APPENDIX A. DATA EXTRACTIONS OF INCLUDED REVIEWS

<table>
<tr><td colspan="2">SR/MA
Citation: Binkley HM, Rudd LE. Head-Out Aquatic Exercise for Generally Healthy Postmenopausal Women: A Systematic Review. Journal of Physical Activity and Health, 2019, 16, 76-97. Journal of Physical Activity and Health, 2019, 16, 76-97</td></tr>
<tr><td>Purpose:</td><td rowspan="4">Abstract:
Background: Aquatic exercise (AE) is a method for exercise and rehabilitation to enhance function for various clients. Objectives: Investigate the effects of head-out AE interventions on the physiological and psychological outcomes of healthy postmenopausal women of age 50–70 years. Search Strategies: Databases searched included Scopus, ScienceDirect, ResearchGate, PubMed/MEDLINE, PEDro, CINAHL, The Cochrane Library, Nursing & Allied Health Collection: Comprehensive, JSTOR, and OTSeeker.com, through January 2015. Search Criteria: Randomized controlled trial and quasi-randomized controlled trial studies. Data Collection and Analysis: Two researchers scanned studies based on inclusion and exclusion criteria. Studies included were critically appraised using the Physiotherapy Evidence Database scale (PEDro scale). Results: A total of 15 studies including postmenopausal women and head-out AE intervention were reviewed. Considerable variation existed in the interventions and assessments. Outcome measures showed anthropometric measures (body mass index, circumference, skinfolds, and body fat) were inconclusive; upper and lower body strength improved; flexibility improved; all functional movements (short-distance walk, long-distance walk/run, power, agility, balance and falls) improved; bone density improved; biochemical and hormonal variables were inconclusive; and quality of life outcomes improved. Conclusions: Head-out AE appears to be an effective training and conditioning method for postmenopausal women to improve strength, flexibility, functional movements, bone density, and quality of life.</td></tr>
<tr><td>Search Dates: Jan 1989 – Jan 2015</td></tr>
<tr><td>Total # studies included: 15</td></tr>
<tr><td>Other details (e.g. definitions used, exclusions etc)</td></tr>
<tr><td>Outcomes addressed: strength, flexibility, functional variables</td></tr>
</table>

SR/MA

Citation: Bruderer-Hofstetter M, Rausch-Osthoff A, Mechtry A, Munzer T, Niedermann K. Effective multicomponent interventions in comparison to active control and no interventions on physical capacity, cognitive function and instrumental activities of daily living in elderly people with and without mild impaired cognition – A systematic review and network meta-analysis. Ageing Research Reviews 45 (2018) 1–14. doi.org/10.1016/j.arr.2018.04.002

Purpose: **Last Search Date:** May 2017 **Total # studies included:** 17 **Other details (e.g. definitions used, exclusions etc)** **Outcomes addressed:** IADL, and/or physical capacity (e.g. CRF; balance; flexibility; muscle strength) and/or cognitive function	**Abstract:** Multicomponent interventions (MCT) combine physical exercises and cognitive training and seem to be most effective in improving cognition in elderly people. However, literature is inconclusive if MCTs are superior to active comparison interventions, if delivery modes matter, and if people can transfer achieved effects to instrumental activities of daily living (IADL). This network meta-analysis aimed to a) identify MCTs that were effective on physical capacity and/or cognitive function and able to transfer these effects into IADL in elderly people with normal cognition (NC) and mild cognitive impairment (MCI); b) provide a rating on the best interventions per outcome; c) evaluate MCTs' mode of delivery. Eligible studies were randomized controlled trials comparing MCTs to active comparison or no treatments. Six studies in participants with MCI (n=1088) and eleven studies in participants with NC (n=670) were included. Five effective MCTs that were superior to physical exercises or cognitive training alone in improving physical capacity and/or cognitive function were detected, however none of these MCTs improved IADL. In people with NC MCTs performed separately or simultaneously were effective. However, in people with MCI MCTs performed separately were more effective. A framework needs to be developed to better understand the mediating effects of physical capacity and cognitive function on IADL and to design MCTs that effectively improve IADL.

SR/MA **Citation:** Bueno de Souza RO, Marcon LF, Arruda ASF, Pontes Junior FL, Melo RC. Effects of Mat Pilates on Physical Functional Performance of Older Adults: A Meta-analysis of Randomized Controlled Trials. Am J Phys Med Rehabil 2018;97:414–425. DOI: 10.1097/PHM.0000000000000883	
Purpose:	**Abstract:** **Objective**: The present meta-analysis aimed to examine evidence from randomized controlled trials to determine the effects of mat Pilates on measures of physical functional performance in the older population. **Design**: A search was conducted in the MEDLINE/PubMed, Scopus, Scielo, and PEDro databases between February and March 2017. Only randomized controlled trials that were written in English, included subjects aged 60 yrs who used mat Pilates exercises, included a comparison (control) group, and reported performance-based measures of physical function (balance, flexibility, muscle strength, and cardiorespiratory fitness) were included. The methodological quality of the studies was analyzed according to the PEDro scale and the best-evidence synthesis. The meta-analysis was conducted with the Review Manager 5.3 software. **Results**: The search retrieved 518 articles, nine of which fulfilled the inclusion criteria. High methodological quality was found in five of these studies. Meta-analysis indicated a large effect of mat Pilates on dynamic balance (standardized mean difference = 1.10, 95% confidence interval = 0.29–1.90), muscle strength (standardized mean difference = 1.13, 95% confidence interval = 0.30–1.96), flexibility (standardized mean difference = 1.22, 95% confidence interval = 0.39–2.04), and cardiorespiratory fitness (standardized mean difference = 1.48, 95% confidence interval = 0.42–2.54) of elderly subjects. **Conclusions**: There is evidence that mat Pilates improves dynamic balance, lower limb strength, hip and lower back flexibility, and cardiovascular endurance in elderly individuals. Furthermore, high-quality studies are necessary to clarify the effects of mat Pilates on other physical functional measurements among older adults.
Search Dates: January 2011 – March 2017	
Total # studies included: 9	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Performance-based measure of physical function (balance, flexibility, muscle strength, and cardiorespiratory fitness)	

SR/MA **Citation:** Burton E, Farrier K, Gavin R, Johnson S, Horgan NF, Warters A, Hill KD. Physical activity programs for older people in the community receiving home care services: systematic review and meta-analysis. Clin Interv Aging. 2019 Jun 6;14:1045-1064. doi: 10.2147/CIA.S205019.	
Purpose: **Search Date:** Oct 2012 – Aug 2018 **Total # studies included:** 18 **Other details (e.g. definitions used, exclusions etc)** **Outcomes addressed:** mobility, endurance, strength, balance (TUG, sit-to-stand five time, grip strength, and walking speed)	**Abstract:** The proportion of older adults is increasing around the world and most wish to live in their home until they die. To achieve this, many will require services in the home to remain living independently. To maintain function (i.e., strength, balance, and endurance), physical activity needs to be undertaken on a regular basis, and is essential as a person ages. Unfortunately, as people age there is a tendency to reduce activity levels, which often leads to loss of function and frailty, and the need for home care services. This updated systematic review includes a mix of study methodologies and meta-analysis, and investigated the effectiveness of physical activity/exercise interventions for older adults receiving home care services. Eighteen studies including ten randomized controlled trials meeting the selection criteria were identified. Many of the studies were multi-factorial interventions with the majority reporting aims beyond solely trying to improve the physical function of home care clients. The meta-analysis showed limited evidence for effectiveness of physical activity for older adults receiving home care services. Future exercise/physical activity studies working with home care populations should consider focusing solely on physical improvements, and need to include a process evaluation of the intervention to gain a better understanding of the association between adherence to the exercise program and other factors influencing effectiveness.

SR/MA

Citation: da Rosa Orssatto LB, de la Tocha Freitas C, Shield AJ, Silveira Pinto R, Trajano GS. Effects of resistance training concentric velocity on older adults' functional capacity: A systematic review and meta-analysis of randomised trials. Experimental Gerontology 127 (2019) 110731. https://doi.org/10.1016/j.exger.2019.110731

Purpose: **Last Search Date:** Jan 2019 **Total # studies included:** 15 **Other details (e.g. definitions used, exclusions etc)** **Outcomes addressed:** functional test for lower limbs	**Abstract:** Reduced levels of functional capacity in older adults are related to lower quality of life, frailty, and sarcopenia, and can increase risk of falling, fractures and hospitalisation. Resistance training is an effective method to attenuate age-related functional declines. Based on the findings that muscle power and explosive strength are strongly associated with functional performance in older adults, it has been suggested that fast-intended-velocity resistance training may elicit greater improvements in functional capacity when compared to moderate-velocity resistance training. However, currently, there is no high-quality systematic review and meta-analysis supporting this assertion. The present study compared the magnitude of functional capacity improvements following resistance training performed with fast-intentional velocity versus moderate velocity. Pubmed, Scopus, and Web of Science databases were searched from inception to January 2019. The following eligibility criteria for selecting studies was adopted: Participants aged ≥60 years; resistance training based intervention for lower limbs performed solely with slow to moderate concentric velocity (≥2 s for each concentric phase) or solely with the intention of maximising velocity (i.e., as fast as possible); and at least one functional test for lower limbs, with pre- and post-intervention measurements. When studies employed multiple functional tests, a single (pooled) standardised mean difference was calculated and presented as combined functional capacity. In addition, functional tests were grouped accordingly to their specificity for the sub-groups meta-analyses. Fifteen studies were selected (high quality, n=3; and pre-registered, n=2). The results presented heterogeneity and small studies publication bias, leading to a biased advantage for fast-intended-velocity resistance training (95%CI=0.18, 0.65; I2=45%). Short physical performance battery indicated an advantage for fast-intended velocity resistance training (95%CI=0.10, 0.94; I2=0%). There was no difference for timed up and go (95%CI=−0.07, 0.94; I2=48%), 30-s chair stand (95%CI=−0.24, 1.39; I2=71%), 5-times chair stand (95%CI=−1.63, 1.27; I2=57%) stair climb (95%CI=−1.89, 2.81; I2=0%), short walk (95%CI=−0.99, 0.96; I2=21%) and long walk (95%CI=−0.59, 1.00; I2=0%). These results suggest that there is inconclusive evidence to support the superiority of fast-intended-velocity resistance training to improve functional capacity when compared to moderate-velocity resistance training. These results may have been influenced by the lack of high-quality and pre-registered studies, high heterogeneity, and small-studies publication bias.

SR/MA

Citation: de Souto Barreto P, Rolland Y, Vellas B, Maltais M. Association of Long-term Exercise Training With Risk of Falls, Fractures, Hospitalizations, and Mortality in Older Adults A Systematic Review and Meta-analysis. *JAMA Intern Med*. 2019;179(3):394-405. doi:10.1001/jamainternmed.2018.5406

Purpose:	**Abstract:**
Last Search Date: March 2018	**IMPORTANCE** Long-term exercise benefits on prevalent adverse events in older populations, such as falls, fractures, or hospitalizations, are not yet established or known.
Total # studies included: 46	**OBJECTIVE** To systematically review and investigate the association of long-term exercise interventions (≥1 year) with the risk of falls, injurious falls, multiple falls, fractures,
Other details (e.g. definitions used, exclusions etc)	**DATA SOURCES** PubMed, Cochrane Central Register of Controlled Trials, SportDiscus, PsychInfo, and Ageline were searched through March 2018. hospitalization, and mortality in older adults.
	STUDY SELECTION Exercise randomized clinical trials (RCTs) with intervention length of 1 year or longer, performed among participants 60 years or older.
Outcomes addressed: mortality; hospitalization; fallers; fallers with multiple falls; injurious fallers; and fractures	**DATA EXTRACTION AND SYNTHESIS** Two raters independently screened articles, abstracted the data, and assessed the risk of bias. Data were combined with risk ratios (RRs) using DerSimonian and Laird's random-effects model (Mantel-Haenszel method).
	MAIN OUTCOMES AND MEASURES Six binary outcomes for the risk of falls, injurious falls, multiple falls (≥2 falls), fractures, hospitalization, and mortality.
	RESULTS Forty-six studies (22 709 participants) were included in the review and 40 (21 868 participants) in the meta-analyses (mean [SD] age, 73.1 [7.1] years; 15 054 [66.3%] of participants were women). The most used exercise was a multicomponent training (eg, aerobic plus strength plus balance); mean frequency was 3 times per week, about 50 minutes per session, at a moderate intensity. Comparator groups were often active controls. Exercise significantly decreased the risk of falls (n = 20 RCTs; 4420 participants; RR, 0.88; 95%CI, 0.79-0.98) and injurious falls (9 RTCs; 4481 participants; RR, 0.74; 95%CI, 0.62-0.88), and tended to reduce the risk of fractures (19 RTCs; 8410 participants; RR, 0.84; 95%CI, 0.71-1.00; *P* = .05). Exercise did not significantly diminish the risk of multiple falls (13 RTCs; 3060 participants), hospitalization (12 RTCs; 5639 participants), and mortality (29 RTCs; 11 441 participants). Sensitivity analyses provided similar findings, except the fixed-effect meta-analysis for the risk of fracture, which showed a significant effect favouring exercisers (RR, 0.84; 95%CI, 0.70-1.00; *P* = .047).Meta-regressions on mortality and falls suggest that 2 to 3 times per week would be the optimal exercise frequency.
	CONCLUSIONS AND RELEVANCE Long-term exercise is associated with a reduction in falls, injurious falls, and probably fractures in older adults, including people with cardiometabolic and neurological diseases.

SR/MA **Citation:** Dillon L, Clemson L, Ramulu P, Sherrington C & Keay L. A systematic review and meta-analysis of exercise-based falls prevention strategies in adults aged 50+ years with visual impairment. Ophthalmic Physiol Opt 2018; 38: 456–467. https://doi.org/10.1111/opo.12562	
Purpose: **Search Dates:** Feb 2013 – July 2017 **Total # studies included:** 7 **Other details (e.g. definitions used, exclusions etc)** **Outcomes addressed:** Physical function as classified by ICF. Timed up and go, functional reach, gait speed, gait kinematics	**Abstract:** **Purpose**: To determine the impact of exercise or physical training on falls or physical function in people aged 50+ years with visual impairment, compared with control (no intervention or usual care). **Methods**: An updated systematic review of randomised controlled trials, investigating the effect of exercise or physical activity on falls prevention or physical function in adults aged 50+ with visual impairment. Searches of CINAHL, the Cochrane Register of Controlled Trials (CENTRAL), Embase, and Medline were undertaken. Three trials were identified for the period February 2013 to July 2017 and added to the four in the original review. **Results**: New trials evaluated yoga, the Otago Exercise Programme in combination with a home safety programme and the Alexander Technique. Meta-analysis of data from two trials (n = 163) indicated a non-statistically significant positive impact of exercise on the Chair Stand Test (WMD _1.85 s, 95% CI _4.65 to 0.96, p = 0.20, I2 22%). In this update, two new trials measured falls so meta-analysis was possible for three trials (n = 539) and revealed no impact on falls (RR 1.05, 95% CI 0.73 to 1.50, p = 0.81, I2 30%). **Discussion**: Although exercise or physical training can improve physical function in older adults with visual impairment, and diverse strategies are being evaluated, there are no proven falls prevention strategies. In the few studies available, falls are not consistently reported and more work is required to investigate falls prevention in older adults with visual impairment.

SR/MA **Citation:** Falck RS, Davis JC, Best JR, Crockett RA, Liu-Ambrose T. Impact of exercise training on physical and cognitive function among older adults: a systematic review and meta-analysis. Neurobiology of Aging 79 (2019) 119e130. https://doi.org/10.1016/j.neurobiolaging.2019.03.007	
Purpose:	**Abstract:** Exercise plays a key role in healthy aging by promoting both physical and cognitive function. Physical function and cognitive function appear to be interrelated and may share common mechanisms. Thus, exercise-induced improvements in physical function and cognitive function may co-occur and be associated with each other. However, no systematic review has specifically assessed and compared the effects of exercise on both physical function and cognitive function in older adults, and the association between changes in both outcomes after exercise training. Thus, we conducted a systematic review and meta-analysis (N = 48 studies) among older adults (60+ years). These data suggest exercise training has a significant benefit for both physical function (g = 0.39; p < 0.001) and cognitive function (g = 0.24; p < 0.001). At the study level, there was a positive correlation between the size of the exercise-induced effect on physical function and on cognitive function (b ¼ 0.41; p ¼ 0.002). Our results indicate exercise improves both physical and cognitive function, reiterating the notion that exercise is a panacea for aging well.
Search Dates: Jan 1990 – Nov 208	
Total # studies included: 58	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: muscle strength, physical performance	

SR/MA

Citation: Gordt K, Gerhardy T, Najafi B, Schwenk M. Effects of Wearable Sensor-Based Balance and Gait Training on Balance, Gait, and Functional Performance in Healthy and Patient Populations: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Gerontology 2018;64:74–89. DOI: 10.1159/000481454

Purpose:	**Abstract:**
Search Dates: Jan 2006 – June 2016	***Background:*** Wearable sensors (WS) can accurately measure body motion and provide interactive feedback for supporting motor learning. ***Objective:*** This review aims to summarize current evidence for the effectiveness of WS training for improving balance, gait and functional performance. ***Methods:*** A systematic literature search was performed in PubMed, Cochrane, Web of Science, and CINAHL. Randomized controlled trials (RCTs) using a WS exercise program were included. Study quality was examined by the PEDro scale. Meta-analyses were conducted to estimate the effects of WS balance training on the most frequently reported outcome parameters. ***Results:*** Eight RCTs were included (Parkinson *n* = 2, stroke *n* = 1, Parkinson/stroke *n* = 1, peripheral neuropathy *n* = 2, frail older adults *n* = 1, healthy older adults *n* = 1). The sample size ranged from *n* = 20 to 40. Three types of training paradigms were used: (1) static steady-state balance training, (2) dynamic steady-state balance training, which includes gait training, and (3) proactive balance training RCTs either used one type of training paradigm (type 2: *n* = 1, type 3: *n* = 3) or combined different types of training paradigms within their intervention (type 1 and 2: *n* = 2; all types: *n* = 2). The meta-analyses revealed significant overall effects of WS training on static steady-state balance outcomes including mediolateral (eyes open: Hedges' *g* = 0.82, CI: 0.43–1.21; eyes closed: *g* = 0.57, CI: 0.14–0.99) and anterior- posterior sway (eyes open: *g* = 0.55, CI: 0.01–1.10; eyes closed: *g* = 0.44, CI: 0.02–0.86). No effects on habitual gait speed were found in the meta-analysis (*g* = –0.19, CI: –0.68 to 0.29). Two RCTs reported significant improvements for selected gait variables including single support time, and fast gait speed. One study identified effects on proactive balance (Alternate Step Test), but no effects were found for the Timed Up and Go test and the Berg Balance Scale. Two studies reported positive results on feasibility and usability. Only one study was performed in an unsupervised setting. ***Conclusion:*** This review provides evidence for a positive effect of WS training on static steady-state balance in studies with usual care controls and studies with conventional balance training controls. Specific gait parameters and proactive balance measures may also be improved by WS training, yet limited evidence is available. Heterogeneous training paradigms, small sample sizes, and short intervention durations limit the validity of our findings. Larger studies are required for estimating the true potential of WS technology.
Total # studies included: 8	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: balance, gait, functional capacity	

SR/MA

Citation: Hita-Contreras F, Bueno-Notivol JB, Martinez-Amat A, Cruz-Diaz D, Hernandez AV, Perez-Lopez FR. Effect of exercise alone or combined with dietary supplements on anthropometric and physical performance measures in community-dwelling elderly people with sarcopenic obesity: A meta-analysis of randomized controlled trials Maturitas 116 (2018) 24–35. doi.org/10.1016/j.maturitas.2018.07.007

Purpose:	**Abstract:**
Last Search Date: April 2018	**Objective**: To evaluate the effect of exercise (EXE) alone or exercise combined with dietary supplements (EXESUPPL) on body composition and physical performance in subjects 60 years and older with sarcopenic obesity.
Total # studies included: 7	**Methods**: A systematic review was carried out of studies identified through five search engines up to April 15, 2018. We searched for randomized controlled trials (RCTs) evaluating EXE or EXE-SUPPL in elderly individuals with sarcopenic obesity for at least six weeks. Primary outcomes were percentage of body fat mass, appendicular skeletal muscle mass, and hand grip strength. Random effects meta-analyses with the inverse variance method were used to evaluate the effects of interventions on outcomes. Effects were expressed as mean differences (MD) and their 95% confidence intervals (CI). Risk of bias was assessed with the Cochrane tool.
Other details (e.g. definitions used, exclusions etc) Included healthy community-dwelling men and/or women aged 60 years and older with sarcopenic obesity	**Results**: Nine papers reporting seven RCTs (with a total of 558 participants) were included in the review. EXE alone and EXE-SUPPL increased grip strength (MD 1.30 kg; 95% CI 0.58–2.01), gait speed (MD 0.05 m/s; 95% CI 0.03–0.07) and appendicular skeletal muscle mass (MD 0.40 kg; 95% CI 0.18–0.63). EXE alone and EXE-SUPPL reduced waist circumference (MD −1,40 cm; 95% CI −1.99 to −0.81), total fat mass (MD −1,77 kg; 95% CI −2.49 to −1.04), and trunk fat mass (MD −0.82 kg; 95% CI −1.22 to −0.42).
Outcomes addressed: 1) percentage of body fat; 2) three sarcopenia diagnostic criteria: (i) appendicular skeletal muscle mass (ii) grip strength (iii) gait speed	**Conclusion**: EXE alone and EXE-SUPPL improved muscle-related outcomes and reduced fat-related outcomes in subjects with sarcopenic obesity. There is a need for better-designed RCTs with systematic assessment of both different exercise regimes and dietary supplements in sarcopenic obese subjects.

SR/MA **Citation:** Kauppi M, Elovainio M, Stenholm S, Virtanen M, Aalto V, Koskenvuo M, Kivimaki M, Vahtera J. Social networks and patterns of health risk behaviours over two decades: A multi-cohort study. Journal of Psychosomatic Research 99 (2017) 45–58. dx.doi.org/10.1016/j.jpsychores.2017.06.003	
Purpose: **Timeframe:** N/A **Total # studies included:** 3 **Other details (e.g. definitions used, exclusions etc)** **Outcomes addressed:** Social network size	**Abstract:** **Objective**: To determine the associations between social network size and subsequent long-term health behaviour patterns, as indicated by alcohol use, smoking, and physical activity. **Methods**: Repeat data from up to six surveys over a 15- or 20-year follow-up were drawn from the Finnish Public Sector study (Raisio-Turku cohort, n =986; Hospital cohort, n= 7307), and the Health and Social Support study (n= 20,115). Social network size was determined at baseline, and health risk behaviours were assessed using repeated data from baseline and follow-up. We pooled cohort-specific results from repeated-measures log binomial regression with the generalized estimating equations (GEE) method using fixed-effects meta-analysis. **Results**: Participants with up to 10 members in their social network at baseline had an unhealthy risk factor profile throughout the follow-up. The pooled relative risks adjusted for age, gender, survey year, chronic conditions and education were 1.15 for heavy alcohol use (95% CI: 1.06–1.24), 1.19 for smoking (95% CI: 1.12–1.27), and 1.25 for low physical activity (95% CI: 1.21–1.29), as compared with those with> 20 members in their social network. These associations appeared to be similar in subgroups stratified according to gender, age and education. **Conclusions**: Social network size predicted persistent behaviour-related health risk patterns up to at least two decades.

SR/MA

Citation: Kidd T, Mold F, Jones C, Ream E, Grosvenor W, Sund-Levander M, Tingstrom P, Carey N. (2019). What are the most effective interventions to improve physical performance in pre-frail and frail adults? A systematic review of randomised control trials. BMC geriatrics, 19(1), 184. https://doi.org/10.1186/s12877-019-1196-x

Purpose:	**Abstract:**
Search Dates: Jan 2010 – Dec 2016	**Background**: With life expectancy continuing to rise in the United Kingdom there is an increasing public health focus on the maintenance of physical independence among all older adults. Identifying interventions that improve physical outcomes in pre-frail and frail older adults is imperative.
Total # studies included: 10	**Methods**: A systematic review of the literature 2000 to 2017 following PRISMA guidelines and registered with PROSPERO (no. CRD42016045325).
Other details (e.g. definitions used, exclusions etc) Studies were excluded if physical performance was only measured using ADL or IADL	**Results**: Ten RCT trials fulfilled selection criteria and quality appraisal. The study quality was moderate to good. Interventions included physical activity; nutrition, physical activity combined with nutrition. Interventions that incorporated one or more physical activity components significantly improved physical outcomes in pre-frail and/or frail older adults.
Outcomes addressed: Physical performance related to frailty criteria (e.g. gait speed, grip strength, physical activity levels, mobility, balance, muscle mass, body mass index)	**Conclusions**: Physical activity interventions are key to maintaining independence in pre-frail and frail older adults. A lack of consensus regarding the definition of frailty, and an absence of core measures to assess this means any attempt to create an optimal intervention will be impeded. This absence may ultimately impact on the ability of older and frail adults to live well and for longer in the community.

SR/MA **Citation:** Labott BK, Bucht H, Morat M, Morat T, Donath L. Effects of Exercise Training on Handgrip Strength in Older Adults: A Meta-Analytical Review. Gerontology. 2019;65(6):686-698. doi: 10.1159/000501203. Epub 2019 Sep 9. PubMed PMID: 31499496	
Purpose: **Last Search Date:** November 2018 **Total # studies included:** 24 **Other details (e.g. definitions used, exclusions etc)** Community-dwelling, healthy older adults **Outcomes addressed:** Handgrip strength	**Abstract:** ***Background:*** Handgrip strength measurements are feasible with older adults and a reliable indicator for vitality, physical function, and several risk factors in the ageing process. Interventions with exercise training induce a variety of strength, balance, and endurance improvements. The pooled transfer effects of exercise training on handgrip strength has not been investigated to date. Thus, the objective of this metanalytical review is to examine the effects of different exercise training on handgrip strength in healthy community dwelling older adults of 60 years or older. ***Methods:*** The literature search was conducted in three databases (PubMed, Web of Science, SPORTDiscus) using the following search terms with Boolean conjunctions: (hand grip* OR grip strength OR grip power) AND (sport* OR train* OR exercis* OR strength OR intervention OR endurance OR resistance OR balance OR aerob*) AND (old* OR elder* OR senior*). Nonrandomized and randomized controlled trials with an exercise training and handgrip strength as the outcome parameter were screened. Study quality was independently assessed by two researchers using the PEDro scale. Comparison of handgrip strength between the intervention and control groups was conducted by using the hedges g (including adjustment for small sample sizes), calculating standardized mean differences (SMDs). A random effects inverse-variance model was applied for statistical analysis. ***Results:*** Twenty-four trials (mean PEDro score 5.8 ± 0.9) with a total of 3,018 participants (mean age 73.3 ± 6.0 years) were included. Small but significant effects ($p < 0.001$) on handgrip strength were observed (SMD 0.28, 95% CI 0.13–0.44). Study heterogeneity (I^2 56%) and the funnel shape for publication bias analyses were acceptable. ***Conclusions:*** Meaningful but small transfer effects of a multitude of different training approaches on handgrip strength occurred in healthy community-dwelling older adults. Handgrip strength cannot clearly be recommended to assess general functional performance for all kinds of exercise programs, whereas task-specific training and multimodal training modes seem to provide an appropriate stimulus to also improve handgrip strength.

SR/MA

Citation: Lindsay Smith G, Banting L, Eime R, O'Sullivan G, Van Uffelen JG. (2017). The association between social support and physical activity in older adults: a systematic review. International Journal of Behavioral Nutrition and Physical Activity, 14(1), 56. doi: 10.1186/s12966-017-0509-8

Purpose:	**Abstract:**
Last Date Searched: Aug 2014 **Total # studies included:** 27 **Other details (e.g. definitions used, exclusions etc)** **Outcomes addressed:** Social support, loneliness	**Background**: The promotion of active and healthy ageing is becoming increasingly important as the population ages. Physical activity (PA) significantly reduces all-cause mortality and contributes to the prevention of many chronic illnesses. However, the proportion of people globally who are active enough to gain these health benefits is low and decreases with age. Social support (SS) is a social determinant of health that may improve PA in older adults, but the association has not been systematically reviewed. This review had three aims: 1) Systematically review and summarise studies examining the association between SS, or loneliness, and PA in older adults; 2) clarify if specific types of SS are positively associated with PA; and 3) investigate whether the association between SS and PA differs between PA domains. **Methods**: Quantitative studies examining a relationship between SS, or loneliness, and PA levels in healthy, older adults over 60 were identified using MEDLINE, PSYCInfo, SportDiscus, CINAHL and PubMed, and through reference lists of included studies. Quality of these studies was rated. **Results**: This review included 27 papers, of which 22 were cross sectional studies, three were prospective/ longitudinal and two were intervention studies. Overall, the study quality was moderate. Four articles examined the relation of PA with general SS, 17 with SS specific to PA (SSPA), and six with loneliness. The results suggest that there is a positive association between SSPA and PA levels in older adults, especially when it comes from family members. No clear associations were identified between general SS, SSPA from friends, or loneliness and PA levels. When measured separately, leisure time PA (LTPA) was associated with SS in a greater percentage of studies than when a number of PA domains were measured together. **Conclusions**: The evidence surrounding the relationship between SS, or loneliness, and PA in older adults suggests that people with greater SS for PA are more likely to do LTPA, especially when the SS comes from family members. However, high variability in measurement methods used to assess both SS and PA in included studies made it difficult to compare studies.

SR/MA **Citation:** McMullan II, McDonough SM, Tully MA, Cupples M, Casson K, Bunting BP. The association between balance and freeliving physical activity in an older community-dwelling adult population: a systematic review and meta-analysis. BMC Public Health (2018) 18:431. https://doi.org/10.1186/s12889-018-5265-4	
Purpose: **Last Search Date:** June 2016 **Total # studies included:** 30 **Other details (e.g. definitions used, exclusions etc)** **Outcomes addressed:** Balance, falls, and physical function	**Abstract:** **Background**: Poor balance is associated with an increased risk of falling, disability and death in older populations. To better inform policies and help reduce the human and economic cost of falls, this novel review explores the effects of free-living physical activity on balance in older (50 years and over) healthy community-dwelling adults. **Methods**: Search methods: CENTRAL, Bone, Joint and Muscle Trauma Group Specialised register and CDSR in the Cochrane Library, MEDLINE, EMBASE, CINAHL, PsychINFO, and AMED were searched from inception to 7th June 2016. Selection criteria: Intervention and observational studies investigating the effects of free-living PA on balance in healthy community-dwelling adults (50 years and older). Data extraction and analysis: Thirty studies were eligible for inclusion. Data extraction and risk of bias assessment were independently carried out by two review authors. Due to the variety of outcome measures used in studies, balance outcomes from observational studies were pooled as standardised mean differences or mean difference where appropriate and 95% confidence intervals, and outcomes from RCTs were synthesised using a best evidence approach. **Results**: Limited evidence provided by a small number of RCTs, and evidence from observational studies of moderate methodological quality, suggest that free-living PA of between one and 21 years' duration improves measures of balance in older healthy community-dwelling adults. Statistical analysis of observational studies found significant effects in favour of more active groups for neuromuscular measures such as gait speed; functionality using Timed Up and Go, Single Leg Stance, and Activities of Balance Confidence Scale; flexibility using the forward reach test; and strength using the isometric knee extension test and ultrasound. A significant effect was also observed for less active groups on a single sensory measure of balance, the knee joint repositioning test. **Conclusion**: There is some evidence that free-living PA is effective in improving balance outcomes in older healthy adults, but future research should include higher quality studies that focus on a consensus of balance measures that are clinically relevant and explore the effects of free-living PA on balance over the longer-term.

SR/MA **Citation:** Sherrington C, Fairhall NJ, Wallbank GK, Tiedemann A, Michaleff ZA, Howard K, Clemson L, Hopewell S, Lamb SE. Exercise for preventing falls in older people living in the community. Cochrane Database of Systematic Reviews 2019, Issue 1. Art. No.: CD012424. DOI: 10.1002/14651858.CD012424.pub2	
Purpose:	**Abstract:** **Background:** At least one-third of community-dwelling people over 65 years of age fall each year. Exercises that target balance, gait and muscle strength have been found to prevent falls in these people. An up-to-date synthesis of the evidence is important given the major long-term consequences associated with falls and fall-related injuries **Objectives:** To assess the effects (benefits and harms) of exercise interventions for preventing falls in older people living in the community. **Search methods:** We searched CENTRAL, MEDLINE, Embase, three other databases and two trial registers up to 2 May 2018, together with reference checking and contact with study authors to identify additional studies. **Selection criteria:** We included randomised controlled trials (RCTs) evaluating the effects of any form of exercise as a single intervention on falls in people aged 60+ years living in the community. We excluded trials focused on particular conditions, such as stroke. **Data collection and analysis:** We used standard methodological procedures expected by Cochrane. Our primary outcome was rate of falls. **Main results:** We included 108 RCTs with 23,407 participants living in the community in 25 countries. There were nine cluster-RCTs. On average, participants were 76 years old and 77% were women. Most trials had unclear or high risk of bias for one or more items. Results from four trials focusing on people who had been recently discharged from hospital and from comparisons of different exercises are not described here.
Last Search Date: May 2018	
Total # studies included: 10	
Other details (e.g. definitions used, exclusions etc) Excluded trials focused on particular conditions, such as stroke.	
Outcomes addressed: Fall-related fractures	

SR/MA

Citation: Sivaramakrishnan D, Fitzsimons C, Kelly P, Ludwig K, Mutrie N, Saunders DH, Baker G. (2019). The effects of yoga compared to active and inactive controls on physical function and health related quality of life in older adults-systematic review and meta-analysis of randomised controlled trials. International Journal of Behavioral Nutrition and Physical Activity, 16(1), 33.

Purpose: **Last Search Date:** Sept 2017 **Total # studies included:** 22 **Other details (e.g. definitions used, exclusions etc)** **Outcomes addressed:** Physical function and/or HRQoL	**Abstract:** **Background**: Yoga has been recommended as a muscle strengthening and balance activity in national and global physical activity guidelines. However, the evidence base establishing the effectiveness of yoga in improving physical function and health related quality of life (HRQoL) in an older adult population not recruited on the basis of any specific disease or condition, has not been systematically reviewed. The objective of this study was to synthesise existing evidence on the effects of yoga on physical function and HRQoL in older adults not characterised by any specific clinical condition. **Methods**: The following databases were systematically searched in September 2017: MEDLINE, PsycInfo, CINAHL Plus, Scopus, Web of Science, Cochrane Library, EMBASE, SPORTDiscus, AMED and ProQuest Dissertations & Theses Global. **Study inclusion criteria**: Older adult participants with mean age of 60 years and above, not recruited on the basis of any specific disease or condition; yoga intervention compared with inactive controls (example: wait-list control, education booklets) or active controls (example: walking, chair aerobics); physical function and HRQoL outcomes; and randomised/cluster randomised controlled trials published in English. A vote counting analysis and meta-analysis with standardised effect sizes (Hedges' g) computed using random effects models were conducted. **Results**: A total of 27 records from 22 RCTs were included (17 RCTs assessed physical function and 20 assessed HRQoL). The meta-analysis revealed significant effects (5% level of significance) favouring the yoga group for the following physical function outcomes compared with inactive controls: balance (effect size (ES) = 0.7), lower body flexibility (ES = 0.5), lower limb strength (ES = 0.45); compared with active controls: lower limb strength (ES = 0.49), lower body flexibility (ES = 0.28). For HRQoL, significant effects favouring yoga were found compared to inactive controls for: depression (ES = 0.64), perceived mental health (ES = 0.6), perceived physical health (ES = 0.61), sleep quality (ES = 0.65), and vitality (ES = 0.31); compared to active controls: depression (ES = 0.54). **Conclusion**: This review is the first to compare the effects of yoga with active and inactive controls in older adults not characterised by a specific clinical condition. Results indicate that yoga interventions improve multiple physical function and HRQoL outcomes in this population compared to both control conditions. This study provides robust evidence for promoting yoga in physical activity guidelines for older adults as a multimodal activity that improves aspects of fitness like strength, balance and flexibility, as well as mental wellbeing.

SR/MA

Citation: Taylor LM, Kerse N, Frakking T, Maddison R. *J Geriatr Phys Ther* 2018;41:108-123. DOI: 10.1519/JPT.0000000000000078

Purpose:	**Abstract:**
Last Search Date: April 2015	**Background and Purpose**: Participation in regular physical activity is associated with better physical function in older people (> 65 years); however, older people are the least active of all age groups. Exercise-based active video games (AVGs) offer an alternative to traditional exercise programs aimed at maintaining or enhancing physical performance measures in older people. This review systematically evaluated whether AVGs could improve measures of physical performance in older people. Secondary measures of safety, game appeal, and usability were also considered. **Methods:** Electronic databases were searched for randomized controlled trials published up to April 2015. Included were trials with 2 or more arms that evaluated the effect of AVGs on outcome measures of physical performance in older people. **Results**: Eighteen randomized controlled trials (n = 765) were included. Most trials limited inclusion to healthy community dwelling older people. With the exception of 1 trial, all AVG programs were supervised. Using meta-analyses, AVGs were found to be more effective than conventional exercise (mean difference [MD], 4.33; 95% confidence intervals [CIs], 2.93- 5.73) or no intervention (MD, 0.73; 95% CI, 0.17-1.29) for improving Berg Balance scores in community-dwelling older people. Active video games were also more effective than control for improving 30-second sit-to-stand scores (MD, 3.99; 95% CI, 1.92-6.05). No significant differences in Timed Up and Go scores were found when AVGs were compared with no intervention or with conventional exercise. **Conclusions:** Active video games can improve measures of mobility and balance in older people when used either on their own or as part of an exercise program. It is not yet clear whether AVGs are equally suitable for older people with significant cognitive impairments or balance or mobility limitations. Given the positive findings to date, consideration could be given to further development of age-appropriate AVGs for use by older people with balance or mobility limitations.
Total # studies included: 15	
Other details (e.g. definitions used, exclusions etc) Trials of AVGs targeting individuals with specifi c conditions (eg, stroke or diabetes) were excluded.	
Outcomes addressed: 1) Objectively measured physical performance (ie, balance, mobility or physical performance test batteries), or 2) subjectively measured physical performance (ie, activity or balance confidence questionnaires)	

SR/MA **Citation:** Vancampfort D, Lara E, Smith L, Rosenbaum S, Firth J, Stubbs B, Hallgren M, Koyanagi A. Physical activity and loneliness among adults aged≥ 50 years in six low-and middle-income countries. International journal of geriatric psychiatry. *Int J Geriatr Psychiatry*. 2019 Dec;34(12):1855-1864. doi: 10.1002/gps.5202.	
Purpose: **Timeframe:** Survey conducted 2007 to 2010 **Total # studies included:** 1 **Other details (e.g. definitions used, exclusions etc)** **Outcomes addressed:** loneliness	**Abstract:** **Introduction:** Loneliness is widespread and associated with deleterious outcomes in middle-aged and older age people in low- and middle-income countries (LMICs). Physical activity is one potential psychosocial strategy with the potential to reduce loneliness in this population. Thus, the aim of this study was to explore associations between physical activity (PA) and loneliness in middle-aged and older people from six LMICs. **Materials and methods:** Data from the Study on Global Ageing and Adult Health (SAGE) were analyzed. Self-reported data on loneliness and PA (as assessed by the Global Physical Activity Questionnaire) were collected. Participants were dichotomized into those who do and do not meet the international recommendation of 150 minutes of moderate to vigorous PA per week. Associations between loneliness and PA were examined using logistic regressions. **Results:** Among 34 129 individuals aged 50 years or older, the prevalence of loneliness was higher among those not meeting the PA guidelines in all countries, although this difference was not significant in Mexico and South Africa. After full adjustment, not meeting PA guidelines was positively associated with loneliness in the meta-analysis based on country-wise estimates, with a moderate level of between-country heterogeneity being observed (OR = 1.31; 95% CI, 1.07-1.61; *I*2 = 48.7%). At an individual country level, statistical significance was only reached in Ghana (OR = 1.89; 95% CI = 1.44-2.49). **Discussion:** Our data suggest that physical inactivity and loneliness commonly cooccur in adults aged 50 years or older in LMICs overall but that this association differs by country. Longitudinal studies are required to confirm these findings and investigate potential mechanisms that may inform future interventions.