combined functional weight-bearing exercise seems applicable for use regarding attendance and adverse events, and there is some evidence that exercise improves walking performance and reduces the decline in activities of daily living. Furthermore, there is some evidence that walking exercise performed individually reduces decline in walking performance, but adverse events need to be evaluated. Among older people with various types of dementia disorders who are staying in a hospital, there is some evidence that combined functional and nonfunctional exercise over 2 wks has no effect on mobility. It seems important that the interventions last for at least a few months and that the exercises are task-specific and are intended to challenge the individual’s physical capacity. Among older people with unspecified dementia disorders in residential care facilities, there is some evidence that walking exercise performed at a self-selected speed has no effect on cognitive functions. Whether physical exercise can improve cognitive functions among people with dementia remains unclear because studies evaluating this have either been of low methodologic quality or used an intervention of presumably insufficient intensity. There is a need for more studies of high methodologic quality, especially among people with dementia disorders other than Alzheimer disease.</td></tr>
<tr><td>Timeframe: Inception–September 2010</td></tr>
<tr><td>Total # of Studies: 10</td></tr>
<tr><td>Exposure Definition: Supervised exercise interventions that included aerobic (mostly walking), balance, lower-limb strength, and flexibility exercises. Interventions were conducted 2–7 times/week for 20–75 minutes per session, for 2 weeks to 12 months. Walking exercise was specifically performed in 3–5, 30-minute sessions a week for 6–16 weeks. Intensity was generally light to moderate.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical function: tests of balance and mobility; performance of activities of daily living (ADLs).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
</table>

Populations Analyzed: Adults Mean age 74–87, Dementia	**Author-Stated Funding Source:** Erik and Anne-Marie Detlof's Foundation, Lions Club International Swedish Research Foundation for Aging-Related Diseases, Swedish Research Council, and Swedish Dementia Foundation.

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Lotzke D, Ostermann T, Bussing A. Argentine tango in Parkinson disease—a systematic review and meta-analysis. BMC Neurol. 2015;15:226. doi:10.1186/s12883-015-0484-0.</td></tr>
<tr><td>Purpose: To summarize the current research results on the effectiveness of Argentine tango for individuals with Parkinson's disease.</td><td rowspan="4">Abstract: BACKGROUND: Parkinson's Disease (PD) is a neurodegenerative disease with increasing motor and non-motor symptoms in advanced stages. In addition to conventional exercise therapy and drug treatment, Argentine Tango (AT) is discussed as an appropriate intervention for patients to improve physical functioning and health-related quality of life. This review aimed to summarize the current research results on the effectiveness of AT for individuals with PD. METHODS: The global literature search with the search terms "(Parkinson OR Parkinson's disease) AND tango" was conducted in PubMED, AMED, CAMbase, and Google Scholar for publications in English and German. There were no limitations on the study design, year of publication, stage of disease, considered outcome or the age of participants. RESULTS: Thirteen studies met the inclusion criteria. These included 9 randomized-controlled trials, one non-randomized trial, two case studies and one uncontrolled pre-post study. Our meta-analysis revealed significant overall effects in favor of tango for motor severity measured with the Unified Parkinson's Disease Rating Scale 3 (ES = -0.62, 95 % CI [-.1.04, -0.21]), balance as measured with the Mini-BESTest (ES = 0.96 [0.60, 1.31]) or Berg Balance Scale (ES = 0.45 [0.01, 0.90]), and gait with the Timed Up and Go Test (ES = -.46 [-0.72, -0.20]). However, gait as measured with a 6-Minute Walk Test did not demonstrate statistical significance (ES = 0.36 [-0.06, 0.77]). For freezing of gait, no significant effects were observed in favor of AT (ES = 0.16 [-.62, 0.31]). Further, our systematic review revealed a tendency for positive effects on fatigue, activity participation and Parkinson-associated quality of life. A limitation of the studies is the small number of participants in each study (maximum 75). Moreover, most studies are from the same research groups, and only a few are from other researchers. CONCLUSIONS: Future studies should enroll more individuals and should also focus on long-term effects. In addition, future research should address more closely the effects of AT on personal relationships, the individual social network as well as on aspects of quality of life.</td></tr>
<tr><td>Timeframe: Inception–January 2015</td></tr>
<tr><td>Total # of Studies: 13 (7 included in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Argentine tango sessions of variable duration (1 dance to 1.5 hours) and intervention of variable lengths (2 weeks–24 months). For all but one study, classes in group setting.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Motor Severity: Unified Parkinson's Disease Rating Scale. Balance: Mini-BESTest and the Berg Balance Scale. Gait: Timed Up and Go, the 6-Minute Walk Test, and Freezing of Gait Questionnaire. Activity participation.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults Mean age 63–86, Parkinson's disease</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

Parkinson's Disease	
Meta-Analysis **Citation:** Mehrholz J, Kugler J, Storch A, Pohl M, Elsner B, Hirsch K. Treadmill training for patients with Parkinson's disease. *Cochrane Database Syst Rev.* 2015;(8):Cd007830. doi:10.1002/14651858.CD007830.pub3.	
Purpose: To assess the effectiveness of treadmill training in improving the gait function of patients with Parkinson's Disease. **Timeframe:** Inception–September 2014 **Total # of Studies:** 18 **Exposure Definition:** Treadmill training compared with no treadmill training. No dose reported. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No **Outcomes Addressed:** Walking speed and stride length. Cadence and walking distance. **Examine Cardiorespiratory Fitness as Outcome:** No	**Abstract:** BACKGROUND: Treadmill training is used in rehabilitation and is described as improving gait parameters of patients with Parkinson's disease. OBJECTIVES: To assess the effectiveness of treadmill training in improving the gait of patients with Parkinson's disease and the acceptability and safety of this type of therapy. SEARCH METHODS: We searched the Cochrane Movement Disorders Group Specialised Register (see Review Group details for more information) (last searched September 2014), Cochrane Central Register of Controlled Trials (The Cochrane Library 2014, Issue 10), MEDLINE (1950 to September 2014), and EMBASE (1980 to September 2014). We also handsearched relevant conference proceedings, searched trials and research registers, and checked reference lists (last searched September 2014). We contacted trialists, experts and researchers in the field and manufacturers of commercial devices. SELECTION CRITERIA: We included randomised controlled trials comparing treadmill training with no treadmill training in patients with Parkinson's disease. DATA COLLECTION AND ANALYSIS: Two review authors independently selected trials for inclusion, assessed trial quality and extracted data. We contacted the trialists for additional information. We analysed the results as mean differences (MDs) for continuous variables and relative risk differences (RD) for dichotomous variables. MAIN RESULTS: We included 18 trials (6 3 3 participants) in this update of this review. Treadmill training improved gait speed (MD = 0.09 m/s; 95% confidence interval (CI) 0.03 to 0.14; P = 0.001; I(2) = 24%; m oderate quality of evidence), stride length (MD = 0.05 metres; 95% CI 0.01 to 0.09; P = 0.01; I(2) = 0%; l ow quality of e vidence), but walking distance (MD = 48.9 metres; 95% CI -1.32 to 99.14; P = 0.06; I(2) = 91%; very low quality of evidence) and cadence did not improve (MD = 2.16 steps/minute; 95% CI -0.13 to 4.46; P = 0.07; I(2) = 28%; low quality of evidence) at the end of study. Treadmill training did not increase the risk of patients dropping out from intervention (RD = -0.02; 95% CI -0.06 to 0.02; P = 0.32; I(2) = 1 3%; m oderate quality of evidence). Adverse events were not reported in included studies. AUTHORS' CONCLUSIONS: This update of our systematic review provides evidence from e ighteen trials with moderate to l ow risk of bias that the use of treadmill training in patients with PD may improve clinically relevant gait parameters such as gait speed and stride length (m oderate and low quality of evidence, respectively) . This apparent benefit for patients is, however, not supported by all secondary variables (e.g. cadence and walking distance). Comparing physiotherapy and treadmill training against other alternatives in the treatment of gait hypokinesia such as physiotherapy without treadmill training this type of therapy seems to be more beneficial in practice without increased risk. The gain seems small to moderate clinically relevant . However, the results must be interpreted with

	caution because it is not known how long these improvements may last and some s tudies used no intervention in the control group and underlie some risk of bias . Additionally the results were heterogenous and we found variations between the trials in patient characteristics, the duration and amount of training, and types of treadmill training applied.
Populations Analyzed: Adults 58–74, Parkinson's disease	**Author-Stated Funding Source:** Wissenschaftliches Institut, Klinik Bavaria Kreischa, Germany; Department of Public Health, Medizinische Fakultat Carl Gustav Carus, Technische Universitat Dresden, Germany.

<table>
<tr><th colspan="2">Stroke</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Nascimento LR, de Oliveira CQ, Ada L, Michaelsen SM, Teixeira-Salmela LF. Walking training with cueing of cadence improves walking speed and stride length after stroke more than walking training alone: a systematic review. J Physiother. 2015;61(1):10-15. doi:10.1016/j.jphys.2014.11.015.</td></tr>
<tr><td>Purpose: To examine the efficacy of the addition of cueing of cadence to walking training for improving walking after stroke.</td><td rowspan="4">Abstract: QUESTION: After stroke, is walking training with cueing of cadence superior to walking training alone in improving walking speed, stride length, cadence and symmetry? DESIGN: Systematic review with meta-analysis of randomised or controlled trials. PARTICIPANTS: Adults who have had a stroke. INTERVENTION: Walking training with cueing of cadence. OUTCOME MEASURES: Four walking outcomes were of interest: walking speed, stride length, cadence and symmetry. RESULTS: This review included seven trials involving 211 participants. Because one trial caused substantial statistical heterogeneity, meta-analyses were conducted with and without this trial. Walking training with cueing of cadence improved walking speed by 0.23 m/s (95% CI 0.18 to 0.27, I(2)=0%), stride length by 0.21 m (95% CI 0.14 to 0.28, I(2)=18%), cadence by 19 steps/minute (95% CI 14 to 23, I(2)=40%), and symmetry by 15% (95% CI 3 to 26, random effects) more than walking training alone. CONCLUSIONS: This review provides evidence that walking training with cueing of cadence improves walking speed and stride length more than walking training alone. It may also produce benefits in terms of cadence and symmetry of walking. The evidence appears strong enough to recommend the addition of 30 minutes of cueing of cadence to walking training, four times a week for 4 weeks, in order to improve walking in moderately disabled individuals with stroke. REVIEW REGISTRATION: PROSPERO (CRD42013005873).</td></tr>
<tr><td>Timeframe: Inception–August 2013</td></tr>
<tr><td>Total # of Studies: 7 (6 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Walking training accompanied by cueing of cadence. Participants undertook training for 10 to 30 minutes, once or twice a day, 3 to 5 times per week, for 3 to 6 weeks.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Measures of walking: speed, stride length, cadence, and symmetry.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults >18, Stroke</td><td>Author-Stated Funding Source: The Brazilian government funding agencies (CAPES, CNPq, and FAPEMIG).</td></tr>
</table>

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Nash KC. The effects of exercise on strength and physical performance in frail older people: a systematic review. Rev Clin Gerontol. 2012;22(4):274-285. doi:10.1017/S0959259812000111.</td></tr>
<tr><td>Purpose: To synthesize and evaluate randomized controlled trials investigating the effects of exercise interventions on physical performance and muscle strength in frail older people to ascertain the sustainability of any benefits and identify adverse events.</td><td rowspan="4">Abstract: The proportion of older people becoming frail will increase with the expanding older population. Apart from poor health, frailty is associated with loss of strength and functional dependency. Building on previous work in this area, this review investigates the effectiveness, sustainability and adverse effects of exercise interventions on muscle strength and physical performance in frail older people. Randomized controlled trials reporting physical outcomes in frail older people were identified from seven electronic databases. Thirteen trials involving 1652 participants met the inclusion criteria. There was wide heterogeneity in degree of frailty, types of intervention, outcome measures and results. However, evidence from this review suggests that exercise and some physical activity programmes, particularly moderate intensity and multi-component programmes, are safe and can improve strength and function in the majority of frail older people except highly frail individuals with multiple co-morbidities. There was limited evidence on transferability of improvements into everyday life, and sustainability could not be determined.</td></tr>
<tr><td>Timeframe: September 2007–September 2010</td></tr>
<tr><td>Total # of Studies: 13</td></tr>
<tr><td>Exposure Definition: Exercise programs performed at home or in a clinic. Programs included were either multi-component (resistance training, flexibility, aerobic), functional training (balance and gait), and other (ballroom dancing and tai chi). Most interventions were 3 times a week, for 45 minutes, and lasted at least 4 weeks.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Performance: physical performance test, senior fitness test. Muscle strength. Balance: Berg Balance Scale. Mobility: 6-minute timed walk, gait speed. Activities of daily living: daily living scale, functional independence measure.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Older adults, Frail</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

Chronic Obstructive Pulmonary Disease	
Meta-Analysis **Citation:** Ngai SPC, Jones AYM, Tam W. Tai chi for chronic obstructive pulmonary disease (COPD). *Cochrane Database Syst Rev.* 2016;(6):Cd009953. doi:10.1002/14651858.CD009953.pub2.	
Purpose: To explore the effectiveness of tai chi in reducing dyspnoea and improving exercise capacity in people with chronic obstructive pulmonary disease. **Timeframe:** Inception–September 2015 **Total # of Studies:** 23 **Exposure Definition:** Tai chi programs, regardless of styles and forms, lasting a minimum of 4 weeks and including regular practice (at least once a week). Could be provided alone or in addition to another intervention. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No **Outcomes Addressed:** Level of dyspnoea: all measures considered (e.g., Borg Scale, Modified Medical Research Council Dyspnoea Scale, Dyspnoea Visual Analogue Scale). Functional capacity or aerobic capacity (e.g., distance walked in 6-minute walk test or incremental shuttle walk test, or volume	**Abstract:** BACKGROUND: Tai Chi, a systematic callisthenic exercise first developed in ancient China, involves a series of slow and rhythmic circular motions. It emphasises use of 'mind' or concentration to control breathing and circular body motions to facilitate flow of internal energy (i.e. 'qi') within the body. Normal flow of 'qi' is believed to be essential to sustain body homeostasis, ultimately leading to longevity. The effect of Tai Chi on balance and muscle strength in the elderly population has been reported; however, the effect of Tai Chi on dyspnoea, exercise capacity, pulmonary function and psychosocial status among people with chronic obstructive pulmonary disease (COPD) remains unclear. OBJECTIVES: * To explore the effectiveness of Tai Chi in reducing dyspnoea and improving exercise capacity in people with COPD.* To determine the influence of Tai Chi on physiological and psychosocial functions among people with COPD. SEARCH METHODS: We searched the Cochrane Airways Group Specialised Register of trials (which included the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Allied and Complementary Medicine Database (AMED) and PsycINFO); handsearched respiratory journals and meeting abstracts; and searched Chinese medical databases including Wanfang Data, Chinese Medical Current Contents (CMCC), Chinese Biomedical Database (CBM), China Journal Net (CJN) and China Medical Academic Conference (CMAC), from inception to September 2015. We checked the reference lists of all primary studies and review articles for relevant additional references. SELECTION CRITERIA: We included randomised controlled trials (RCTs) comparing Tai Chi (Tai Chi alone or Tai Chi in addition to another intervention) versus control (usual care or another intervention identical to that used in the Tai Chi group) in people with COPD. Two independent review authors screened and selected studies. DATA COLLECTION AND ANALYSIS: Two independent review authors extracted data from included studies and assessed risk of bias on the basis of suggested criteria listed in the Cochrane Handbook for Systematic Reviews of Interventions. We extracted post-programme data and entered them into RevMan software (version 5.3) for data synthesis and analysis. MAIN RESULTS: We included a total of 984 participants from 12 studies (23 references) in this analysis. We included only those involved in Tai Chi and the control group (i.e. 811 participants) in the final analysis. Study sample size ranged from 10 to 206, and mean age ranged from 61 to 74 years. Programmes lasted for six weeks to one year. All included studies were RCTs; three studies used allocation concealment, six reported blinded outcome assessors and three studies adopted an intention-to-treat approach to statistical analysis. No adverse events were reported. Quality of evidence of the outcomes ranged from very low to moderate.Analysis was split into three comparisons: (1) Tai Chi

of oxygen consumption). Quality of life: generic (Medical Outcome Survey 36-Item Short Form, Sickness Impact Profile) and disease-specific (Chronic Respiratory Questionnaire, St. George's Respiratory Questionnaire). Balance. **Examine Cardiorespiratory Fitness as Outcome:** Yes	versus usual care; (2) Tai Chi and breathing exercise versus breathing exercise alone; and (3) Tai Chi and exercise versus exercise alone.Comparison of Tai Chi versus usual care revealed that Tai Chi demonstrated a longer six-minute walk distance (mean difference (MD) 29.64 metres, 95% confidence interval (CI) 10.52 to 48.77 metres; participants = 318; I(2) = 59%) and better pulmonary function (i.e. forced expiratory volume in one second, MD 0.11 L, 95% CI 0.02 to 0.20 L; participants = 258; I(2) = 0%) in post-programme data. However, the effects of Tai Chi in reducing dyspnoea level and improving quality of life remain inconclusive. Data are currently insufficient for evaluating the impact of Tai Chi on maximal exercise capacity, balance and muscle strength in people with COPD. Comparison of Tai Chi and other interventions (i.e. breathing exercise or exercise) versus other interventions shows no superiority and no additional effects on symptom improvement nor on physical and psychosocial outcomes with Tai Chi. AUTHORS' CONCLUSIONS: No adverse events were reported, implying that Tai Chi is safe to practise in people with COPD. Evidence of very low to moderate quality suggests better functional capacity and pulmonary function in post-programme data for Tai Chi versus usual care. When Tai Chi in addition to other interventions was compared with other interventions alone, Tai Chi did not show superiority and showed no additional effects on symptoms nor on physical and psychosocial function improvement in people with COPD. With the diverse style and number of forms being adopted in different studies, the most beneficial protocol of Tai Chi style and number of forms could not be commented upon. Hence, future studies are warranted to address these topics.
Populations Analyzed: Adults Mean age 61–74, Chronic obstructive pulmonary disease (COPD)	**Author-Stated Funding Source:** National Institute for Health Research.

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Ni X, Liu S, Lu F, Shi X, Guo X. Efficacy and safety of Tai Chi for Parkinson's disease: a systematic review and meta-analysis of randomized controlled trials. PLoS One. 2014;9(6):e99377. doi:10.1371/journal.pone.0099377.</td></tr>
<tr><td>Purpose: To identify whether tai chi safely benefits Parkinson's disease patients.</td><td rowspan="4">Abstract: BACKGROUND AND OBJECTIVE: In Parkinson's disease (PD), wearing off and side effects of long-term medication and complications pose challenges for neurologists. Although Tai Chi is beneficial for many illnesses, its efficacy for PD remains uncertain. The purpose of this review was to evaluate the efficacy and safety of Tai Chi for PD. METHODS: Randomized controlled trials (RCTs) of Tai Chi for PD were electronically searched by the end of December 2013 and identified by two independent reviewers. The tool from the Cochrane Handbook 5.1 was used to assess the risk of bias. A standard meta-analysis was performed using RevMan 5.2 software. RESULTS: Ten trials with PD of mild-to-moderate severity were included in the review, and nine trials (n = 409) were included in the meta-analysis. The risk of bias was generally high in the blinding of participants and personnel. Improvements in the Unified Parkinson's Disease Rating Scale Part III (mean difference (MD) -4.34, 95% confidence interval (CI) -6.67--2.01), Berg Balance Scale (MD: 4.25, 95% CI: 2.83-5.66), functional reach test (MD: 3.89, 95% CI: 1.73-6.04), Timed Up and Go test (MD: -0.75, 95% CI: -1.30--0.21), stride length (standardized MD: 0.56, 95% CI: 0.03-1.09), health-related quality of life (standardized MD: -1.10, 95% CI: -1.81--0.39) and reduction of falls were greater after interventions with Tai Chi plus medication. Satisfaction and safety were high. Intervention with Tai Chi alone was more effective for only a few balance and mobility outcomes. CONCLUSIONS: Tai Chi performed with medication resulted in promising gains in mobility and balance, and it was safe and popular among PD patients at an early stage of the disease. This provides a new evidence for PD management. More RCTs with larger sample size that carefully address blinding and prudently select outcomes are needed. PROSPERO registration number CRD42013004989.</td></tr>
<tr><td>Timeframe: Inception–December 2013</td></tr>
<tr><td>Total # of Studies: 10 (9 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Tai chi practiced alone or in combination with conventional medication, compared to other exercise with or without conventional medication, medication alone, placebo, or no other intervention. Duration and length of follow-up not restricted.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Motor symptoms: Unified Parkinson's Disease Rating Scale Part III global scores. Balance and mobility function: Berg Balance Scale, functional reach test, Timed Up and Go test. Health-related quality of life: Parkinson's Disease Questionnaire-39 or Parkinson's Disease Questionnaire-39 Summary Index. Gait: velocity and stride length.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Parkinson's disease</td><td>Author-Stated Funding Source: Joint Special Project of Guangdong Provincial Department of Science and Technology and Guangdong Provincial Academy of Chinese Medical Sciences.</td></tr>
</table>

<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Pitkälä K, Savikko N, Poysti M, Strandberg T, Laakkonen ML. Efficacy of physical exercise intervention on mobility and physical functioning in older people with dementia: a systematic review. Exp Gerontol. 2013;48(1):85-93. doi:10.1016/j.exger.2012.08.008.</td></tr>
<tr><td>Purpose: To investigate whether rigorous trials have shown the efficacy of exercise training in the mobility, functional limitations, and physical functioning of people with dementia.</td><td rowspan="4">Abstract: Numerous trials have shown that physical activity and exercise training have beneficial effects in general older populations. However, few have studied its effectiveness among people with dementia. The aim of this systematic review is to examine the efficacy of trials using a rigorous randomised, controlled design and including physical activity or exercise as a major component of intervention on the physical functioning, mobility and functional limitations of people with dementia. We found 20 randomised controlled trials that included a total of 1378 participants. Of these, only three were of high methodological quality, and six of moderate quality. Nevertheless, these studies consistently show that intensive physical rehabilitation enhances mobility and, when administered over a long period, may also improve the physical functioning of patients with dementia.</td></tr>
<tr><td>Timeframe: Inception–August 2011</td></tr>
<tr><td>Total # of Studies: 20</td></tr>
<tr><td>Exposure Definition: Planned, structured, and repetitive training for the purpose of conditioning any part of the body, including strength training, endurance, walking, balance, dual-task training, or training specific daily functions; many programs were multimodal. Duration ranged from 12 weeks to 1 year.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical function: Katz activities of daily living index.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Older adults, Dementia</td><td>Author-Stated Funding Source: Social Insurance Institution of Finland, Central Union for the Welfare of the Aged, Sohlberg Foundation, and King Gustaf V and Queen Victoria’s Foundation.</td></tr>
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<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Potter R, Ellard D, Rees K, Thorogood M. A systematic review of the effects of physical activity on physical functioning, quality of life and depression in older people with dementia. Int J Geriatr Psychiatry. 2011;26(10):1000-1011. doi:10.1002/gps.2641.</td></tr>
<tr><td>Purpose: To develop a synthesis of what is known about PA interventions to address physical functioning, quality of life, and depression in people with cognitive impairment or dementia, and to provide information on the content of the PA programs that have been used to inform the development of the intervention used in the OPERA trial.</td><td rowspan="5">Abstract: BACKGROUND: Depression is common in older people with dementia. Physical activity is effective in reducing depression in adults but there is limited evidence about its effectiveness in people with dementia. DESIGN AND METHODS: A systematic review and partial meta-analysis of physical activity interventions in people with dementia is reported. We searched eight databases for English language papers and reference lists of relevant papers. Included studies reported a physical activity intervention lasting at least 12 weeks in which participants were older and had a diagnosis of dementia. Studies compared the intervention with a non-active or a no-intervention control and reported at least one outcome related to physical function, quality of life or depression. At least two authors independently assessed each paper for inclusion and for study quality and extracted data. RESULTS: We included 13 randomised controlled trials with 896 participants. Three of six trials that reported walking as an outcome found an improvement, as did four of the five trials reporting timed get up and go tests. Only one of the four trials that reported depression as an outcome found a positive effect. Both trials that reported quality of life found an improvement. CONCLUSIONS: There is some evidence that physical activity interventions improve physical function in older people with dementia. Evidence for an effect on depression and quality of life is limited.</td></tr>
<tr><td>Timeframe: Inception–February 2009</td></tr>
<tr><td>Total # of Studies: 15</td></tr>
<tr><td>Exposure Definition: Aerobic, endurance, strength training, balance, or flexibility activities (or a combination of types of activity). Session duration ranged from 15–75 minutes and the number of sessions ranged from 2 to 7 times per week. Interventions lasted from 12 weeks to 12 months.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Timed Up and Go. 6-minute walk. Walking speed. Berg Balance.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults ≥60, Dementia</td><td>Author-Stated Funding Source: Birmingham Science City Translational Medicine Clinical Research and Infrastructure Trials; Advantage West Midlands.</td></tr>
</table>

<table>
<tr><th colspan="2">Cognitive Impairment</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Rao AK, Chou A, Bursley B, Smulofsky J, Jezequel J. Systematic review of the effects of exercise on activities of daily living in people with Alzheimer's disease. Am J Occup Ther. 2014;68(1):50-56. doi:10.5014/ajot.2014.009035.</td></tr>
<tr><td>Purpose: To examine the effectiveness of physical training (aerobic, balance, and strength training) on activities of daily living performance in people with Alzheimer's disease.</td><td rowspan="4">Abstract: OBJECTIVE. Alzheimer's disease (AD) results in a loss of independence in activities of daily living (ADLs), which in turn affects the quality of life of affected people and places a burden on caretakers. Limited research has examined the influence of physical training (aerobic, balance, and strength training) on ADL performance of people with AD. METHOD. Six randomized controlled trials (total of 446 participants) fit the inclusion criteria. For each study, we calculated effect sizes for primary and secondary outcomes. RESULTS. Average effect size (95% confidence interval) for exercise on the primary outcome (ADL performance) was 0.80 ($p < .001$). Exercise had a moderate impact on the secondary outcome of physical function (effect size = 0.53, $p = .004$). CONCLUSION. Occupational therapy intervention that includes aerobic and strengthening exercises may help improve independence in ADLs and improve physical performance in people with AD. Additional research is needed to identify specific components of intervention and optimal dosage to develop clinical guidelines.</td></tr>
<tr><td>Timeframe: Not reported</td></tr>
<tr><td>Total # of Studies: 6</td></tr>
<tr><td>Exposure Definition: Interventions consisted of walking programs, functional activity performance, stretching, strength and resistance training, balance exercises, and aerobic and endurance training. Length of the exercise programs varied from 12 weeks to 12 months and were performed in the participant's community or nursing home.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Functional ability using activities of daily living (ADLs): Katz Index of Independence in ADLs, Barthel Index of ADLs, Physical Functioning subscale of the Short Form–36, Acute Care Index of Function; Physical function: 6-minute walk test, Tinetti Mobility Test, the Senior Fitness Test, Functional Reach Test, Timed Up and Go, Sit-to-stand, 6-minute walking speed, standing balance, one-leg balance test.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults ≥65, Alzheimer's disease</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Saltychev M, Barlund E, Paltamaa J, Katajapuu N, Laimi K. Progressive resistance training in Parkinson's disease: a systematic review and meta-analysis. BMJ Open. 2016;6(1):e008756. doi:10.1136/bmjopen-2015-008756.</td></tr>
<tr><td>Purpose: To evaluate the evidence on the effectiveness of progressive resistance training in the rehabilitation of people with Parkinson's disease.</td><td rowspan="4">Abstract: OBJECTIVES: To investigate if there is evidence on effectiveness of progressive resistance training in rehabilitation of Parkinson disease. DESIGN: Systematic review and meta-analysis. DATA SOURCES: Central, Medline, Embase, Cinahl, Web of Science, Pedro until May 2014. Randomised controlled or controlled clinical trials. The methodological quality of studies was assessed according to the Cochrane Collaboration's domain-based evaluation framework. DATA SYNTHESIS: random effects meta-analysis with test for heterogeneity using the I(2) and pooled estimate as the raw mean difference. PARTICIPANTS: Adults with primary/idiopathic Parkinson's disease of any severity, excluding other concurrent neurological condition. INTERVENTIONS: Progressive resistance training defined as training consisting of a small number of repetitions until fatigue, allowing sufficient rest between exercises for recovery, and increasing the resistance as the ability to generate force improves. COMPARISON: Progressive resistance training versus no treatment, placebo or other treatment in randomised controlled or controlled clinical trials. PRIMARY AND SECONDARY OUTCOME MEASURES: Any outcome. RESULTS: Of 516 records, 12 were considered relevant. Nine of them had low risk of bias. All studies were randomised controlled trials conducted on small samples with none or 1 month follow-up after the end of intervention. Of them, six were included in quantitative analysis. Pooled effect sizes of meta-analyses on fast and comfortable walking speed, the 6 min walking test, Timed Up and Go test and maximal oxygen consumption were below the level of minimal clinical significance. CONCLUSIONS: There is so far no evidence on the superiority of progressive resistance training compared with other physical training to support the use of this technique in rehabilitation of Parkinson's disease. SYSTEMATIC REVIEW REGISTRATION NUMBER: PROSPERO 2014:CRD42014009844.</td></tr>
<tr><td>Timeframe: Inception–May 2014</td></tr>
<tr><td>Total # of Studies: 12 (6 included in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Interventions using progressive resistance training (PRT), defined as training with a) small number of repetitions until fatigue; b) sufficient rest between exercises for recovery; and c) increases in resistance as patient's ability to generate force improves. Intervention duration varied from 1.5 to 24 months with frequency of 2–3 times per week. PRT compared with usual care, vitamins, and other exercise modalities.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Gait velocity and endurance: Fast walking speed, comfortable walking speed, Timed Up and Go test. Gait initiation performance. Gait freezing: Freezing of Gait Questionnaire.
Examine Cardiorespiratory Fitness as Outcome: Yes</td></tr>
<tr><td>Populations Analyzed: Adults Mean age 59–71, Parkinson's disease</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Sharp K, Hewitt J. Dance as an intervention for people with Parkinson's disease: a systematic review and meta-analysis. Neurosci Biobehav Rev. 2014;47:445-456. doi:10.1016/j.neubiorev.2014.09.009.</td></tr>
<tr><td>Purpose: To investigate the effectiveness of dance as an intervention for people with Parkinson's disease in comparison to either no intervention or other exercise interventions.</td><td rowspan="4">Abstract: Recent studies suggest dance may be able to improve motor and non-motor disabilities in Parkinson's disease patients. A systematic review and meta-analysis of randomised controlled trials (RCT's) regarding the effectiveness of dance compared with no intervention and other exercise interventions was performed. Five trials were included and methodological quality and mean or standardised mean differences were calculated. Dance significantly improved UPDRS motor scores (-10.73, CI -15.05 to -6.16; P=0.004), berg balance (0.72, CI 0.31 to 1.44; P=0.0006) and gait speed (0.14 m/s CI 0.02 to 0.26; P=0.02) when compared with no intervention. When compared with other exercise interventions significant improvements in berg balance (3.98, CI 1.52 to 6.44, P=0.002) and quality of life (PDQ-39) (-4.00, CI -7.13 to -0.87, P=0.01) were found. Dance demonstrates short term clinically meaningful benefits in Parkinson's disease. Future RCT's should be well designed and determine the long term effects of dance, which dose and type of dance is most effective and how dance compares to other exercise therapies.</td></tr>
<tr><td>Timeframe: Inception–January 2014</td></tr>
<tr><td>Total # of Studies: 10 (7 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Any form of dance (e.g., Tango, Foxtrot, Irish).
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Unified Parkinson's Disease Rating Scale motor scores. Berg Balance Scale. Freezing of Gait Questionnaire. Velocity. Six-minute walk test. Quality of life: Parkinson's Disease Questionnaire 39.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Parkinson's disease</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Shu HF, Yang T, Yu SX, et al. Aerobic exercise for Parkinson's disease: a systematic review and meta-analysis of randomized controlled trials. Database of Abstracts of Reviews of Effects. 2014;(2):e100503.</td></tr>
<tr><td>Purpose: To evaluate the evidence about whether aerobic exercise is effective for patients with Parkinson's disease.</td><td rowspan="4">Abstract: Although some trials assessed the effectiveness of aerobic exercise for Parkinson's disease (PD), the role of aerobic exercise in the management of PD remained controversial. OBJECTIVE: The purpose of this systematic review is to evaluate the evidence about whether aerobic exercise is effective for PD. METHODS: Seven electronic databases, up to December 2013, were searched to identify relevant studies. Two reviewers independently extracted data and assessed methodological quality based on PEDro scale. Standardised mean difference (SMD) and 95% confidence intervals (CI) of random-effects model were calculated. And heterogeneity was assessed based on the I2 statistic. RESULTS: 18 randomized controlled trials (RCTs) with 901 patients were eligible. The aggregated results suggested that aerobic exerciseshould show superior effects in improving motor actions (SMD, -0.57; 95% CI -0.94 to -0.19; p = 0.003), balance (SMD, 2.02; 95% CI 0.45 to 3.59; p = 0.01), and gait (SMD, 0.33; 95% CI 0.17 to 0.49; p<0.0001) in patients with PD, but not in quality of life (SMD, 0.11; 95% CI -0.23 to 0.46; p = 0.52). And there was no valid evidence on follow-up effects of aerobic exercise for PD. CONCLUSION: Aerobic exercise showed immediate beneficial effects in improving motor action, balance, and gait in patients with PD. However, given no evidence on follow-up effects, large-scale RCTs with long follow-up are warrant to confirm the current findings.</td></tr>
<tr><td>Timeframe: Inception–December 2013</td></tr>
<tr><td>Total # of Studies: 18</td></tr>
<tr><td>Exposure Definition: Aerobic exercise programs were included, such as treadmill training, tai chi, walking, and dancing. Programs ranged from 3 weeks to 16 months, with a variety of frequencies and intensities performed.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Gait: 6-minute walk test, gait velocity, Timed Up and Go, stride/step length. Physical Function: Unified Parkinson's Disease Rating Scale and Functional Reach Test. Balance: Berg Balance Test and Berg Balance Scale. Quality of life: Parkinson's Disease Questionnaire 39.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age 20–85, Parkinson's disease</td><td>Author-Stated Funding Source: National Natural Science Foundation of China, China Postdoctoral Science Foundation, Research Foundation of General Hospital of Chengdu Military Region, and Science Foundation of Health Office of Sichuan Province.</td></tr>
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<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Theou O, Stathokostas L, Roland KP, et al. The effectiveness of exercise interventions for the management of frailty: a systematic review. J Aging Res. April 2011:569194. doi:10.4061/2011/569194.</td></tr>
<tr><td>Purpose: To consider the use of the term "frailty" in relation to exercise interventions and to examine the effectiveness of current exercise interventions for the management of frailty.</td><td rowspan="4">Abstract: This systematic review examines the effectiveness of current exercise interventions for the management of frailty. Eight electronic databases were searched for randomized controlled trials that identified their participants as "frail" either in the title, abstract, and/or text and included exercise as an independent component of the intervention. Three of the 47 included studies utilized a validated definition of frailty to categorize participants. Emerging evidence suggests that exercise has a positive impact on some physical determinants and on all functional ability outcomes reported in this systematic review. Exercise programs that optimize the health of frail older adults seem to be different from those recommended for healthy older adults. There was a paucity of evidence to characterize the most beneficial exercise program for this population. However, multicomponent training interventions, of long duration (>/=5 months), performed three times per week, for 30-45 minutes per session, generally had superior outcomes than other exercise programs. In conclusion, structured exercise training seems to have a positive impact on frail older adults and may be used for the management of frailty.</td></tr>
<tr><td>Timeframe: Inception–February 2009</td></tr>
<tr><td>Total # of Studies: 47</td></tr>
<tr><td>Exposure Definition: Exercise included resistance training (at 80% of 1 repetition maximum), aerobic exercise (walking), other types (Tai Chi, water exercises), and multi-component interventions (resistance, balance, aerobic, and flexibility training). Most interventions were 2 to 3 times a week, 45 to 60 minutes long, and lasted 3 months
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical determinants: flexibility, muscle function, physical activity participation. Functional ability: mobility, balance, and functional performance test batteries. Body composition. Adverse health consequences: activities of daily living and falls.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults 71–90 (mean age 81.5), Frail</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Tillman A, Muthalib M, Hendy A, et al. Lower limb progressive resistance training improves leg strength but not gait speed or balance in Parkinson's disease: a systematic review and meta-analysis. Front Aging Neurosci. 2015;7:40. doi:10.3389/fnagi.2015.00040.</td></tr>
<tr><td>Purpose: To evaluate the current literature for evidence to support the functional benefits of progressive resistance training on gait and balance in people with Parkinson's disease and to identify critical gaps in the literature that needs to be addressed in future research.</td><td rowspan="5">Abstract: The use of progressive resistance training (PRT) to improve gait and balance in people with Parkinson's disease (PD) is an emerging area of interest. However, the main effects of PRT on lower limb functions such as gait, balance, and leg strength in people with PD remain unclear. Therefore, the aim of the meta-analysis is to evaluate the evidence surrounding the use of PRT to improve gait and balance in people with PD. Five electronic databases, from inception to December 2014, were searched to identify the relevant studies. Data extraction was performed by two independent reviewers and methodological quality was assessed using the PEDro scale. Standardized mean differences (SMD) and 95% confidence intervals (CIs) of fixed and random effects models were used to calculate the effect sizes between experimental and control groups and I (2) statistics were used to determine levels of heterogeneity. In total, seven studies were identified consisting of 172 participants (experimental n = 84; control n = 88). The pooled results showed a moderate but significant effect of PRT on leg strength (SMD 1.42, 95% CI 0.464-2.376); however, no significant effects were observed for gait speed (SMD 0.418, 95% CI -0.219 to 1.055). No significant effects were observed for balance measures included in this review. In conclusion, our results showed no discernable effect of PRT on gait and balance measures, although this is likely due to the lack of studies available. It may be suggested that PRT be performed in conjunction with balance or task-specific functional training to elicit greater lower limb functional benefits in people with PD.</td></tr>
<tr><td>Timeframe: Inception–December 2014</td></tr>
<tr><td>Total # of Studies: 7</td></tr>
<tr><td>Exposure Definition: Lower limb progressive resistance training (PRT). Intervention duration ranged from 8 to 24 weeks and frequency ranged from 2 to 3 sessions/week on non-consecutive days. The intensity for each PRT intervention was approximately 60–80% of one repetition maximum for each exercise.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Balance. Gait speed. Leg strength.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults 20–85, Parkinson's disease</td><td>Author-Stated Funding Source: Central Research Grant Scheme, School of Exercise and Nutrition Sciences.</td></tr>
</table>

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Valenzuela T. Efficacy of progressive resistance training interventions in older adults in nursing homes: a systematic review. J Am Med Dir Assoc. 2012;13(5):418-428. doi:10.1016/j.jamda.2011.11.001.</td></tr>
<tr><td>Purpose: To determine whether progressive resistance training, as a single exercise intervention, improves strength and physical performance in older institutionalized adults.</td><td rowspan="4">Abstract: OBJECTIVE: To provide a synthesis of the evidence from clinical trials to determine whether progressive resistance training, as a single exercise intervention, improves strength and functional performance in older institutionalized adults. METHODS: A comprehensive systematic database search for randomized controlled trials was performed, including AMED, CINAHL, COCHRANE, and all EMB reviews: Cochrane DSR, ACP Journal Club, DARE, MEDLINE, PREMEDLINE, and PsycINFO, completed in July 2011. Studies were then assessed for potential inclusion. Study quality indicators, cohort characteristics, training intervention, muscle strength, and functional performance outcomes were extracted. RESULTS: Thirteen studies were reviewed; the mean cohort age range was 80 to 89 years. In general, the quality of the reviewed studies was moderately robust; an average of 9 of 11 quality criteria were accounted for in the reviewed literature. Significant improvements were found in muscle strength outcomes and functional performance outcomes, including chair to stand time, stair climbing, gait speed, balance, and functional capacity following progressive resistance training interventions. CONCLUSIONS: Significant improvements in muscle strength and functional performance occur in response to progressive resistance training exercise, despite advanced age, presence of chronic diseases, extremely sedentary habits, and functional disabilities in older institutionalized individuals. Therefore, the incorporation of a progressive resistance training exercise program is an effective means to preserve independence levels by maintaining or improving the ability to perform activities of daily living and the implementation of this type of exercise program should be promoted and incorporated into the recreational schedules of long term care institutions.</td></tr>
<tr><td>Timeframe: Inception–July 2011</td></tr>
<tr><td>Total # of Studies: 13</td></tr>
<tr><td>Exposure Definition: Progressive resistance training, defined as a strength-training program in which participants exercised their muscles against an external force at a participant-specific intensity adjusted throughout the program. Modalities included weight machines, free weights, elastic bands, and weighted vests. Most trials lasted 2 to 4 months; sessions were held 3 times a week for 30–60. Subgroups: High, moderate, and low intensity.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical performance: Gait velocity, gait speed, stair climbing power, activities of daily living, stair climbing.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults Mean age 70–90</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Vermeulen J, Neyens JC, van Rossum E, Spreeuwenberg MD, de Witte LP. Predicting ADL disability in community-dwelling elderly people using physical frailty indicators: a systematic review. BMC Geriatr. 2011;11:33. doi:10.1186/1471-2318-11-33.</td></tr>
<tr><td>Purpose: To systematically review the literature on the predictive value of physical frailty indicators on activities of daily living disability in community-dwelling elderly people.</td><td rowspan="5">Abstract: BACKGROUND: Disability in Activities of Daily Living (ADL) is an adverse outcome of frailty that places a burden on frail elderly people, care providers and the care system. Knowing which physical frailty indicators predict ADL disability is useful in identifying elderly people who might benefit from an intervention that prevents disability or increases functioning in daily life. The objective of this study was to systematically review the literature on the predictive value of physical frailty indicators on ADL disability in community-dwelling elderly people. METHODS: A systematic search was performed in 3 databases (PubMed, CINAHL, EMBASE) from January 1975 until April 2010. Prospective, longitudinal studies that assessed the predictive value of individual physical frailty indicators on ADL disability in community-dwelling elderly people aged 65 years and older were eligible for inclusion. Articles were reviewed by two independent reviewers who also assessed the quality of the included studies. RESULTS: After initial screening of 3081 titles, 360 abstracts were scrutinized, leaving 64 full text articles for final review. Eventually, 28 studies were included in the review. The methodological quality of these studies was rated by both reviewers on a scale from 0 to 27. All included studies were of high quality with a mean quality score of 22.5 (SD 1.6). Findings indicated that individual physical frailty indicators, such as weight loss, gait speed, grip strength, physical activity, balance, and lower extremity function are predictors of future ADL disability in community-dwelling elderly people. CONCLUSIONS: This review shows that physical frailty indicators can predict ADL disability in community-dwelling elderly people. Slow gait speed and low physical activity/exercise seem to be the most powerful predictors followed by weight loss, lower extremity function, balance, muscle strength, and other indicators. These findings should be interpreted with caution because the data of the different studies could not be pooled due to large variations in operationalization of the indicators and ADL disability across the included studies. Nevertheless, our study suggests that monitoring physical frailty indicators in community-dwelling elderly people might be useful to identify elderly people who could benefit from disability prevention programs.</td></tr>
<tr><td>Timeframe: 1975–April 2010</td></tr>
<tr><td>Total # of Studies: 28 (9 PA exposure)</td></tr>
<tr><td>Exposure Definition: PA or exercise.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Activities of daily living (ADL) outcome: some studies defined disability as dependency in ADL at follow-up, others as difficulty in ADL at follow-up, and some used chronic ADL disability.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults ≥65</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Cardiovascular Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Wang XQ, Pi YL, Chen PJ, et al. Traditional Chinese exercise for cardiovascular diseases: systematic review and meta-analysis of randomized controlled trials. J Am Heart Assoc. 2016;5(3):e002562. doi:10.1161/JAHA.115.002562.</td></tr>
<tr><td>Purpose: To determine the effects of traditional Chinese exercises (TCEs) on physiological outcomes, biochemical outcomes, physical function, quality of life, and depression among cardiovascular disease patients.</td><td rowspan="4">Abstract: BACKGROUND: Traditional Chinese exercise (TCE) has widespread use for the prevention and treatment of cardiovascular disease; however, there appears to be no consensus about the benefits of TCE for patients with cardiovascular disease. The objective of this systematic review was to determine the effects of TCE for patients with cardiovascular disease. METHODS AND RESULTS: Relevant studies were searched by PubMed, Embase, Web of Science, the Cochrane Library, the Cumulative Index to Nursing and Allied Health Literature, and the China National Knowledge Infrastructure. We covered only published articles with randomized controlled trials. The outcome measures included physiological outcomes, biochemical outcomes, physical function, quality of life, and depression. A total of 35 articles with 2249 cardiovascular disease patients satisfied the inclusion criteria. The pooling revealed that TCE could decrease systolic blood pressure by 9.12 mm Hg (95% CI -16.38 to -1.86, P=0.01) and diastolic blood pressure by 5.12 mm Hg (95% CI -7.71 to -2.52, P<0.001). Patients performing TCE also found benefits compared with those in the control group in terms of triglyceride (standardized mean difference -0.33, 95% CI -0.56 to -0.09, P=0.006), 6-minute walk test (mean difference 59.58 m, 95% CI -153.13 to 269.93, P=0.03), Minnesota Living With Heart Failure Questionnaire results (mean difference -17.08, 95% CI -23.74 to -10.41, P<0.001), 36-Item Short Form physical function scale (mean difference 0.82, 95% CI 0.32-1.33, P=0.001), and Profile of Mood States depression scale (mean difference -3.02, 95% CI -3.50 to -2.53, P<0.001). CONCLUSIONS: This study demonstrated that TCE can effectively improve physiological outcomes, biochemical outcomes, physical function, quality of life, and depression among patients with cardiovascular disease. More high-quality randomized controlled trials on this topic are warranted.</td></tr>
<tr><td>Timeframe: 1957–January 2015</td></tr>
<tr><td>Total # of Studies: 35</td></tr>
<tr><td>Exposure Definition: TCEs consisting of tai chi, aerobic, strength, or Baduanjin exercise, ranging from 1 to >5 days/week for 12 weeks to 1 year.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical function: 6-minute walk test, Timed Up and Go test. Quality of life: Minnesota Living With Heart Failure Questionnaire, General Health Questionnaire, and Short Form 36.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults, Heart disease</td><td>Author-Stated Funding Source: Shanghai Key Lab of Human Performance; National Natural Science Foundation of China; Innovation Program of Shanghai Municipal Education Commission; Shanghai Committee of Science and Technology; Shanghai Youth Science and Technology Sail Project, Key Disciplines Group Construction Project of Pudong Health Bureau of Shanghai.</td></tr>
</table>

<table>
<tr><th colspan="2">Frailty</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Weening-Dijksterhuis E, de Greef MH, Scherder EJ, Slaets JP, van der Schans CP. Frail institutionalized older persons: a comprehensive review on physical exercise, physical fitness, activities of daily living, and quality-of-life. Am J Phys Med Rehabil. 2011;90(2):156-168. Doi:10.1097/PHM.0b013e3181f703ef.</td></tr>
<tr><td>Purpose: To propose criteria for an evidence-based exercise protocol aimed at frail institutionalized older people.</td><td rowspan="5">Abstract: The objective of this study was to perform a systematic review on training outcomes influencing physical fitness, activity of daily living performance, and quality-of-life in institutionalized older people. We reviewed 27 studies on older people (age, >/=70 yrs) in long-term care facilities and nursing homes. Our ultimate goal was to propose criteria for an evidence-based exercise protocol aimed at improving physical fitness, activity of daily living performance, and quality-of-life of frail institutionalized older people. The interventions, described in the reviewed studies that showed strong or very strong effect sizes were used to form an exercise prescription. The conclusion is that there is firm evidence for training effects on physical fitness, functional performance, activity of daily living performance, and quality-of-life. The training should contain a combination of progressive resistance training, balance training, and functional training. The proposed intensity is moderate to high, assessed on a 0-10 scale for muscle strengthening activities. The training frequency was three times a week, and the total duration was at least 10 wks.</td></tr>
<tr><td>Timeframe: 1955–2008</td></tr>
<tr><td>Total # of Studies: 27</td></tr>
<tr><td>Exposure Definition: Exercises included balance, strength training, functional performance, gait, tai chi, and flexibility. Most interventions lasted for at least 4 months and were performed 2 times a week for 45–60 minutes.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Activities of daily living. Strength. Balance. Coordination. Endurance. Flexibility. Muscle strength.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age ≥70, Frail</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Osteoporosis/Osteopenia</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Wilhelm M, Roskovensky G, Emery K, Manno C, Valek K, Cook C. Effect of resistance exercises on function in older adults with osteoporosis or osteopenia: a systematic review. Physiother Can. 2012;64(4):386-394. doi:10.3138/ptc.2011-31BH.</td></tr>
<tr><td>Purpose: To evaluate the strength and quality of literature that examined the effect of resistance exercises in older adults with osteoporosis or osteopenia, using self-reported measures on physical function and activities of daily living.</td><td rowspan="5">Abstract: PURPOSE: To examine the effect of resistance exercises on self-reported physical function and activities of daily living (ADL) in older adults with osteoporosis or osteopenia. METHODS: A search of available literature was conducted using PubMed, CINAHL, SPORTDiscus, PEDro, ProQuest Nursing and Allied Health Source, and Cochrane Controlled Trials Register. Studies were included if they involved (1) randomized controlled trials; (2) participants with osteoporosis or osteopenia; (3) resistance exercise as an intervention; and (4) self-report of physical function or ADL. Articles were independently reviewed for quality by two authors using the Physiotherapy Evidence Database (PEDro) scale. Cohen’s d effect size was calculated by dividing standardized mean differences by the standard deviation to determine treatment effect in terms of physical function or ADL. RESULTS: Five full-text articles were selected for inclusion. PEDro scores ranged from 5 to 7 (out of 10). Effect size mean differences as a result of resistance intervention ranged from 0.08 to 1.74, suggesting "trivial" to "large" effects on self-reported physical function and ADL. CONCLUSION: RESULTS suggest that interventions using resistance training have a beneficial impact on the domains of physical function and ADL in participants with osteoporosis or osteopenia. More high-quality studies are needed to lend further validity to this supposition.</td></tr>
<tr><td>Timeframe: 1966–August 2011</td></tr>
<tr><td>Total # of Studies: 5</td></tr>
<tr><td>Exposure Definition: Resistance exercise defined as site-specific resistance exercises that use isometric, concentric, or eccentric contractions against a load of the body segment or an external load.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Physical function or activities of daily living: Short Form-36, the Osteoporosis Functional Disability Questionnaire, the Quality of Life Questionnaire of the European Foundation for Osteoporosis, the Japanese Osteoporosis Quality of Life Questionnaire.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Older adults, Osteoporosis/osteopenia</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

Cardiovascular Disease	
Meta-Analysis **Citation:** Yamamoto S, Hotta K, Ota E, Mori R, Matsunaga A. Effects of resistance training on muscle strength, exercise capacity, and mobility in middle-aged and elderly patients with coronary artery disease: a meta-analysis. *J Cardiol.* 2016;68(2):125-134. doi:10.1016/j.jjcc.2015.09.005.	
Purpose: To clarify the effects of resistance training on exercise capacity, skeletal muscle strength, and mobility in middle-aged and elderly patients with coronary artery disease.	**Abstract:** BACKGROUND: Resistance training (RT) is a core component of cardiac rehabilitation. We investigated the effects of RT on exercise capacity, muscle strength, and mobility in middle-aged and elderly patients with coronary artery disease (CAD). METHODS: We searched for randomized controlled trials of RT versus usual care, or combined RT and aerobic training (AT) versus AT alone, and identified 440 trials in total from inception to January 2014. Participants who had myocardial infarction, coronary revascularization, angina pectoris or CAD were included in the analysis. Those who had heart failure, heart transplants with either cardiac resynchronization therapy or implantable defibrillators were excluded. RESULTS: Twenty-two trials totaling 1095 participants were analyzed. We performed random-effects meta-analysis. In middle-aged participants, RT increased lower extremity muscle strength [standardized mean difference (SMD): 0.65, 95% confidence interval (CI): 0.35 to 0.95], upper extremity muscle strength (SMD: 0.73, 95% CI: 0.48 to 0.99) and peak oxygen consumption (VO2) [weight mean difference (WMD): 0.92mL/kg/min, 95% CI: 0.12 to 1.72], but did not improve mobility compared with the control. In elderly participants, RT increased lower extremity muscle strength (SMD: 0.63, 95% CI: 0.05 to 1.21), upper extremity muscle strength (SMD: 1.18, 95% CI: 0.56 to 1.80), and peak VO2 (WMD: 0.70mL/kg/min, 95% CI: 0.03 to 1.37), and improved mobility (SMD: 0.61, 95% CI: 0.21 to 1.01) compared with the control. CONCLUSIONS: Resistance training could increase exercise capacity and muscle strength in middle-aged and elderly patients, and mobility in elderly patients, with CAD.
Timeframe: Inception–January 2014	
Total # of Studies: 22	
Exposure Definition: Resistance training was defined as muscular fitness using free weights, machines with stacked weights or pneumatic resistance, and rubber bands. Training duration ranged from 1 month to over 7 months, with generally 3 sessions per week conducted at an intensity of 40–80% of 1 repetition maximum. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No	
Outcomes Addressed: Mobility: household PA and functional mobility scores from continuous-scale physical performance tests. **Examine Cardiorespiratory Fitness as Outcome:** Yes	
Populations Analyzed: Adults <65 and ≥65, Coronary artery disease OR history of myocardial infarction, coronary revascularization, or angina pectoris	**Author-Stated Funding Source:** Japan's Ministry of Health, Labour and Welfare and the National Center for Child Health and Development.

<table>
<tr><th colspan="2">Parkinson's Disease</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Yang Y, Li XY, Gong Li, Zhu YL, Hao YL. Tai chi for improvement of motor function, balance and gait in Parkinson's disease: a systematic review and meta-analysis. PLoS One. 2014;9(7):e102942. doi:10.1371/journal.pone.0102942.</td></tr>
<tr><td>Purpose: To summarize and evaluate the evidence on the efficacy of tai chi for Parkinson's disease.</td><td rowspan="4">Abstract: BACKGROUND: Recently, several studies assessed the effectiveness of Tai Chi for Parkinson's disease (PD), but the role of Tai Chi in the management of PD remained controversial. Therefore, the purpose of this systematic review is to evaluate the evidence on the efficacy of Tai Chi for PD. METHODS: Six English and Chinese electronic databases, up to April 2014, were searched to identify relevant studies. The risk of bias in eligible studies was assessed by Cochrane Collaboration's tools. The primary outcomes were motor function, balance and gait in individuals with PD. Standardized mean difference (SMD) and 95% confidence intervals (CI) of random-effect model were calculated. And heterogeneity was assessed based on the I2 statistic. RESULTS: 7 randomized controlled trials and 1 non-randomized controlled trial were eligible. The aggregated results suggested that Tai Chi showed beneficial effects in improving motor function (SMD, -0.57; 95% CI -1.11 to -0.04; p = 0.03), balance (SMD, 1.22; 95% CI 0.80 to 1.65; p<0.00001) and functional mobility (SMD, 1.06; 95% CI 0.68 to 1.44; p<0.00001) in patients with PD, but not in improving gait velocity (SMD, -0.02; 95% CI -0.58 to 0.54; p = 0.94), step length (SMD, -0.00; 95% CI -0.57 to 0.56; p = 0.99), or gait endurance (SMD, 0.53; 95% CI -0.07 to 1.12; p = 0.08). Comparing with other active therapies, however, Tai Chi only showed better effects in improving balance (SMD, 0.74; 95% CI 0.38 to 1.10; p<0.0001). CONCLUSION: Tai Chi should be a valid complementary and alternative therapy for PD, especially in improving motor function and balance. However, more studies with long follow-up are warrant to confirm the current finding of Tai Chi for PD.</td></tr>
<tr><td>Timeframe: Inception–April 2014</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Tai chi (any style), 4 weeks to 24 weeks. Tai chi compared with placebo, no intervention, and any other therapies; tai chi combined with conventional drugs compared with conventional drugs; or other therapies combined with conventional drugs.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Motor function: Unified Parkinson's Disease Rating Scale. Balance: Berg Balance Scale, Tandem Stance Test, One Leg Stance Test, and Functional Reach Test. Gait: velocity, step length, endurance (6 minute walk distance). Functional mobility: Timed Up and Go.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Parkinson's disease</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Osteoporosis/Osteopenia</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Zanotto T, Bergamin M, Roman F, et al. Effect of exercise on dual-task and balance on elderly in multiple disease conditions. Curr Aging Sci. 2014;7(2):115-136.</td></tr>
<tr><td>Purpose: To summarize and analyze articles that investigated exercise protocols and their effects on dual task performance in elderly subjects.</td><td rowspan="4">Abstract: Investigations on how exercise and physical activity affect dual-task (DT) performance in the elderly are growing rapidly due to the fact that DT activities are commonplace with activities of daily living. Preliminary evidence has shown the benefit in exercise on DT balance, though it is unclear to what extent the effect exercise has on DT performance in elderly subjects with disease conditions, including subjects with a high risk of falls. Hence, the objective of this study was to critically review the existing evidence of a potential relationship between exercise and improvement of static and dynamic balance during DT conditions as well as secondary outcomes in elderly subjects with different disease conditions. A systematic search using online databases was performed to source documents. Inclusion criteria sourced articles classified as randomized controlled trials (RCT), controlled trials (CT) and uncontrolled trials (UT). Moreover, the studies had to administrate an exercise or physical activity protocol in the intervention. Seventeen studies met the eligibility criteria and were comprised of 12 RCTs, 3 CTs, and 2 UTs. Overall, 13 studies supported exercise being effective to improve parameters of static and dynamic balance during single or DT conditions. Despite the heterogeneity of pathologic conditions, exercise showed similar benefits to improve function in two main areas: neurological conditions and frailty conditions. The lack of a common method to assess DT performance limited the ability to compare different interventions directly. Future research is warranted to study the optimal dose and exercise modalities to best reduce the risk of falls in the elderly with multiple disease conditions.</td></tr>
<tr><td>Timeframe: Inception–October 2013</td></tr>
<tr><td>Total # of Studies: 17</td></tr>
<tr><td>Exposure Definition: Exercise programs varied and included different modalities, intensities, frequencies, and durations. Some programs included concurrent cognitive tasks, music-based activities, and virtual reality; some did not include secondary concurrent tasks; and one was performed in a water-based environment.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Static or dynamic balance or dual task performance.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults >59, Stroke, Parkinson’s disease, Dementia, Frail elderly</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

Table 3. Existing Systematic Reviews and Meta-Analyses Quality Assessment Chart

	Alves Da Rocha, 2015	Anthony, 2013	Auais, 2012	Blankevoort, 2010	Brett, 2016	Brienesse, 2013	Burge, 2012	Cadore, 2013
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	No	No	Yes	No	No	No	No
Comprehensive literature search performed.	Yes	Yes	Yes	Yes	Yes	Partially Yes	Yes	Yes
Duplicate study selection and data extraction performed.	No	No	Yes	No	No	No	No	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Relevant grey literature included in review.	No	No	Yes	No	Yes	No	Yes	No
List of studies (included and excluded) provided.	No	No	Yes	No	No	No	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	No	N/A	No	N/A	N/A	N/A	No	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	No	No	Yes	Yes	No	Yes	No	No
Scientific quality used appropriately in formulating conclusions.	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	N/A	Yes	N/A	N/A	N/A	Yes	N/A
Effect size index chosen justified, statistically.	Yes	N/A	Yes	Yes	N/A	N/A	Yes	N/A
Individual-level meta-analysis used.	No	N/A	No	N/A	N/A	N/A	No	N/A
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	No	Yes	No	No	No	No	No
Conflict of interest disclosed.	Yes	No	No	Yes	Yes	Yes	No	Yes

	Chen, 2016	Chin, 2008	Chou, 2012	Chung, 2016	Clegg, 2012	Crizzle, 2006	Cruickshank, 2015	Cruz-Jentoft, 2014
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	Yes	No	No	No	No	No	No	No
Comprehensive literature search performed.	Yes	Partially Yes	Partially Yes	Partially Yes	Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	Yes	Yes	Yes	Yes	Yes	No	No	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	No	No	No	No	No	Yes	No
List of studies (included and excluded) provided.	No	No	Yes	No	No	No	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	No	N/A	No	No	N/A	N/A	No	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	No	Yes	No	Yes	No	Yes	No	Yes
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	N/A	Partially Yes	Yes	N/A	N/A	Yes	N/A
Effect size index chosen justified, statistically.	Yes	N/A	Yes	Yes	N/A	N/A	Yes	N/A
Individual-level meta-analysis used.	No	N/A	No	No	N/A	N/A	No	N/A
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	Yes	No	No	No	No	No	Yes	No
Conflict of interest disclosed.	Yes	Yes	No	Yes	Yes	No	No	Yes

	Daniels, 2008	de Dreu, 2012	de Labra, 2015	de Vries, 2012	Ding, 2014	Diong, 2016	Dockx, 2016	Eng, 2007
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Population variables defined and considered in methods.	No	No	No	No	No	Yes	Yes	No
Comprehensive literature search performed.	Yes	Partially Yes	Partially Yes	Partially Yes	Partially Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	Yes	Yes	No	No	Yes	Yes	Yes	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	No	No	No	Yes	Yes	Yes	No
List of studies (included and excluded) provided.	No	No	No	No	No	No	Yes	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	N/A	No	N/A	Yes	No	Yes	No	No
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Results depended on study quality, either overall, or in interaction with moderators.	No	Yes	No	No	No	Yes	Yes	N/A
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Data appropriately synthesized and if applicable, heterogeneity assessed.	N/A	Yes	N/A	Yes	Yes	Yes	Yes	Partially Yes
Effect size index chosen justified, statistically.	N/A	Yes	N/A	Yes	Yes	Yes	Partially Yes	Partially Yes
Individual-level meta-analysis used.	N/A	No	N/A	No	No	No	No	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	No	No	Yes	No	Yes	No	No
Conflict of interest disclosed.	Yes	No	Yes	Yes	Yes	Yes	Yes	No

	Fang, 2011	Floegel, 2016	Forbes, 2015	Fox, 2014	Fritz, 2015	Giangregorio, 2013	Gine-Garriga, 2014	Gleeson, 2014
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	No	No	No	No	No	Yes	No
Comprehensive literature search performed.	Yes	Partially Yes	Yes	Yes	Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	No	No	Yes	No	Yes	Yes	Yes	Yes
Search strategy clearly described.	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	No	Yes	Yes	No	Yes	No	Yes
List of studies (included and excluded) provided.	No	No	Yes	Yes	No	Yes	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	N/A	N/A	Yes	No	N/A	No	No	No
Scientific quality (risk of bias) of included studies assessed and documented.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	N/A	N/A	Yes	Yes	No	Yes	No	No
Scientific quality used appropriately in formulating conclusions.	N/A	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	N/A	N/A	Yes	Yes	N/A	Yes	Yes	Yes
Effect size index chosen justified, statistically.	N/A	N/A	Yes	Yes	N/A	Yes	Yes	Yes
Individual-level meta-analysis used.	N/A	N/A	No	No	N/A	No	No	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Likelihood of publication bias assessed.	No	No	Yes	No	No	No	No	No
Conflict of interest disclosed.	Yes	No	Yes	No	Yes	Yes	No	Yes

	Goodwin, 2008	Inskip, 2016	Kwok, 2016	Lamotte, 2015	Laver, 2016	Lewis, 2017	Li, 2009	Lima, 2013
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	Yes	No	No	No	No	No	No
Comprehensive literature search performed.	Yes	Yes	Yes	Yes	Partially Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	No	No	No	No	Yes	Yes	Yes	Yes
Search strategy clearly described.	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	Yes	Yes	Yes	No	No	No	No
List of studies (included and excluded) provided.	No	No	No	No	No	No	Yes	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	No	N/A	Yes	No	N/A	No	Yes	No
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	Yes	Yes	No	N/A	Yes	Yes	No	No
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	N/A	Yes	No	N/A	Yes	Partially Yes	Yes
Effect size index chosen justified, statistically.	Yes	N/A	Yes	No	N/A	Yes	Yes	Yes
Individual-level meta-analysis used.	No	N/A	No	No	N/A	No	No	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	No	No	No	Yes	No	No	No
Conflict of interest disclosed.	No	Yes	Yes	Yes	Yes	Yes	Yes	No

	Littbrand, 2011	Lotzke, 2015	Mehrholz, 2015	Nascimento, 2015	Nash, 2012	Ngai, 2016	Ni, 2014	Pitkala, 2013
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	Yes	No	No	No	No	No	Yes	No
Comprehensive literature search performed.	Yes	Yes	Yes	Yes	Partially Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	Yes	No	Yes	Yes	No	Yes	Yes	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	Yes	Yes	No	No	Yes	Yes	Yes
List of studies (included and excluded) provided.	No	No	Yes	Yes	No	Yes	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	N/A	No	No	No	N/A	No	No	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	Yes	No	Yes	Yes	No	Yes	No	No
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	N/A	Yes	Yes	Yes	N/A	Yes	Yes	N/A
Effect size index chosen justified, statistically.	N/A	Yes	Yes	Yes	N/A	Yes	Yes	N/A
Individual-level meta-analysis used.	N/A	No	No	No	N/A	No	No	N/A
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	No	Yes	No	No	Yes	No	No
Conflict of interest disclosed.	Yes	Yes	Yes	Yes	No	Yes	Yes	No

Aging Subcommittee: Q3. What is the relationship between physical activity and physical function in older individuals with selected chronic conditions?

	Potter, 2011	Rao, 2014	Saltychev, 2016	Sharp, 2014	Shu, 2014	Theou, 2011	Tillman, 2015	Valenzuela, 2012
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	No	No	No	No	Yes	No	No
Comprehensive literature search performed.	Yes	Yes	Yes	Yes	Yes	Yes	Partially Yes	Yes
Duplicate study selection and data extraction performed.	Yes	No	No	Yes	Yes	Yes	Yes	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	Yes	No	Yes	Yes	Yes	No	No	No
List of studies (included and excluded) provided.	No	No	No	Yes	No	No	No	No
Characteristics of included studies provided.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	No	No	No	No	No	N/A	No	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Yes	Partially Yes	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	No	No	No	No	Yes	Yes	No	No
Scientific quality used appropriately in formulating conclusions.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	Yes	Yes	Yes	Yes	N/A	Yes	N/A
Effect size index chosen justified, statistically.	Yes	Partially Yes	Yes	Yes	Yes	N/A	Yes	N/A
Individual-level meta-analysis used.	No	No	No	No	No	N/A	No	N/A
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	No	Yes	No	No	No	No	No
Conflict of interest disclosed.	Yes	No	Yes	No	Yes	Yes	Yes	No

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	Vermeulen, 2011	Wang, 2016	Weening-Dijksterhuis, 2011	Wilhelm, 2012	Yamamoto, 2016	Yang, 2014	Zanotto, 2014
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	No	No	Yes	Yes	Yes	Yes
Comprehensive literature search performed.	Yes	Partially Yes	Yes	Yes	Partially Yes	Yes	Yes
Duplicate study selection and data extraction performed.	No	Yes	No	Yes	No	Yes	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	No	No	Yes	No	Yes	No
List of studies (included and excluded) provided.	No	No	No	No	No	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	N/A	No	N/A	N/A	No	No	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	No	Yes	Yes	No	No	No	Yes
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	Yes	Yes	No	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	N/A	Yes	N/A	N/A	Yes	Yes	N/A
Effect size index chosen justified, statistically.	N/A	Yes	N/A	N/A	Yes	Yes	N/A
Individual-level meta-analysis used.	N/A	No	N/A	N/A	No	No	N/A
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	Yes	No	No	Yes	No	No
Conflict of interest disclosed.	Yes	Yes	Yes	No	Yes	Yes	No

Appendices

Appendix A: Analytical Framework

Topic Area
Aging

Systematic Review Question
What is the relationship between physical activity and physical function in older individuals with selected chronic conditions?

Population
Adults, 50 years and older with selected chronic conditions (i.e., Alzheimer's Disease, Chronic Obstructive Pulmonary Disease, Congestive Heart Failure, Coronary Artery/Heart Disease, Frailty, Obesity, Osteoporosis/Osteopenia, Parkinson's Disease, or Post-Hip Fracture)

Exposure
All types and intensities of physical activity

Comparison
Adults, 50 years and older with selected chronic conditions, who participate in varying levels of physical activity, including no reported physical activity

Endpoint Health Outcomes
- Physical function
- Functional ability
- Move around
- Behavioral ability
- Behavioral disability
- Functional limitations
- Loss of physical function
- Physical disability
- Physical intrinsic capacity

Key Definitions
- "Physical function" and "physical functioning" are regarded as synonyms that refer to: "the *ability* of a person to move around and to perform types of physical activity."
- For example, measures of physical function include measures of ability to walk (e.g., usually gait speed), run, climb stairs, carry groceries, sweep the floor, stand up, and bath oneself.
- As measures of behavioral abilities, physical function measures do not include:
  - Physiologic measures, including measures of physiologic capacity (e.g., maximal lung capacities, maximal aerobic capacity, maximal muscle strength, bone density).
  - Measures of the environment or of the host-environmental interaction (e.g., disability accommodation).
  - Measures of what a person usually does (e.g., physical activity level) (as opposed to what a person is capable of doing).

Appendix B: Final Search Strategy

Search Strategy: PubMed (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports)

Database: PubMed; Date of Search: 2/24/17; 1,144 results

Set	Search Terms
Limit: Language	(English[lang])
Limit: Exclude animal only	NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh]))
Limit: Exclude child only	NOT (("infant"[Mesh] OR "child"[mesh] OR "adolescent"[mh]) NOT (("infant"[Mesh] OR "child"[mesh] OR "adolescent"[mh]) AND "adult"[Mesh]))
Limit: Publication Date (SR/MA)	AND ("2006/01/01"[PDAT] : "3000/12/31"[PDAT])
Limit: Publication Type Include (SR/MA)	AND (systematic[sb] OR meta-analysis[pt] OR "systematic review"[tiab] OR "systematic literature review"[tiab] OR metaanalysis[tiab] OR "meta analysis"[tiab] OR metanalyses[tiab] OR "meta analyses"[tiab] OR "pooled analysis"[tiab] OR "pooled analyses"[tiab] OR "pooled data"[tiab])
Limit: Publication Type Exclude (SR/MA)	NOT ("comment"[Publication Type] OR "editorial"[Publication Type])
Physical Activity	AND (("Exercise"[mh] OR "Exercise"[tiab] OR "Physical activity"[tiab] OR "Sedentary lifestyle"[mh] OR "Lifestyle activities"[tiab] OR "Lifestyle activity"[tiab] OR "Recreational activities"[tiab] OR "Recreational activity"[tiab] OR "Tai ji"[mh] OR "Yoga"[mh] OR "Balance training"[tiab] OR "Qigong"[mh] OR "Functional training"[tiab]) OR (("Aerobic activities"[tiab] OR "Aerobic activity"[tiab] OR "Cardiovascular activities"[tiab] OR "Cardiovascular activity"[tiab] OR "Endurance activities"[tiab] OR "Endurance activity"[tiab] OR "Physical activities"[tiab] OR "Physical conditioning"[tiab] OR "Resistance training"[tiab] OR "strength training"[tiab] OR "Sedentary"[tiab] OR "Tai chi"[tiab] OR "Tai ji"[tiab] OR "Yoga"[tiab] OR "Walk"[tiab] OR "Walking"[tiab] OR "Chi kung"[tiab] OR "Qigong"[tiab] OR "stretching"[tiab]) NOT medline[sb]))
Physical Function	AND ("Physical function"[tiab] OR "Physical functioning"[tiab] OR "Physical ability"[tiab] OR "Physical disability"[tiab] OR "Gait speed"[tiab] OR "Walking speed"[tiab] OR "Mobility"[tiab] OR "Chair stands"[tiab] OR "Activities of daily living"[tiab] OR "Activity of daily living"[tiab] OR "Tandem walk"[tiab] OR "Health status"[ti] OR "Health related quality of life"[ti] OR "HRQOL"[ti] OR "Physical performance"[tiab] OR ("Functional"[tiab] AND "Physical"[tiab]))

Search Strategy: CINAHL (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports)

Database: CINAHL; Date of Search: 2/24/17; 56 results
Terms searched in title or abstract, aside from those in *italics* which are only searched in title

Set	Search Terms
Physical Activity	("Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Endurance activities" OR "Endurance activity" OR "Exercise" OR "Physical activity" OR "Physical activities" OR "Physical conditioning" OR "Resistance training" OR "strength training" OR "Sedentary" OR "Lifestyle activities" OR "Lifestyle activity" OR "Recreational activities" OR "Recreational activity" OR "Tai chi" OR "Tai ji" OR "Yoga" OR "Walk" OR "Walking" OR "Balance training" OR "Chi kung" OR "Qigong" OR "Functional training" OR "stretching")
Physical Function	AND ("Physical function" OR "Physical functioning" OR "Physical ability" OR "Physical disability" OR "Gait speed" OR "Walking speed" OR "Mobility" OR "Chair stands" OR "Activities of daily living" OR "Activity of daily living" OR "Tandem walk" OR *"Health status" OR "Health related quality of life" OR "HRQOL"* OR "Physical performance" OR (Functional AND Physical))
Limit: Publication Type Include (SR/MA)	AND ("systematic review" OR "systematic literature review" OR "metaanalysis" OR "meta analysis" OR metanalyses OR "meta analyses" OR "pooled analysis" OR "pooled analyses" OR "pooled data")
Limits	2006-present English language Peer reviewed Exclude Medline records Human

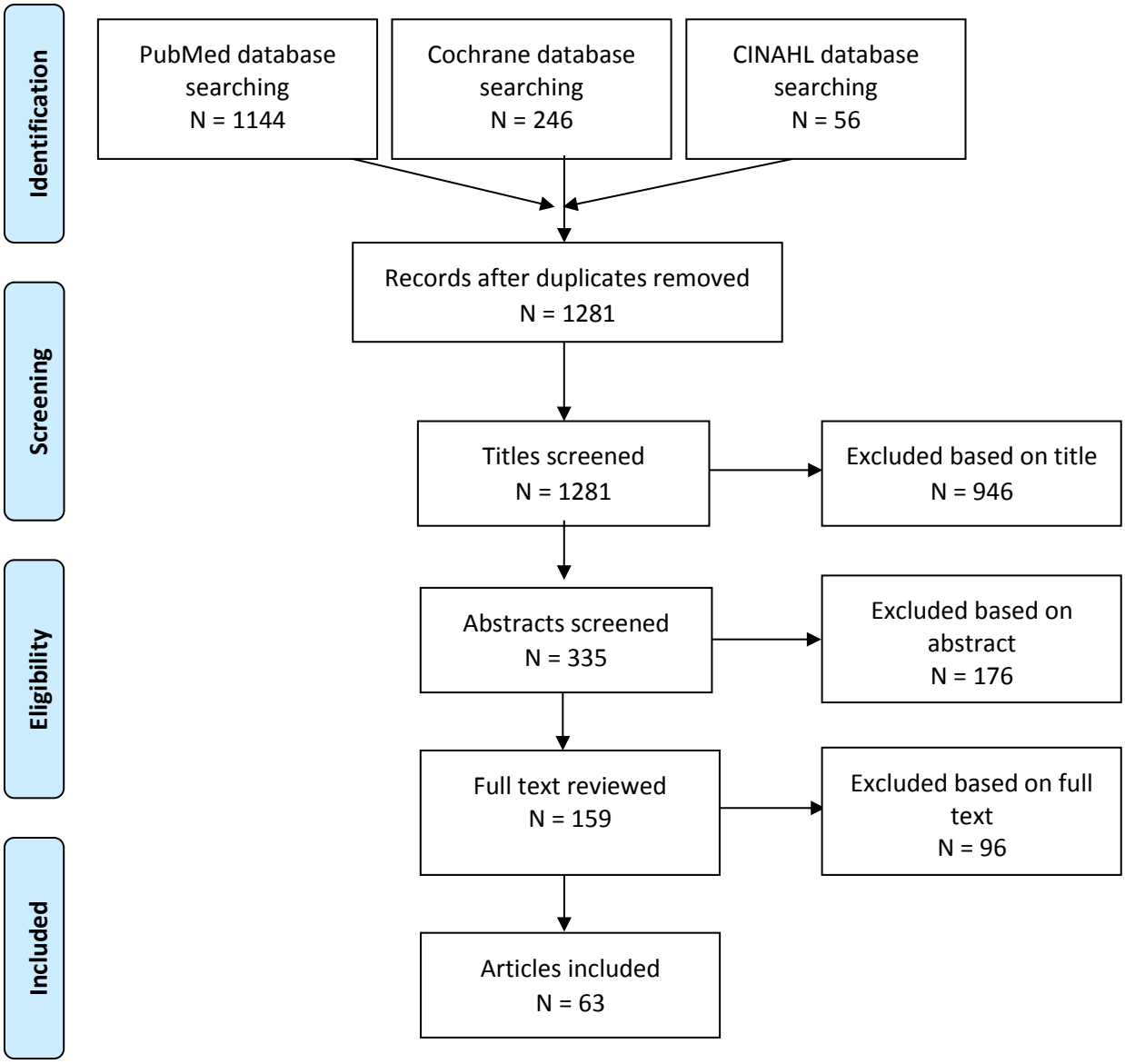
Search Strategy: Cochrane (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports)

Database: Cochrane; Date of Search: 2/28/17; 246 results
Terms searched in title, abstract, or keywords, aside from those in *italics* which are only searched in title

Set	Search Terms
Physical Activity	("Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Endurance activities" OR "Endurance activity" OR "Exercise" OR "Physical activity" OR "Physical activities" OR "Physical conditioning" OR "Resistance training" OR "strength training" OR "Sedentary" OR "Lifestyle activities" OR "Lifestyle activity" OR "Recreational activities" OR "Recreational activity" OR "Tai chi" OR "Tai ji" OR "Yoga" OR "Walk" OR "Walking" OR "Balance training" OR "Chi kung" OR "Qigong" OR "Functional training" OR "stretching")
Physical Function	AND ("Physical function" OR "Physical functioning" OR "Physical ability" OR "Physical disability" OR "Gait speed" OR "Walking speed" OR "Mobility" OR "Chair stands" OR "Activities of daily living" OR "Activity of daily living" OR "Tandem walk" OR "Physical performance" OR (Functional AND Physical) or *"Health status" or "Health related quality of life" or "HRQOL"*)
Limits	2006-present Cochrane Reviews and Other Reviews Word variations will not be searched

Appendix C: Literature Tree

Existing Systematic Reviews, Meta-Analyses, Pooled Analyses, and Reports Literature Tree



Appendix D: Inclusion/Exclusion Criteria

Aging Subcommittee

Q3: What is the relationship between physical activity and physical function in older individuals with selected chronic conditions?

Category	Inclusion/Exclusion Criteria	Notes/Rationale
Publication Language	**Include:** • Studies published with full text in English	
Publication Status	**Include:** • Studies published in peer-reviewed journals • Reports determined to have appropriate suitability and quality by PAGAC **Exclude:** • Grey literature, including unpublished data, manuscripts, abstracts, conference proceedings	
Research Type	**Include:** • Original research • Meta-analyses • Systematic reviews • Pooled analyses • Reports determined to have appropriate suitability and quality by PAGAC	
Study Subjects	**Include:** • Human subjects	
	Exclude: • Athletes only	Exclude studies that do not present data on non-athletes.
Age of Study Subjects	**Include:** • Adults ages 50 and older • When data are analyzed by age groups, only data with lower range of 50 or older may be included (e.g., in a study with individuals 45-90 where data are presented for three age groups: 45-55, 55-65, and 65-90, only data for 55-65 and 65-90 may be included)	Data must be provided for adults ages 50 and older to be relevant to this question.
Health Status of Study Subjects	**Include:** • Individuals with a chronic condition (e.g., obstructive pulmonary disorder, cognitive impairments, cardiovascular disease, frailty, osteoporosis/osteopenia, Parkinson's disease, post-hip fracture, stroke, visual impairment) **Exclude:**	• Do not exclude ER, care homes, assisted living, long-term care facilities • Do not exclude studies of individuals who need canes to walk.

	• Hospitalized patients only (acute care, admitted into the hospital, rehabilitation facilities) • Nonambulatory adults only (can't walk, need wheelchair, need walker)	• Do exclude studies of individuals who need walkers to walk.
Comparison	**Include:** • Adults ages 50 and older who participate in varying levels of physical activity, including no reported physical activity	
Date of Publication	**Include:** • Original research published 2006 - 2016 • Systematic reviews and meta-analyses published from 2006 – 2016	
Study Design	**Include:** • Randomized controlled trials • Non-randomized controlled trials • Prospective cohort studies • Retrospective cohort studies • Case-control studies • Systematic reviews • Meta-analyses • Pooled reports • PAGAC-Approved reports **Exclude:** • Narrative reviews • Commentaries • Editorials • Cross-sectional studies • Before-and-after studies	
Exposure/Intervention	**Include studies in which the exposure or intervention is:** • All types and intensities of physical activity **Exclude:** • Studies missing physical activity (mental games such as Sudoku instead of physical activities) • Studies of a single, acute session of exercise • Studies of a disease-specific therapeutic exercise delivered by a medical professional (e.g., physical therapist) • Studies with measures of physical fitness as the exposure • Studies of multimodal interventions that do not present data on physical activity alone	

	• Studies that only use physical activity as a confound variable	
Outcome	**Include studies in which the outcome is:** • Physical function • Functional ability • "Move around" • Behavioral ability • Behavioral disability • Functional limitations • Loss of physical function • Physical disability • Physical intrinsic capacity	

Appendix E: Rationale for Exclusion at Abstract or Full-Text Triage for Existing Systematic Reviews, Meta-Analyses, Pooled Analyses, and Reports

The table below lists the excluded articles with at least one reason for exclusion, but may not reflect all possible reasons.

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Abariga S, Wang C. P04.29. Tai chi and health related quality of life: a systematic review and meta-analysis of randomized controlled trials. *BMC Complement Altern Med*. 2012;12(suppl 1):1-1. doi:10.1186/1472-6882-12-S1-P299.			X			
Abbruzzese G, Marchese R, Avanzino L, Pelosin E. Rehabilitation for Parkinson's disease: current outlook and future challenges. *Parkinsonism Relat Disord*. 2016;22(suppl 1):S60-S64. doi:10.1016/j.parkreldis.2015.09.005.			X			
Ahlskog JE, Geda YE, Graff-Radford NR, Petersen RC. Physical exercise as a preventive or disease-modifying treatment of dementia and brain aging. *Mayo Clin Proc*. 2011;86(9):876-884. doi:10.4065/mcp.2011.0252.				X		
Alfred T, Ben-Shlomo Y, Cooper R, et al.; HALCyon Study Team. Associations between APOE and low-density lipoprotein cholesterol genotypes and cognitive and physical capability: the HALCyon programme. *Age (Dordr)*. 2014;36(4):9673. doi:10.1007/s11357-014-9673-9.				X		
Alibhai SM, Santa Mina D, Ritvo P, et al. A phase II RCT and economic analysis of three exercise delivery methods in men with prostate cancer on androgen deprivation therapy. *BMC Cancer.* 2015;15:312. doi:10.1186/s12885-015-1316-8.		X				
Allen NE, Schwarzel AK, Canning CG. Recurrent falls in Parkinson's disease: a systematic review. *Parkinsons Dis.* 2013;2013:906274. doi:10.1155/2013/906274.				X		
Amorim JS, Salla S, Trelha CS. Factors associated with work ability in the elderly: systematic review. *Rev Bras Epidemiol.* 2014;17(4):830-841.				X		
Anderiesen H, Scherder EJ, Goossens RH, Sonneveld MH. A systematic review—physical activity in dementia: the influence of the nursing home environment. *Appl Ergon.* 2014;45(6):1678-1686. doi:10.1016/j.apergo.2014.05.011.	X					
Anderson ND, Damianakis T, Kröger E, et al.; BRAVO Team. The benefits associated with				X		

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
volunteering among seniors: a critical review and recommendations for future research. *Psychol Bull.* 2014;140(6):1505-1533. doi:10.1037/a0037610.						
Arbesman M, Mosley LJ. Systematic review of occupation- and activity-based health management and maintenance interventions for community-dwelling older adults. *Am J Occup Ther.* 2012;66(3):277-283. doi:10.5014/ajot.2012.003327.				X		
Artaza-Artabe I, Sáez-López P, Sánchez-Hernández N, Fernández-Gutierrez N, Malafarina V. The relationship between nutrition and frailty: effects of protein intake, nutritional supplementation, vitamin D and exercise on muscle metabolism in the elderly. A systematic review. *Maturitas.* 2016;93:89-99. doi:10.1016/j.maturitas.2016.04.009.				X		
Baker MK, Atlantis E, Fiatarone Singh MA. Multi-modal exercise programs for older adults. Age Ageing. 2007;36(4):375-381.		X				
Barker AL, Talevski J, Morello RT, Brand CA, Rahmann AE, Urquhart DM. Effectiveness of aquatic exercise for musculoskeletal conditions: a meta-analysis. *Arch Phys Med Rehabil.* 2014;95(9):1776-1786. doi:10.1016/j.apmr.2014.04.005.		X				
Batsis JA, Gill LE, Masutani RK, et al. Weight loss interventions in older adults with obesity: a systematic review of randomized controlled trials since 2005. J Am Geriatr Soc. 2017;65(2):257-268. doi:10.1111/jgs.14514.		X				
Beckenkamp PR, Lin CW, Chagpar S, Herbert RD, van der Ploeg HP, Moseley AM. Prognosis of physical function following ankle fracture: a systematic review with meta-analysis. *J Orthop Sports Phys Ther.* 2014;44(11):841-851, B2. doi:10.2519/jospt.2014.5199.				X		
Behm DG, Blazevich AJ, Kay AD, McHugh M. Acute effects of muscle stretching on physical performance, range of motion, and injury incidence in healthy active individuals: a systematic review. *Appl Physiol Nutr Metab.* 2016;41(1):1-11. doi:10.1139/apnm-2015-0235.	X					
Bernhardt J, Thuy MN, Collier JM, Legg LA. Very early versus delayed mobilisation after stroke. *Cochrane Database Syst Rev.* 2009;(1):CD006187. doi:10.1002/14651858.CD006187.pub2.				X		

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Birch L, Perry R, Penfold C, Beynon R, Hamilton-Shield J. What change in body mass index is needed to improve metabolic health status in childhood obesity: protocol for a systematic review. *Syst Rev.* 2016;5:120. doi:10.1186/s13643-016-0299-0.		X				
Bize R, Johnson JA, Plotnikoff RC. Physical activity level and health-related quality of life in the general adult population: a systematic review. *Prev Med.* 2007;45(6):401-415.	X					
Block VA, Pitsch E, Tahir P, Cree BA, Allen DD, Gelfand JM. Remote physical activity monitoring in neurological disease: a systematic review. *PLoS One.* 2016;11(4):e0154335. doi:10.1371/journal.pone.0154335.				X		
Blyton F, Chuter V, Walter KE, Burns J. Non-drug therapies for lower limb muscle cramps. *Cochrane Database Syst Rev.* 2012;1:Cd008496. doi:10.1002/14651858.CD008496.pub2.				X		
Bohannon RW, Glenney SS. Minimal clinically important difference for change in comfortable gait speed of adults with pathology: a systematic review. *J Eval Clin Pract.* 2014;20(4):295-300. doi:10.1111/jep.12158.				X		
Boone-Heinonen J, Evenson KR, Taber DR, Gordon-Larsen P. Walking for prevention of cardiovascular disease in men and women: a systematic review of observational studies. *Obes Rev.* 2009;10(2):204-217. doi:10.1111/j.1467-789X.2008.00533.x.	X					
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Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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Romero-Ortuno R, Soraghan C. A Frailty Instrument for primary care for those aged 75 years or more: findings from the Survey of Health, Ageing and Retirement in Europe,			X			

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Sharififar S, Coronado RA, Romero S, Azari H, Thigpen M. The effects of whole body vibration on mobility and balance in Parkinson disease: a systematic review. *Iran J Med Sci.* 2014;39(4):318-326.				X		
Shepherd CW, While AE. Cardiac rehabilitation and quality of life: a				X		

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Skelton DA, Howe TE, Ballinger C, Neil F, Palmer S, Gray L. Environmental and behavioural interventions for reducing physical activity limitation in community-dwelling visually impaired older people. *Cochrane Database Syst Rev.* 2013;(6):Cd009233. doi:10.1002/14651858.CD009233.pub2.				X		
Skjaeret N, Nawaz A, Morat T, et al. Exercise and rehabilitation delivered through exergames in older adults: an integrative review of technologies, safety and efficacy. Int J Med Inform. 2016;85(1):1-16. doi:10.1016/j.ijmedinf.2015.10.008.		X				
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Steele T, Cuthbertson DJ, Wilding JP. Impact of bariatric surgery on physical functioning in obese adults. *Obes Rev.* 2015;16(3):248-258. doi:10.1111/obr.12247.				X		
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Taylor RS, Sagar VA, Davies EJ, et al. Exercise-based rehabilitation for heart failure. *Cochrane Database Syst Rev.* 2014;(4). doi:10.1002/14651858.CD003331.pub4.	X					
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Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
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