Effect of Different Types of Physical Activity on Activities of Daily Living in Older Adults: Systematic Review and Meta-Analysis

Abstract

Physical activity is associated with greater independence in old age. However, little is known about the effect of physical activity level and activity type on activities of daily living (ADL). This review systematically analyzed the effects of physical activity level and activity type on ADL in older adults (mean age, 60+). Electronic search methods (up to March 2015) identified 47 relevant, randomized controlled trials. Random effects meta-analyses revealed significant, beneficial effects of physical activity on ADL physical performance (SMD = 0.72, 95% CI [0.45, 1.00]; $p < 0.01$), with the largest effects found for moderate physical activity levels, and for activity types with high levels of mental (e.g. memory, attention), physical (e.g. coordination, balance) and social (e.g. social interaction) demands. Inconsistent effects were observed on self-reported ADL measures. Interventions that include moderate physical activity levels with high mental, physical and social demands may produce greatest benefits on ADL physical performance.

Keywords: physical activity, activities of daily living, older adults, systematic review

Between 2015 and 2050, the global proportion of older adults aged 60 and over will nearly double from 12% to 22% (World Health Organization [WHO], 2015), resulting in significant economic, political and social consequences to society (United Nations, 2013).

Advanced age involves structural and functional deterioration of most physiological systems (Chodzko-Zajko et al., 2009) which may negatively impact an individuals' ability to carry out activities of daily living (ADLs) such as grooming, feeding, mobilizing, and continence, alonside instrumental activities of daily living (IADL) such as housework, managing money and shopping for groceries. A loss of ADL ability is often associated with poorer quality of life (Murakami & Scattolin, 2010) and increased strain on families and healthcare systems. Therefore, strategies designed to maintain ADL and IADL abilities during old age are of prime importance.

Mounting evidence from large-scale epidemiological studies, randomized controlled trials and meta-analytic reviews offer compelling evidence that physical activity positively influences older adults' ability to carry out ADLs (Chou, Hwang, & Wu, 2012; Tak, Kuiper, Chorus & Hopman-Rock, 2013) alongside improving ADL-related outcomes such as muscular strength (Paterson & Warburton, 2010), balance (Howe, Rochester, Neil, Skelton, & Ballinger, 2011), mobility (Yeom, Keller, & Fleury, 2009), flexibility (Peri et al., 2008), cognitive function (Blondell, Hammersley-Mather, & Veerman, 2014), executive functioning (Guiney & Machado, 2013), and reducing the risk of disability (Gretebeck, Ferraro, Black, Holland, & Gretebeck, 2012) and falls (Allan, Ballard, Rowan, & Kenny, 2009). These findings have led to questions regarding which characteristics of physical activity are most important for maintaining ADL in old age.

It is recommended that older adults undertake 150 minutes a week of moderate-intensity physical activity in bouts of 10 minutes or more (WHO, 2010) to achieve beneficial health outcomes. Although many older adults struggle to meet these guidelines (Sparling, Howard, Dunstan & Owen, 2015) a lower amount of physical activity may still be of some benefit. Physical activity patterns are commonly quantified by combining the weekly frequency, intensity and time spent engaging in physical activity (e.g. Hupin et al., 2015), which results in an overall *physical activity level.* Physical activity undertaken at a lower frequency, time, and intensity (i.e. *low* physical activity level) may have a differential impact on ADL than activities undertaken at a higher frequency, time, and intensity (i.e. *high* physical activity level). Currently, limited attention has been directed towards the impact of different physical activity levels (including *low* physical activity levels, which may be more acceptable to older adults) on ADL ability. Furthermore, the impact of different *types* of physical activity on ADL ability in old age is largely unexplored.

Golf (Fan, Kowaleski-Jones & Wen, 2013; Kolt, Driver & Giles, 2004; Stenner, Mosewich & Buckley, 2016), bowling (Crombie et al., 2004; Fan et al., 2013; Kolt et al., 2004) and dancing (Department of Culture, Media and Sport, 2011; Fan et al., 2013) are examples of physical activities commonly undertaken during old age, which vary in terms of their mental (e.g. memory, attention), physical (e.g. balance, coordination), and social (e.g. level of social interaction required) demands. Golf involves mental demands such as problem-solving, ability to read the greens, make tactical decisions and keep score (Weeks & Nye, 2008), thus golf is more mentally demanding than simpler activities such as walking. Bowling, on the other hand, involves physical skill demands such as dynamic balance, mobility, reaction time and postural stability (Brooke-Wavell & Cooling, 2009), thus lawn bowls is more physically demanding than other activities such as stationary cycling. Finally, dancing involves intrinsic, social interaction demands (Lakes et al., 2016) such as cooperation and interaction with a partner or a group, thus dancing is more socially demanding than activities that are often performed alone, such as housework. It is possible, therefore, that activity types which combine greater amounts of mental, physical and social demands (i.e. *high* multitask activities) may have a stronger, beneficial effect on ADL ability than simpler physical activities (i.e. *low* multitask activities).

Several systematic reviews have attempted to investigate physical activity type (Chou et al., 2012; de Vries et al., 2012; Giné-Garriga, Roque-Figuls, Coll-Planas, Sitja-Rabert, & Martin-Borras, et al., 2014), but the inclusion of interventions that incorporated a combination of different types of physical activity prevented statistical, comparative analyses. In a recent Cochrane review, Howe et al., (2011) analyzed the effects of different types of physical *exercise* (a subcategory of physical activity) on balance performance, concluding that the more effective interventions involved standing dynamic exercise, but an analysis of the specific types of activities and their underlying demands was not conducted. To the best of our knowledge, no studies have investigated specific types of physical activities (with their underlying mental, physical and social demands) and whether these differences affect ADL outcomes.

This systematic review aimed to synthesize data from randomized controlled trials to investigate the effect of physical activity level and multitask activity level on ability to carry out ADLs in older adults. Given that physical performance measures are more likely to be sensitive to change over time (Goldman, Glei, Rosero-Bixby, Chiou, and Weinstein, 2014), self-reported and physical performance measures were analyzed separately.

Method

Study Design

This study was a systematic review of published, randomized controlled trials (RCTs). A protocol (available on request) was developed prior to undertaking the review, which adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (Liberati et al., 2009).

Study Selection

Details of the selection process are shown in Figure 1. Included studies met the following criteria:

Studies.

Pre-posttest RCTs investigating the effect of specific types of physical activities on ADLs in older adults were included. All methods of randomization were accepted. Trials with multiple study arms were also accepted, providing that each intervention met with specified inclusion criteria (see *Interventions*). Where this was not the case, that study arm was excluded but all other remaining study arms were included. Studies included, but were not limited to, community and home-based interventions, laboratory-based interventions, and care facility settings such as retirement home interventions.

Participants.

Studies included older adult participant samples with a mean age of 60+ years. Several potentially relevant studies with this desired mean age included participants as young as 40 years old, which may not conform to generally accepted definitions of old age (e.g. WHO, 2012). Therefore, participant samples also had to have a minimum age of 55 years to be eligible for inclusion in the present study. Given that an older adult sample free of disease is not likely to be representative of this population (Chodzko-Zajko et al., 2009), studies containing participants with conditions/diseases typical of old age were included. However, studies that exclusively recruited volunteers with a particular disease (e.g. stroke, cancer, dementia) were excluded, with the exception of ADL-related limitations, namely: balance impairment; frailty; mild cognitive impairment; dependence in ADLs; disability; and history of falls.

Interventions.

Included interventions comprised of one specific type of physical activity, as specified within the Compendium of Physical Activities (Ainsworth et al., 2011), with the exceptions of balance and functional training, which are not included within the compendium but are highly relevant modes of exercise training among older adults. Multicomponent interventions (e.g. including an educational or nutritional component, electrical/vibrational stimulation) were excluded to ensure that any observed effects were due to the physical activity alone. Controls could have no intervention, a placebo non-active contact intervention (e.g. arts and crafts), or standard care. The frequency, intensity, time and type of activities were recorded. All durations of interventions were accepted, although interventions with physical activity sessions of less than 10 minutes each were excluded as this is the minimum bout of time for activity recommended for older adults by the American College of Sports Medicine (ACSM) (Chodzko-Zajko et al., 2009) and the WHO (2010) to improve health.

Outcome measures.

Studies were required to report at least one ADL or ADL-related outcome. Accepted physical performance measures of ADL were: Timed Up and Go Test (TUG); Berg Balance Scale (BBS); 8-Foot Up and Go (8FUG); Sit Up and Go (SUG); 6-minute walk test (6MW); 5-times sit to stand (5STS); Group of Development Latin-American for Maturity (GDLAM's) protocol of Functional Autonomy evaluation (FA); and the Physical Performance Test (PPT). Accepted self-reported ADL measures were: MOS Short form, physical functioning subscale (SF36-PF); Barthel Index (BI); Lawton and Brody Instrumental Activities of Daily Living Scale (IADL); Katz Index of Independence in Activities of Daily Living (Katz ADL); Functional Independence Measure (FIM); Groningen Activities Restriction Scale (GARS); and the Assessment of Daily Activity Performance (ADAP). This review only included pre and post-test intervention outcome measures. Any additional follow-up measures were not included in the analyses.

Search Strategy and Identification of Trials

Studies included in this review were identified from five electronic databases:

MEDLINE; EMBASE; PsycINFO; SPORTDiscus; and the Cochrane Library Register of Controlled Trials. There were no restrictions on year of publication up until March 2015. The search was limited to randomized controlled trials, human subjects, and English language. The electronic search strategy was initially developed in MEDLINE (Supplementary file 1) by combining a string of relevant Medical Subject Headings (MeSH) terms and text words (e.g. *older adults, elderly; physical activity, sport, exercise;* and *activities of daily living, physical function, independence*), which were then adapted for all remaining databases. Reference lists of potentially relevant studies were also hand-searched, and additional studies identified via researcher knowledge of relevant literature were also added. The first author performed each search, and forwarded results to a centralized data bank (RefWorks) for the removal of duplicates. The same author performed initial screening of all titles and abstracts to determine relevance. To ensure accuracy of screening, 10% of the same studies were independently screened by a second reviewer, resulting in an initial 71.62% agreement. Remaining disagreements were resolved through discussion until 100% agreement was achieved. Following this, one author performed full text screening of all selected studies to ensure they met the review inclusion/exclusion criteria. Study eligibility doubts were resolved by discussion with all authors. Five authors of included studies were contacted via email (of which, 4 responded) to clarify information and/or request missing data, resulting in a response rate of 80%.

Data Extraction and Quality Assessment

The first author performed data extraction on all included studies using a piloted data extraction form, where data to be extracted was tightly specified. To determine reliability, three other authors independently performed data extraction for a total of 25.5% of included studies. Results were cross-checked, demonstrating 100% agreement across authors, thus further cross-checking was deemed unwarranted. Quality of all included studies was assessed by the first author, using the PEDro (Physiotherapy Evidence Database) Scale. This 11-item scale analyzes methodological quality of clinical trials (RCT's) by assessing the following criteria: specified eligibility criteria; random allocation; allocation concealment; homogeneity of participants at baseline; blinding of subjects; intention to treat analysis; group statistical analysis; and point measures and measures of variability (Moseley, Herbert, Sherrington, & Maher, 2002). Items receive a *yes* or *no* response, and (as utilized in Lopez Fernadndez-Arguelles, Rodriguez-Mansilla, Espejo Antunez, Maria Garrido-Ardila, & Perez Munoz, 2015) a total score of study quality is calculated (9-10 = *excellent*; 6-8 = *good*; 4-5 = *fair*; <4 = *poor*). In randomized trials, reliability of this total PEDro score is *fair* to *good* (Maher, Sherrington, Herbert, Moseley, & Elkins, 2003). Studies with a *poor* quality rating were excluded from this review.

Data Synthesis

Similar to previously used methods (Paterson & Warburton, 2010; Hupin et al., 2015; Weauve et al., 2004), physical activity level was determined by multiplying the weekly volume of each activity (i.e. frequency and time) by the metabolic output (METs) of the type of physical activity (i.e. intensity), which resulted in a value of weekly MET-minutes for each intervention group. MET values were taken from Ainsworth et al.'s (2011) Compendium of Physical Activities, which lists 822 different physical activities alongside their corresponding metabolic expenditures. Following a careful inspection of the intervention activity descriptions, the most representative compendium activity was selected. Where types of physical activity interventions existed that were not included in the compendium (in the case of this review, balance training and functional training), a description of the physical activity (and its intensity) was matched to the closest available activity listed in the compendium.

The WHO (2010) recommends that older adults undertake 150 minutes of moderate intensity physical activity in bouts of 10 minutes or more per week. According to Ainsworth et al. (2011), moderate intensity ranges from 3-5.9 MET's. Thus, *moderate* physical activity levels for older adults were classified as 450-885 MET-minutes (i.e. 150 x 3 to 150 x 5.9), with <450 and >885 MET-minutes classified as *low* and *high* physical activity levels respectively. Where intervention groups had been pooled for meta-analysis (i.e. a study with more than one intervention group), the mean MET-minutes of the two intervention groups was accepted.

A coding system (supplementary file 4) for analyzing multitask activity level was developed by the research team, which categorized each activity as *high, moderate*, or *low*. These methods were adapted from the work of Karp and colleagues (2006) in their assessment of the mental, physical and social components of different leisure activities. Using existing literature (e.g. Corbin, Pangrazi & Franks, 2000; Goldstein, 2008; Rolls, 2008), eight non-metabolic, mental (i.e. *attention/concentration, decision-making and strategy, memory*), physical (i.e. *flexibility, balance, coordination, speeded reactions*) and social (i.e. *level of interaction*) demands of different types of physical activity were identified. These demands were then rated by three researchers during two rounds of scoring. In round one, researchers independently scored each of the nine demands within the 15 physical activities included in the present review (totaling 120 individual scores), using a points system of: 1 = little/none required; 2 = a moderate amount required; 3 = a high amount required. Scores were accepted when 100% agreement was reached. Seventy-seven of the 120 scores reached 100% agreement in round one, and were therefore, accepted as complete. In round two, the remaining 43 non-agreed scores were discussed among the same three researchers until a consensus was reached. All scoring was based upon specific intervention content reported within the selected study papers, alongside researcher knowledge of the different types of physical activity. The total score for each physical activity was calculated, revealing three natural clusters. These clusters, were used to form three subcategories of multitask activity level for subsequent analyses. The first cluster contained activities requiring minimal cognitive demands and simple, repetitive movements. These *low* multitask activities (8-11 points) were flexibility training, gardening, stationary cycling, strength training, and walking. The middle cluster contained activities with a moderate level of mental and physical functioning that can be performed alone or in a group setting. These *moderate* multitask activities (13-16 points) were: aquafit, balance training, exergaming, functional training, Pilates, qigong, tai chi, and yoga. The third cluster contained inherently social activities, requiring continuous interaction with others, complex movement skills and high levels of cognitive processing. These *high* multitask activities (19-20 points) were dancing, and handball. Consequently, a *high* multitask activity has high mental, physical, and social demands, and a *low* multitask activity involves little or no mental, physical, and social demands.

A narrative synthesis was used to evaluate key findings, and where data allowed, meta-analyses were undertaken to determine the effect of physical activity level (subcategorized as *high, moderate* and *low*) and multitask activity level (subcategorized as *high, moderate* and *low*) relative to control on both physical performance and self-reported ADL measures. The meta-analyses were performed using Review Manager Software (version 5.0). Due to the variety of outcome measures, a standardized mean difference approach (*SMD*) with a random effects model was used. Given that the combination of post and change data is not advised for standardized mean difference (Higgins & Green, 2011), only studies (individually randomized, parallel trials) providing post data were included in the meta-analyses. For physical activity level meta-analyses (Figures 2 and 3), intervention groups were pooled. This was not possible for multitask activity level meta-analyses (Figures 4 and 5) unless both intervention groups used the same type of activity or if both types of activities fell into the same multitask level subcategory. To facilitate comparisons across studies, outcomes with a lower score indicating a beneficial effect of physical activity were converted by multiplying the means by -1 (Higgins & Green, 2011). Means and standard deviations were extracted for use, or where necessary, calculated from other statistical data.

Sensitivity Analysis

A sensitivity analysis was performed to determine the effect of methodological quality on effects of the interventions. This was achieved by temporarily removing *fair* quality studies (as identified by the PEDro scale) and comparing these results with the full set of results.

Analysis of Publication Bias

Funnel plots of the pooled study data were performed to allow for visual inspection of publication bias (Figures 6-9).

Results

The search process (Figure 1) identified 47 studies (48 articles) that met the inclusion criteria, of which 33 were suitable for meta-analysis. A list of excluded studies can be found in Supplementary file 2.

Characteristics of Included Studies

A detailed summary of all study characteristics and study identification (ID) numbers can be found in Table 1, whereby ID numbers are presented adjacent to first author name and year of publication.

Study design.

Of the 47 studies, 44 were individually randomized (study IDs: (1-14, 16-26, 28-43, 45-47)) and three were cluster randomized trials (15, 27, 44). Forty-five studies used parallel arm designs (1, 2, 4, 6-47), one study used crossover designs (5), and one study used semi-crossover designs (3). Thirty-one studies were two-arm trials (1-3, 5, 10, 11, 13, 14, 17-23, 25-27, 29, 30, 33-36, 40-44, 46, 47), 13 studies were three-arm trials (7, 8, 12, 15, 16, 24, 28, 31, 32, 37-39, 45) and three studies were four-arm trials [9, 4, 6]. Intervention arms from three studies were excluded from this review due to the intervention group undertaking a combination of different types of physical activity [9, 16] or including multicomponent intervention techniques (neuromuscular electrical stimulation during physical activity sessions) [4].

Participants.

Of the study arms that were included in this review, there was a total of *N* = 3,520 randomized older adult participants. Three studies did not report the sex of participants [6, 16, 38], however the majority of study samples were either mostly or all female.

Setting.

Twenty-two studies were set in community venues [2, 7, 10-12, 33, 16-18, 21-26, 28, 29, 32, 34, 38, 41, 43]; seven studies were set in medical facilities [36, 14, 30, 35, 39, 42, 47]; 13 studies were set in care homes [3, 4, 6, 9, 13, 15, 21, 27, 37, 40, 44, 45, 46]; and five studies were set in research facilities [1, 5, 8, 19, 31].

Interventions.

Physical activity level.

Physical activity level was determined by calculating MET minutes (weekly volume of activity multiplied by estimated metabolic output of the type of activity). Summaries of physical activity level are shown in Supplementary file 3 for all individual intervention arms.

Physical activity type and multitask activity level.

A total of 15 different types of physical activity were identified across the individual study arms for *high* multitask activities: dancing [6, 10, 14, 17, 20]; handball [46]; *moderate* multitask activities: aquafit [21, 24, 38]; balance training [15, 30, 39, 47]; exergaming [22, 25, 35]; tai chi [11, 13, 31, 37, 42]; functional training [9, 12, 15]; Pilates [5, 33, 36, 24, 28]; qigong [43]; yoga [18, 31, 32, 41, 37]; and *low* multitask activities: flexibility training [28, 40]; gardening [44]; stationary cycling [1, 7, 45]; strength training [2-4, 8, 9, 12, 16, 19, 34]; walking [23, 26, 29, 32]. Most interventions included a 5-

minute warm-up, main session of the physical activity type, and a 5-minute cool down. Summaries of physical activity types and multitask activity levels are presented in Supplementary file 3 for all individual intervention arms.

Duration of intervention.

Intervention duration was less than two months in five studies (5, 28, 34, 35, 47); between two and five months in 28 studies (2, 4, 12, 14-23, 25, 26, 29-31, 33, 36, 37, 39, 40, 41-45); and between six and eight months in 14 studies (1, 3, 6-11, 13, 24, 27, 32, 38, 46).

Control group activity.

Seven studies used standard care activities for the control group (2, 13, 31, 37, 39, 42, 44); 14 studies used a sham activity such as arts and crafts, or other recreational activities (3, 8, 9, 11, 18, 22, 27, 29, 33, 38, 40, 43, 45, 47); and 26 studies did not include any change to the control groups' normal activities (1, 4-7, 10, 12, 14-17, 19-21, 23-26, 28, 30, 32, 34-36, 41, 46).

Intervention Delivery.

Forty studies used an instructor to deliver physical activity sessions (2-5, 7, 9-15, 17-20, 22, 24-33, 35-47); two study interventions did not require an instructor (1, 23); and five studies did not report the presence or absence of an instructor (6, 8, 16, 21, 34).

Methodological Quality

According to the PEDro scale, methodological quality of 29 studies were rated as *good* (1-5, 7, 9-15, 17, 18, 22, 23, 28, 32-35, 37, 41-43, 45-47), and 18 studies were rated as *fair* (6, 8, 16, 19-21, 24-27, 29-31, 36, 38-40, 44). A rating of *excellent* was unachievable as it is not possible to blind participants or therapists in physical activity interventions.

Summary of Individual Study Arms

A summary of the effects of the 47 included studies is presented in Supplementary file 3. Of the 47 studies (60 intervention arms), 66.30% of relevant outcomes measures were statistically significant in favor of the intervention group. 60.78% of relevant outcome measures within the *low* physical activity level subgroup were statistically significant; 80% of relevant outcome measures within the *moderate* physical activity level subgroup were statistically significant; and 33.33% of relevant outcome measures within the *high* physical activity level subgroup were statistically significant. 90% of relevant outcome measures in the *high* multitask activity level subgroup were statistically significant; 72.9% of relevant outcome measures in the *moderate* multitask activity level subgroup were statistically significant; and 50% of relevant outcome measures in the *low* multitask activity level were statistically significant.

Effect of physical activity level on ADL (physical performance measures)

The effect of physical activity level (subcategorized as *low, moderate* and *high*) on directly measured ADL physical performance was analyzed via meta-analysis (Figure 2). Post data were available (or calculable) from 29 individually randomized, parallel trials. Pooling of the 29 studies resulted in a statistically significant, beneficial effect of the physical activity interventions versus control on ADL *(SMD* = 0.72, 95% CI [0.45, 1.00]; $p < 0.01$). No studies reporting physical performance measures fell into the *high* physical activity level subgroup, meaning that conclusions could not be drawn for this level. While the *low* and *moderate* physical activity level subgroups both produced significantly beneficial effects, the *moderate* subgroup produced the largest effect (*SMD* = 1.07, 95% CI [0.44, 1.70]; $p < 0.01$) and the *low* subgroup produced a smaller effect (*SMD* = 0.57, 95% CI [0.29, 0.86]; $p < 0.01$). However, substantial heterogeneity was present across studies.

Effect of physical activity level on ADL (self-reported measures)

The effect of physical activity level (subcategorized as *low, moderate* and *high*) on ADL self-reported measures was analyzed via meta-analysis (Figure 3). Post data were available (or calculable) from nine individually randomized, parallel trials. Pooling of the nine studies resulted in a non-significant, beneficial effect of the physical activity interventions versus control on ADL (*SMD* = 0.41, 95% CI [-0.12, 0.94]; $p < 0.01$). The *moderate* physical activity level subgroup produced a significant, beneficial effect (*SMD* = 1.12, 95% CI [0.74, 1.49]; $p < 0.01$), whereas the *low* subgroup did not produce a consistent effect (*SMD* = 0.02, 95% CI [-0.46, 0.49]; $p = 0.95$). Only a single study fell into the *high* subgroup, which demonstrated a significant effect in favor of the control group (*SMD* = -0.82, 95% CI [-1.34, -0.29]; $p < 0.01$), however, the limited number of studies meant that conclusions could not be drawn for this level. Again, substantial heterogeneity was present across studies.

Effect of multitask activity level on ADL (physical performance measures)

The effect of multitask activity level (subcategorized as *low*, *moderate*, and *high*) versus control on directly measured ADL physical performance was analyzed via meta-analysis (Figure 4). Post data were available (or calculable) from 27 individually randomized, parallel trials. The *high* multitask activity level subgroup produced the largest, significantly beneficial effect on ADL (*SMD* = 1.36, 95% CI [0.46, 2.26]; $p < 0.01$), followed by the *moderate* multitask subgroup (*SMD* = 0.74, 95% CI [0.41, 1.06]; $p < 0.01$). The *low* multitask subgroup produced the smallest, beneficial effect, which failed to reach statistical significance (*SMD* = 0.45, 95% CI [-0.01, 0.91]; $p = 0.06$). However, substantial heterogeneity was present across studies.

Effect of multitask activity level on ADL (self-reported measures)

The effect of multitask activity level (subcategorized as *low*, *moderate* and *high*) versus control on ADL self-reported measures was analyzed via meta-analysis (Figure 5). Post data were available (or calculable) from eight individually randomized, parallel trials. The *moderate* multitask activity subgroup produced a significantly beneficial effect on ADL (*SMD* = 1.12, 95% CI [0.55, 1.69]; $p = 0.47$). The *low* (*SMD* = 0.53, 95% CI [-0.34, 1.40]; *p*

= 0.23) and *high* (*SMD* = -0.10, 95% CI [-1.53, 1.32], *p* = 0.89) subgroups did not produce a consistent effect. Again, substantial heterogeneity was present across studies.

Sensitivity Analysis

Studies of *poor* methodological quality (PEDro <4) were already excluded from this review. Removing studies of *fair* methodological quality (PEDro 4-5) resulted in a similar pooled effect size of physical activity versus control on physical performance measures (*SMD* = 0.68, 95% CI, [0.30, 1.07]; *p* = 0.0005), with the *moderate* physical activity level subgroup remaining with the largest effect size (*SMD* = 1.36, 95% CI [0.26, 2.47]; *p* = 0.02) and the *low* level subgroup producing a smaller, but significant effect (*SMD* = 0.42, 95% CI [0.08, 0.76]; *p* = 0.02). Removing studies of *fair* methodological quality also produced a similar pooled effect size of physical activity on self-reported measures (*SMD* = 0.18, 95% CI [-0.37, 0.72]; *p* = 0.52), with the *moderate* physical activity level subgroup producing the largest effect (*SMD* = 0.99, 95% CI [0.30, 1.67]; *p* = 0.005) and no change in the *low* and *high* physical activity level subgroups. Removing studies of *fair* methodological quality produced similar effects of *low* (*SMD* = 0.39, 95% CI [-0.32, 1.10]; *p* = 0.28), *moderate* (*SMD* = 0.44, 95% CI [0.14, 0.74]; *p* = 0.004), and *high* (*SMD* = 2.19, 95% CI [0.24, 4.14]; *p* = 0.03) multitask activity levels on physical performance measures. Finally, removing studies of *fair* methodological quality produced similar effects of *low* (*SMD* = 0.30, 95% CI [-0.69, 1.28]; *p* = 0.55), *moderate* (*SMD* = 0.95, 95% CI [0.21, 1.68]; *p* = 0.01), and *high* (*SMD* = -0.10, 95% CI [-1.53, 1.32]; *p* = 0.89) multitask activity levels on self-reported ADL measures. Results suggest that there was no statistically significant effect of removing the *fair* methodological quality studies from the pooled data.

Analysis of Publication Bias

Visual inspection of the four funnel plots (Figures 6-9) containing 33 studies in total suggests some asymmetry, indicating possibility of some publication bias. Methods for correcting intervention effect estimates such as ‘trim and fill’ were considered, however, the presence of substantial between-study heterogeneity suggested that this approach was unsuitable for the present data set (Peters, Sutton, Jones, Abrams, & Rushton, 2007).

Discussion

As far as the authors are aware, no other study or review to date has attempted to examine the underlying demands of different types of physical activity, and to relate differences in these demands to a key health outcome: ADL (both directly measured physical performance and self-reported outcomes). Forty-seven randomized controlled trial studies were included in the review, of which, 35 reported a statistically significant, positive effect of physical activity on ADL in older adults. A limited number of studies analyzed the effect of physical activity on self-reported ADL outcomes, of which, results were inconsistent. However, the effect of physical activity on ADL physical performance measures produced a statistically significant, beneficial effect. While the limited number of studies assessing *high* physical activity levels mean that conclusions cannot be drawn for this level, *moderate* physical activity levels and *high* multitask activity levels appear to produce the greatest effects. These results demonstrate for the first time that differences in the physical, mental and social demands of different physical activity types produce predictable changes in the beneficial health effects obtained by participating older adults. This finding has both theoretical implications, in terms of advancing thinking about the processes underlying the established association between physical activity and health, and practical implications for the design of health promoting interventions for older adults.

The current review pooled physical performance measures together, demonstrating that physical activity had a significant, beneficial effect on ADL. Giné-Garriga et al., (2014) also investigated the effect of physical activity on physical function and ADL via meta-analysis, and found that while some physical performance measures were significantly improved (e.g. Short Physical Performance Battery, Berg Balance Scale, 5-Times Sit to Stand) others failed to demonstrate a difference, such as the Timed Up and Go (TUG). Given the high prevalence of TUG, 8FUG and SUG (highly similar outcomes) within the current review, a similar result would have been expected. This difference may be due to the inclusion of both frail and healthy older adults in the current review, that is, the inclusion of healthy participants who have greater functional capacities than frail participants (Lenardt et al., 2016) and are therefore, more likely to improve.

Similar to the present review, Giné-Garriga et al., (2014) did not find a consistent effect of physical activity on self-reported measures of ADL, and reported high levels of heterogeneity. Research suggests that self-reported ADL however, are prone to weak face validity, reproducibility (Guralnick & Simonsick, 1993), and may not be responsive to detecting significant functional changes in community-dwelling older adults (Lin et al., 2012), which may explain the inconsistent findings. Findings may also differ across included studies of the present review as the majority of participant samples included both males and females, whereas only a few study samples were gender-specific. Given that females are more prone to dependence in ADLs than males (Millan-Calenti et al., 2010), more studies are needed that analyze the effects of physical activity on ADL outcomes across males and females separately.

Burge, Kuhne, Berchtold, Maupetit, and von Gunten (2012) undertook a critical review, with meta-analysis, to investigate the impact of physical activity on functional independence and ADL in older adults suffering from moderate-to-severe dementia. While physical activity tended to positively impact ADL performance, ADL status did not significantly change between pre-and-post measures. However, ADL status in control participants significantly declined. This trend was similar to some of the individually included studies within the current review (e.g. Dechamps et al., 2010). Despite lack of significant improvements, these are still promising findings as they suggest that physical activity may offer a protective effect on ADL ability within the context of dementia. Burge et al., suggested that the small number of studies with inconsistent reporting methods meant that questions relating to key characteristics of physical activity level (e.g. intensity and duration) remained unanswered.

Regarding physical activity level, the present review found that *low* and *moderate* subgroups produced a significantly beneficial effect on physical performance measures of ADL, with the *moderate* subgroup producing the largest effect. The effect of physical activity level on self-reported measures of ADL revealed that only the *moderate* subgroup produced a significantly beneficial effect. No studies fell into the *high* subgroup for physical performance measures, and only a single study fell into the *high* subgroup for self-reported measures, meaning that it was not possible for firm conclusions to be drawn regarding *high* physical activity levels, which has been associated with a reduced risk of disability in basic ADLs in previous studies (Tak et al., 2013). Paterson and Warburton (2010) undertook a systematic review that investigated the relationship between physical activity, functional limitations, disability, and loss of independence among community-dwelling older adults. Although an optimal dose of physical activity could not be determined, moderate-to-vigorous levels of physical activity had a greater effect on functional limitations and disability compared with lower levels. Paterson and Warburton's review differed from the present review in terms of the measurement and analysis of physical activity levels, alongside their inclusion of multiple study designs (the present review was restricted to RCTs), which may explain the differences in findings. However, the most likely reason that findings of the current review did not concur that *high* physical activity levels had the largest, beneficial effect is due to the insufficient number of studies that fell into the *high* physical activity level subgroup. Thus, future RCT interventions investigating the effect of *high* physical activity levels on ADL in old age are warranted. However, the present review found evidence that *moderate* physical activity levels produce a larger, beneficial effect than *low* levels, which suggests that increasing levels of physical activity may produce a greater, beneficial effect on ADL.

Findings of the current review builds on a recent meta-analytic review, which investigated whether physical activity could prevent or reduce disability in ADLs (Tak et al., 2013). Tak and colleagues found that, compared with lower levels of physical activity, risk of disability was reduced with moderate to high physical activity levels. The review, however, relied on prospective, longitudinal studies that measured and reported physical activity variables in different ways. By restricting the inclusion criteria to RCTs, the current review was able to use gold standard evidence to provide an accurate summation of physical activity levels across such interventions. RCT study designs were particularly ideal for the current review as each intervention arm evaluated a single type of physical activity, which was then coded to determine multitask activity level.

The current review used a novel coding system to determine multitask activity level by quantifying the underlying mental, physical and social demands of different types of physical activity. While this method has a subjective element, differences found in the scores between different multitask levels warrant future research in this area. Dancing and handball were coded as *high* multitask activities, due to a combination of their underlying mental, physical and social demands. Dancing is usually accompanied by sequential movements to music, thus requiring higher levels of attention, memory and coordination. Handball, on the other hand, requires speeded reactions and decision making skills. Dancing and handball are inherently social activities, thus requiring social interaction. Due to their coordination and speeded reaction demands, dancing and handball also have a higher demand for balance.

Both activities require moderate to high levels of attention skills, relating to either keeping focus on a ball or an opponent (handball), or following the movements of an instructor or partner (dancing). In contrast, *low* multitask activities (i.e. strength training, flexibility training, stationary cycling, and walking) require little or no attention, memory, decision-making, coordination, balance and social interaction due to their simple, repetitive movement patterns, which may easily be undertaken in social isolation. Interestingly, the underlying demands of *high* multitask activities mirror the underlying demands of several ADL and IADL activities (e.g. shopping for groceries requires decision-making skills over what to buy; memory of shopping list requirements; calculation of monetary values; balance and functional flexibility needed to reach items off a high shelf or maneuver a shopping cart; and possible interaction with fellow customers and retail staff). This may offer insight as to why the *high* multitask activity level subgroup had a larger effect on ADL physical performance measures than *moderate* and *low* multitask activity level subgroups.

De Vries et al., (2012) performed a meta-analysis of physical exercise on ADL-related outcomes pertaining to mobility and physical function in older adults, reporting a large intervention effect for three studies that all had a strength training component. In contrast, the current review placed strength training in the *low* multitask activity level subgroup, which had the smallest effect size compared with the *high* multitask activity level subgroup. However, the studies highlighted by de Vries et al., combined strength training with balance and functional task training making these interventions higher in terms of multitasking, which may explain the contrasting results. The hypothesis of greater benefits arising from high multitask activities is further supported by Anderson-Hanley et al., (2012) who found that cycling with a simultaneous cognitive task (i.e. *cybercycling*) had a greater positive effect on cognitive functioning (which underlies ADL ability) than cycling alone. Thus, the evidence combined suggests that physical activities with greater multitask demands have a larger positive impact on ADLs in older adults, possibly due to their close resemblance of actual ADL activities, which also have underlying mental, physical and social demands. In addition, one of the three studies in De Vries' review incorporated behavioural and cognitive strategies to maximise participation. In doing so, it is plausible that the positive effects are partly due to cognitive/behavioural conditioning rather than purely from strength training alone. By excluding such studies, the present review was able to rule out the possibility of results being contaminated by cognitive/behavioural intervention.

Both Giné-Garriga et al's., (2014) and de Vries et al's., (2012) reviews included physical activity interventions consisting of multiple types of activities, meaning that statistical analysis of physical activity type could not be undertaken. The present review excluded interventions that did not focus on a single type of physical activity. Using this approach, the present review was able to adopt a coding system to investigate the combined, underlying mental, physical and social demands of individual types of physical activities, and found that the *high* multitask activity level subgroup (activities with high mental, physical and social demands) had the largest effect on ADL, sequentially followed by *moderate*, then *low* multitask activity level subgroups. Howe et al's., (2011) Cochrane review of exercise interventions on balance outcomes in older adults found that exercise programs involving gait, balance, co-ordination and functional exercises; muscle strengthening exercise; three-dimensional (3D) activities (e.g. tai chi, dancing) and multiple exercise types had the greatest impact on some indirect measures of balance. While there are key differences between Howe et al's review and the present review (such as the types of included activity interventions, groupings of activities, and outcome measures) there are several similar findings pertaining to the types of activities that appear to be most beneficial (e.g. 3D exercises that require dynamic, coordinated movements, memory, attention and social interaction). By using a coding system to identify the underlying mental, physical and social demands of physical activity types, the present review advances the current field of knowledge by moving beyond attempts to identify optimal types of physical activities, but to also theorize why some types of physical activities may be more effective than others.

Given the high prevalence of functional limitations, disability and disease within the older adult population, health status often poses a barrier to entry into physical activity (Chen, 2010). For older adults with mobility limitations, the promotion of gentler levels, and simpler types of physical activities may still be of benefit. However, findings of the present review demonstrate that *moderate* physical activity levels and *high* multitask activities provide the greatest benefits to ADL performance.

Strengths of the Review

This is the first systematic review to investigate the underlying mental, physical and social demands of different types of physical activity on ADLs in older adults. These findings have been coupled with physical activity levels to provide a more comprehensive investigation into the characteristics of different modalities of physical activity. Relying solely on quality-assessed RCTs improved the quality of evidence considered. The current review extends previously undertaken reviews (e.g. de Vries et al., 2012) by incorporating all four physical activity variables (frequency, intensity, time, type) into the results, in addition to a preliminary investigation regarding the intrinsic (multitask) nature of different types of physical activity.

Limitations

Substantial heterogeneity was present across the studies included in the meta-analyses; only a single study fell into the *high* physical activity level subcategory, meaning that conclusions for this level could not be drawn; classification of activities as having *high*, *moderate* and *low* levels of multitasking relied on subjective scoring methods and group consensus; asymmetry of the funnel plots (Figures 6-9) suggest that publication bias may be present; and due to a limited number of studies that met our inclusion criteria, participant samples from multiple different settings (e.g. community, care homes) were analyzed together.

Conclusion

In conclusion, this review demonstrates that engagement in physical activity has a beneficial effect on ability to undertake activities of daily living in older adults. While there are no clear effects of physical activity on self-reported measures of ADL, *moderate* physical activity levels that combine *high* levels of physical, mental and social demands are more advantageous for enhancing physical performance of ADLs. More RCTs are needed to explore the effect of increased physical activity (particularly *high* physical activity levels) on ADL, and further research is needed to develop reliable, valid measures of underlying, non-metabolic demands of different types of physical activity.

References

References marked with an asterisk indicate studies included in the meta-analysis. The in-text citations to studies selected for meta-analysis are not preceded by asterisks.

Ainsworth, B. E., Haskell, W. L., Herrmann, S. D., Meckes, N., Bassett, D. R., Jr., Tudor-Locke, C., . . . Leon, A. S. (2011). 2011 compendium of physical activities: A second update of codes and MET values. *Medicine and Science in Sports and Exercise, 43*(8), 1575-1581. doi:10.1249/MSS.0b013e31821ece12

Allan, L. M., Ballard, C. G., Rowan, E. N., & Kenny, R. A. (2009). Incidence and prediction of falls in dementia: A prospective study in older people. *Plos One, 4*(5), e5521. doi:10.1371/journal.pone.0005521

Anderson-Hanley, C., Arciero, P. J., Brickman, A. M., Nimon, J. P., Okuma, N., Westen, S. C., . . . Zimmerman, E. A. (2012). Exergaming and older adult cognition: A cluster randomized clinical trial. *American Journal of Preventive Medicine, 42*(2), 109-119. doi:10.1016/j.amepre.2011.10.016

*Antunes, H., Stella, S., Santos, R., Buono, O., & de Mello, M. (2005). Depression, anxiety and quality of life scores in seniors after an endurance exercise program. *Revista Brasileira De Psiquiatria, 27*(4), 266-271. doi:10.1590/S1516-44462005000400003

*Barrett, C., & Smerdely, P. (2002). A comparison of community-based resistance exercise and flexibility exercise for seniors. *Australian Journal of Physiotherapy, 48*(3), 215-219.

*Baum, E. E., Jarjoura, D., Polen, A. E., Faur, D., & Rutecki, G. (2003). Effectiveness of a group exercise program in a long-term care facility: A randomized pilot trial. *Journal of the American Medical Directors Association, 4*(2), 74-80. doi:10.1097/01.JAM.0000053513.24044.6C

*Benavent-Caballer, V., Rosado-Calatayud, P., Segura-Orti, E., Amer-Cuenca, J. J., & Lison, J. F. (2014). Effects of three different low-intensity exercise interventions on physical performance, muscle CSA and activities of daily living: A randomized controlled trial. *Experimental Gerontology, 58*, 159-165. doi:10.1016/j.exger.2014.08.004

*Bird, M., Hill, K. D., & Fell, J. W. (2012). A randomized controlled study investigating static and dynamic balance in older adults after training with Pilates. *Archives of Physical Medicine and Rehabilitation*, *93*(1), 43-49. doi:10.1016/j.apmr.2011.08.005

Blondell, S. J., Hammersley-Mather, R., & Veerman, J. L. (2014). Does physical activity prevent cognitive decline and dementia?: A systematic review and meta-analysis of longitudinal studies. *Bmc Public Health, 14*, 510. doi:10.1186/1471-2458-14-510

*Borges, E. G., Cader, S. A., de Souza Vale, R. G., Pires Cruz, T. H., de Gurgel de Alencar Carvalho Mauro Cezar, Pinto, F. M., & Dantas, E. H. M. (2012). The effect of ballroom dance on balance and functional autonomy among the isolated elderly. *Archives of Gerontology and Geriatrics*, *55*(2), 492-496. doi:10.1016/j.archger.2011.09.004

Brooke-Wavell, K., Cooling, V. (2009). Fall risk factors in older female lawn bowls players and controls. *Journal of aging and physical activity*, *17*(1), 123-130.

*Buchner, D., Cress, M., deLateur, B., Esselman, P., Margherita, A., Price, R., & Wagner, E. (1997). The effect of strength and endurance training on gait, balance, fall risk, and health services use in community-living older adults. *Journals of Gerontology Series A-Biological Sciences and Medical Sciences, 52*(4), M218-M224.

Burge, E., Kuhne, N., Berchtold, A., Maupetit, C., & von Gunten, A. (2012). Impact of physical activity on activity of daily living in moderate to severe dementia: A critical review. *European Review of Aging and Physical Activity, 9*(1), 27-39. doi:10.1007/s11556-011-0092-y

*Cassilhas, R. C., Viana, V. A. R., Grassmann, V., Santos, R. T., Santos, R. F., Tufik, S., & Mello, M. T. (2007). The impact of resistance exercise on the cognitive function of the elderly. *Medicine and Science in Sports and Exercise, 39*(8), 1401-1407. doi:10.1249/mss.0b013e318060111f

Chen, Y. (2010). Perceived barriers to physical activity among older adults residing in long-term care institutions. *Journal of Clinical Nursing, 19*(3-4), 432-439. doi:10.1111/j.1365-2702.2009.02990.x

*Chin A Paw MJ, van Poppel MN, Twisk JW, & van Mechelen W. (2006). Once a week not enough, twice a week not feasible? A randomized controlled exercise trial in long-term care facilities [ISRCTN87177281]. *Patient Education & Counseling, 63*(1-2), 205-214.

Chodzko-Zajko, W. J., Proctor, D. N., Singh, M. A. F., Minson, C. T., Nigg, C. R., Salem, G. J., & Skinner, J. S. (2009). Exercise and physical activity for older adults. *Medicine and Science in Sports and Exercise, 41*(7), 1510-1530. doi:10.1249/MSS.0b013e3181a0c95c

Chou, C., Hwang, C., & Wu, Y. (2012). Effect of exercise on physical function, daily living activities, and quality of life in the frail older adults: A meta-analysis. *Archives of Physical Medicine and Rehabilitation*, *93*(2), 237-244. doi:10.1016/j.apmr.2011.08.042

Corbin, C. Pangrazi, R. Franks, D. (2000) Definitions: Health, Fitness, and Physical Activity. *President's Council on Physical Fitness and Sports Research Digest*, 3(9). Retrieved from http://files.eric.ed.gov/fulltext/ED470696.pdf

Crombie, K. Irvine, L. Williams, B. McGinnis, A. Slane, P. Alder, E. et al. (2004). Why older people do not participate in leisure time physical activity: a survey of activity levels, beliefs and deterrents. *Age and Ageing*, 33(3), 287-292.

*Cruz-Ferreira, A., Marmeleira, J., Formigo, A., Gomes, D., & Fernandes, J. (2015). Creative dance improves physical fitness and life satisfaction in older women. *Research on Aging, 37*(8), 837-855. doi:10.1177/0164027514568103

*Day, L., Hill, K. D., Jolley, D., Cicuttini, F., Flicker, L., & Segal, L. (2012). Impact of tai chi on impairment, functional limitation, and disability among preclinically disabled older people: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation, 93*(8), 1400-1407. doi:10.1016/j.apmr.2012.03.018

Department of Culture, Media and Sport (2011) *Adult participation in sport Analysis of the Taking Part Survey*. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/137986/tp-adult-participation-sport-analysis.pdf

*de Vreede, P., Samson, M., van Meeteren, N., Duursma, S., & Verhaar, H. (2005). Functional-task exercise versus resistance strength exercise to improve daily function in older women: A randomized, controlled trial. *Journal of the American Geriatrics Society, 53*(1), 2-10. doi:10.1111/j.1532-5415.2005.53003.x

de Vries, N. M., van Ravensberg, C. D., Hobbelen, J. S. M., Rikkert, M. G. M. O., Staal, J. B., & Nijhuis-van der Sanden, M. W. G. (2012). 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 Research Reviews, 11*(1), 136-149. doi:10.1016/j.arr.2011.11.002

*Dechamps, A., Diolez, P., Thiaudiere, E., Tulon, A., Onifade, C., Vuong, T., . . . Bourdel-Marchasson, I. (2010). Effects of exercise programs to prevent decline in health-related quality of life in highly deconditioned institutionalized elderly persons: A randomized controlled trial. *Archives of Internal Medicine, 170*(2), 162-169.

*Eyigor, S., Karapolat, H., Durmaz, B., Ibisoglu, U., & Cakir, S. (2009). A randomized controlled trial of Turkish folklore dance on the physical performance, balance, depression and quality of life in older women. *Archives of Gerontology and Geriatrics, 48*(1), 84-88. doi:10.1016/j.archger.2007.10.008

*Faber, M., Bosscher, R., Paw, M., & van Wieringen, P. (2006). Effects of exercise programs on falls and mobility in frail and pre-frail older adults: A multicenter randomized controlled trial. *Archives of Physical Medicine and Rehabilitation, 87*(7), 885-896. doi:10.1016/j.apmr.2006.04.005

*Fahlman, M., Morgan, A., McNevin, N., Topp, R., & Boardley, D. (2007). Combination training and resistance training as effective interventions to improve functioning in elders. *Journal of Aging and Physical Activity, 15*(2), 195-205.

Fan, J. X., Kowaleski-Jones, L., & Wen, M. (2013). Walking or dancing patterns of physical activity by cross-sectional age among U.S. women. *Journal of Aging and Health, 25*(7), 1182-1203. doi:10.1177/0898264313495561

*Federici, A., Bellagamba, S., & Rocchi, M. (2005). Does dance-based training improve balance in adult and young old subjects? A pilot randomized controlled trial. *Aging Clinical and Experimental Research, 17*(5), 385-389.

Gine-Garriga, M., Roque-Figuls, M., Coll-Planas, L., Sitja-Rabert, M., & Martin-Borras, C. (2014). Physical exercise interventions for improving performance-based measures of physical function in community-dwelling frail older adults: A systematic review and meta-analysis. *Archives of Physical Medicine and Rehabilitation, 95*(4), 753-769. doi:10.1016/j.apmr.2013.11.007

Goldman, N., Glei, D. A., Rosero-Bixby, L., Chiou, S., & Weinstein, M. (2014). Performance-based measures of physical function as mortality predictors: Incremental value beyond self-reports. *Demographic Research, 30*, 227-252. doi:10.4054/DemRes.2013.30.7

Goldstein, E. (2008) Cognitive Psychology: Connecting Mind, Research, and Everyday Experience, 2nd Ed. USA: Thomson Wadsworth.

*Gothe, N. M., E. (2015). Yoga is as good as stretching-strengthening exercises in improving functional fitness outcomes: Results from a randomized controlled trial. *Journal of Gerontology: Medical Sciences*, *0*(0), 1-6.

*Granacher U, Lacroix A, Muehlbauer T, Roettger K, & Gollhofer A. (2013). Effects of core instability strength training on trunk muscle strength, spinal mobility, dynamic balance and functional mobility in older adults. *Gerontology, 59*(2), 105-113.

Gretebeck RJ, Ferraro KF, Black DR, Holland K, & Gretebeck KA. (2012). Longitudinal change in physical activity and disability in adults. *American Journal of Health Behavior, 36*(3), 385-394.

Guiney, H., & Machado, L. (2013). Benefits of regular aerobic exercise for executive functioning in healthy populations. *Psychonomic Bulletin & Review*, *20*(1), 73-86. doi:10.3758/s13423-012-0345-4

Guralnik, J., & Simonsick, E. (1993). Physical-disability in older americans. *Journals of Gerontology, 48*, 3-10.

Higgins, J. Green, S. (2011). *Cochrane handbook for systematic reviews of interventions, version 5.1.0.* Retrieved from http://handbook.cochrane.org/

*Holmerova, I., Machacova, K., Vankova, H., Veleta, P., Juraskova, B., Hrnciarikova, D., . . . Andel, R. (2010). Effect of the exercise dance for seniors (EXDASE) program on lower-body functioning among institutionalized older adults. *Journal of Aging and Health, 22*(1), 106-119. doi:10.1177/0898264309351738

*Hosseini, S. Mirzaei, B. Panahi, M. Rostamkhany. H. (2011). Effect of aquatic balance training and detraining on neuromuscular performance, balance and walking ability in healthy older men. *Middle-East Journal of Scientific Research, 9*(5), 661-666.

Howe, T. E., Rochester, L., Neil, F., Skelton, D. A., & Ballinger, C. (2011). Exercise for improving balance in older people. *Cochrane Database of Systematic Reviews,* (11), CD004963. doi:10.1002/14651858.CD004963.pub3

Hupin, D., Roche, F., Gremeaux, V., Chatard, J., Oriol, M., Gaspoz, J., . . . Edouard, P. (2015). Even a low-dose of moderate-to-vigorous physical activity reduces mortality by 22% in adults aged >= 60 years: A systematic review and meta-analysis. *British Journal of Sports Medicine, 49*(19) doi:10.1136/bjsports-2014-094306

*Jorgensen, M. G., Laessoe, U., Hendriksen, C., Nielsen, O. B. F., & Aagaard, P. (2013). Efficacy of Nintendo Wii training on mechanical leg muscle function and postural balance in community-dwelling older adults: A randomized controlled trial. *Journals of Gerontology Series A-Biological Sciences and Medical Sciences, 68*(7), 845-852. doi:10.1093/gerona/gls222

Karp, A. Paillard-Borg, S. Wang, H. Silverstein, M. Winblad, B. Fratiglion, L. (2006) Mental, physical and social components in leisure activities. *Dement Geriactr Cogn Disord., 21*(2), 65-73.

*Kalapotharakos, V., Michalopoulos, M., Strimpakos, N., Diamantopoulos, K., & Tokmakidis, S. (2006). Functional and neuromotor performance in older adults - effect of 12 wks of aerobic exercise. *American Journal of Physical Medicine & Rehabilitation, 85*(1), 61-67. doi:10.1097/01.phm.0000179479.30543.1c

Kolt, G., Driver, R., & Giles, L. (2004). Why older australians participate in exercise and sport. *Journal of Aging and Physical Activity, 12*(2), 185-198.

*Kovách, M. Plachy, J. Bognár, J. (2013). Effects of Pilates and aqua fitness training on older adults' physical functioning and quality of life. *Biomedical Human Kinetics, 5*, 22–27.

Lakes, K. Marvin, S. Rowley, J. San Nicolas, M. Arastoo, S. Viray, L. Orozco, A. Jurnak, F. (2016) Dancer perceptions of the cognitive, social, emotional, and physical benefits of modern styles of partnered dancing. *Complimentary therapies in medicine, 26*, 117-122.

Lenardt, H. Carneiro, K. Binotto, A. Willig, H. Lourenço, M. Albino, J. (2016) Frailty and quality of life in elderly primary health care users. *Rev Bras Enferm, 69*(3):448-53. doi: http://dx.doi.org/10.1590/0034-7167.2016690309i

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gotzsche, P. C., Ioannidis, J. P. A., . . . Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: Explanation and elaboration. *Bmj-British Medical Journal, 339*, b2700. doi:10.1136/bmj.b2700

Lin, J. S., Whitlock, E. P., Eckstrom, E., Fu, R., Perdue, L. A., Beil, T. L., & Leipzig, R. M. (2012). Challenges in synthesizing and interpreting the evidence from a systematic review of multifactorial interventions to prevent functional decline in older adults. *Journal of the American Geriatrics Society, 60*(11), 2157-2166. doi:10.1111/j.1532-5415.2012.04214.x

Lopez Fernandez-Arguelles, E., Rodriguez-Mansilla, J., Espejo Antunez, L., Maria Garrido-Ardila, E., & Perez Munoz, R. (2015). Effects of dancing on the risk of falling related factors of healthy older adults: A systematic review. *Archives of Gerontology and Geriatrics, 60*(1), 1-8. doi:10.1016/j.archger.2014.10.003

Maher, C., Sherrington, C., Herbert, R., Moseley, A., & Elkins, M. (2003). Reliability of the PEDro scale for rating quality of randomized controlled trials. *Physical Therapy, 83*(8), 713-721.

*Maillot, P., Perrot, A., & Hartley, A. (2012). Effects of interactive physical-activity video-game training on physical and cognitive function in older adults. *Psychology and Aging, 27*(3), 589-600. doi:10.1037/a0026268

*McKinley, P., Jacobson, A., Leroux, A., Bednarczyk, V., Rossignol, M., & Fung, J. (2008). Effect of a community-based argentine tango dance program on functional balance and confidence in older adults. *Journal of Aging and Physical Activity*, *16*(4), 435-453.

*McMurdo, M., & Rennie, L. (1993). A controlled trial of exercise by residents of old people’s homes. *Age and Ageing*, *22*(1), 11-15. doi:10.1093/ageing/22.1.11

*Mesquita, L. S., de Carvalho, F. T., de Andrade Freire, L. S., Neto, O. P., & Zangaro, R. A. (2015). Effects of two exercise protocols on postural balance of elderly women: A randomized controlled trial. *Bmc Geriatrics*, *15*, 61. doi:10.1186/s12877-015-0059-3

Millan-Calenti, J. C., Tubio, J., Pita-Fernandez, S., Gonzalez-Abraldes, I., Lorenzo, T., Fernandez-Arruty, T., & Maseda, A. (2010). Prevalence of functional disability in activities of daily living (ADL), instrumental activities of daily living (IADL) and associated factors, as predictors of morbidity and mortality. *Archives of Gerontology and Geriatrics*, *50*(3), 306-310. doi:10.1016/j.archger.2009.04.017

*Moore-Harrison, T. L., Speer, E. M., Johnson, F. T., & Cress, M. E. (2008). The effects of aerobic training and nutrition education on functional performance in low socioeconomic older adults. *Journal of Geriatric Physical Therapy (2001)*, *31*(1), 18-23.

Murakami, L., & Scattolin, F. (2010). Evaluation of functional independence and quality of life in institutionalized elderly. *Revista Medica Herediana*, 21(1), 18-26.

Moseley, A., Herbert, R., Sherrington, C., & Maher, C. (2002). Evidence for physiotherapy practice: A survey of the physiotherapy evidence database (PEDro). *Australian Journal of Physiotherapy*, *48*(1), 43-49.

*Nagai, K., Yamada, M., Tanaka, B., Uemura, K., Mori, S., Aoyama, T., . . . Tsuboyama, T. (2012). Effects of balance training on muscle coactivation during postural control in older adults: A randomized controlled trial. *Journals of Gerontology Series A-Biological Sciences and Medical Sciences*, *67*(8), 882-889. doi:10.1093/gerona/glr252

*Ni, M., Mooney, K., Richards, L., Balachandran, A., Sun, M., Harriell, K., . . . Signorile, J. F. (2014). Comparative impacts of tai chi, balance training, and a specially-designed yoga program on balance in older falters. *Archives of Physical Medicine and Rehabilitation, 95*(9), 1620-1628. doi:10.1016/j.apmr.2014.04.022

*Oken, B., Zajdel, D., Kishiyama, S., Flegal, K., Dehen, C., Haas, M., . . . Leyva, J. (2006). Randomized, controlled, six-month trial of yoga in healthy seniors: Effects on cognition and quality of life. *Alternative Therapies in Health and Medicine, 12*(1), 40-47.

*Oliveira, L. C., de Oliveira, R. G., & de Almeida Pires-Oliveira, D. A. (2015). Effects of Pilates on muscle strength, postural balance and quality of life of older adults: A randomized, controlled, clinical trial. *Journal of Physical Therapy Science, 27*(3), 871-876.

Paterson, D. H., & Warburton, D. E. R. (2010). Physical activity and functional limitations in older adults: A systematic review related to Canada's physical activity guidelines. *The International Journal of Behavioral Nutrition and Physical Activity, 7 May*, Art 38-22.

Peri, K., Kerse, N., Kiata, L., Wilkinson, T., Robinson, E., Parsons, J., . . . Arroll, B. (2008). Promoting independence in residential care: Successful recruitment for a randomized controlled trial. *Journal of the American Medical Directors Association, 9*(4), 251-256. doi:10.1016/j.jamda.2007.11.008

Peters, J. L., Sutton, A. J., Jones, D. R., Abrams, K. R., & Rushton, L. (2007). Performance of the trim and fill method in the presence of publication bias and between-study heterogeneity. *Statistics in Medicine, 26*(25), 4544-4562. doi:10.1002/sim.2889

*Pinto, R. S., Correa, C. S., Radaelli, R., Cadore, E. L., Brown, L. E., & Bottaro, M. (2014). Short-term strength training improves muscle quality and functional capacity of elderly women. *Age, 36*(1), 365-372. doi:10.1007/s11357-013-9567-2

*Rendon, A. A., Lohman, E. B., Thorpe, D., Johnson, E. G., Medina, E., & Bradley, B. (2012). The effect of virtual reality gaming on dynamic balance in older adults. *Age and Ageing, 41*(4), 549-552. doi:10.1093/ageing/afs053

*Rodrigues, B. G. d., Ali Cader, S., Bento Torres, N. V. O., Oliveira, E. M. d., & Martin Dantas, E. H. (2010). Pilates method in personal autonomy, static balance and quality of life of elderly females. *Journal of Bodywork and Movement Therapies, 14*(2), 195-202. doi:10.1016/j.jbmt.2009.12.005

Rolls, E. (2008) *Memory, Attention and Decision-making: a Unifying, Computational Neuroscience Approach.* Oxford: Oxford University Press.

*Saravanakumar, P., Higgins, I. J., van der Riet, P. J., Marquez, J., & Sibbritt, D. (2014). The influence of tai chi and yoga on balance and falls in a residential care setting: A randomized controlled trial. *Contemporary Nurse, 48*(1), 76-87.

*Sato, D., Kaneda, K., Wakabayashi, H., & Nomura, T. (2007). The water exercise improves health-related quality of life of frail elderly people at day service facility. *Quality of Life Research, 16*(10), 1577-1585. doi:10.1007/s11136-007-9269-2

*Shimada, H., Uchiyama, Y., & Kakurai, S. (2003). Specific effects of balance and gait exercises on physical function among the frail elderly. *Clinical Rehabilitation, 17*(5), 472-479. doi:10.1191/0269215503cr638oa

Sparling, P. B., Howard, B. J., Dunstan, D. W., & Owen, N. (2015). Recommendations for physical activity in older adults. *Bmj-British Medical Journal, 350*, h100. doi:10.1136/bmj.h100

*Stanziano, D. C., Roos, B. A., Perry, A. C., Lai, S., & Signorile, J. F. (2009). The effects of an active-assisted stretching program on functional performance in elderly persons: A pilot study. *Clinical Interventions in Aging, 4*, 115-120.

Stenner, B. J., Mosewich, A. D., & Buckley, J. D. (2016). An exploratory investigation into the reasons why older people play golf. *Qualitative Research in Sport Exercise and Health, 8*(3), 257-272. doi:10.1080/2159676X.2016.1148773

Tak, E., Kuiper, R., Chorus, A., & Hopman-Rock, M. (2013). Prevention of onset and progression of basic ADL disability by physical activity in community dwelling older adults: A meta-analysis. *Ageing Research Reviews, 12*(1), 329-338. doi:10.1016/j.arr.2012.10.001

*Tiedemann, A., O'Rourke, S., Sesto, R., & Sherrington, C. (2013). A 12-week iyengar yoga program improved balance and mobility in older community-dwelling people: A pilot randomized controlled trial. *Journals of Gerontology Series A-Biological Sciences and Medical Sciences, 68*(9), 1068-1075. doi:10.1093/gerona/glt087

*Tousignant, M., Corriveau, H., Roy, P., Desrosiers, J., Dubuc, N., Hebert, R., . . . Beaudoin, A. (2012). The effect of supervised tai chi intervention compared to a physiotherapy program on fall-related clinical outcomes: A randomized clinical trial. *Disability and Rehabilitation, 34*(3), 196-201. doi:10.3109/09638288.2011.591891

*Tsang, H. W. H., Lee, J. L. C., Au, D. W. H., Wong, K. K. W., & Lai, K. W. (2013). Developing and testing the effectiveness of a novel health qigong for frail elders in Hong Kong: A preliminary study. *Evidence-Based Complementary and Alternative Medicine,* , 827392. doi:10.1155/2013/827392

*Tse, M. M. Y. (2010). Therapeutic effects of an indoor gardening programme for older people living in nursing homes. *Journal of Clinical Nursing, 19*(7-8), 949-958. doi:10.1111/j.1365-2702.2009.02803.x

United Nations, Department of Economic and Social Affairs, Population Division. (2013). *World population ageing 2013. ST/ESA/SER.A/348*.

*Varela, S., Ayan, C., Cancela, J. M., & Martin, V. (2012). Effects of two different intensities of aerobic exercise on elderly people with mild cognitive impairment: A randomized pilot study. *Clinical Rehabilitation, 26*(5), 442-450. doi:10.1177/0269215511425835

Weeks, J., Nye, S. (2008). Developing the four domains through golf. *VAHPERD Journal*, *29*(3), 12-17.

*Wei, X., & Ji, L. (2014). Effect of handball training on cognitive ability in elderly with mild cognitive impairment. *Neuroscience Letters, 566*, 98-101. doi:10.1016/j.neulet.2014.02.035

Weuve, J., Kang, J., Manson, J., Breteler, M., Ware, J., & Grodstein, F. (2004). Physical activity, including walking, and cognitive function in older women. *Jama-Journal of the American Medical Association, 292*(12), 1454-1461. doi:10.1001/jama.292.12.1454

*Wolf, B., Feys, H., De Weerdt, W., van der Meer, J., Noom, M., & Aufdemkampe, G. (2001). Effect of a physical therapeutic intervention for balance problems in the elderly: A single-blind, randomized, controlled multicentre trial. *Clinical Rehabilitation, 15*(6), 624-636. doi:10.1191/0269215501cr456oa

World Health Organization (2015). *Ageing and Health.* Retrieved from http://www.who.int/mediacentre/factsheets/fs404/en/

World Health Organization (2012) *Definition of an older or elderly person.* Retrieved from http://www.who.int/healthinfo/survey/ageingdefnolder/en/index.html

World Health Organization (2010).*Global recommendations on physical activity for health.* Retried from http://apps.who.int/iris/bitstream/10665/44399/1/9789241599979_eng.pdf

Yeom, H. A., Keller, C., & Fleury, J. (2009). Interventions for promoting mobility in community-dwelling older adults. *Journal of the American Academy of Nurse Practitioners*, *21*(2), 95-100.

Table 1

Characteristics of Included Studies

ID	Author, date	Design	Sample (n, IG and CG) IG:CG	Intervention (FITT)	Control (FITT)	Outcomes relevant to this review	Results
1	Antunes (2005)	RCT, Parallel trial, Individual randomization	Randomized, 23:23; Analyzed, 23:23	Stationary cycling, 20-60 minutes, 3 x weekly, 6 months	None	SF36-PF	The IG showed significant improvements in SF36-PF (p = <0.05), however, no change was detected in the CG
2	Barrett (2002)	RCT, Parallel trial, Individual randomization	Randomized, 22:22; Analyzed, 20:20	Strength training, 60 minutes, 2 x weekly, 10 weeks	Stretching	5STS, SF36-PF	Both groups significantly improved 5STS (p = <0.003), but only small improvements in the groups were seen in SF36-PF (p = >0.05)

3	Baum (2003)	RCT, Semi-crossover trial, Individual randomization	Randomized, 11:9; Analyzed, 11:9	Strength training 60 minutes, 3 x weekly, 6 months	Recreational therapy	TUG, BBS, PPT	Statistically significant improvements across all measures in IG (*p* = <0 .05) compared with CG (*p* = 0.068)
4	Benavent-Caballer (2014)	RCT, Parallel trial, Individual randomization	Randomized, 22:23 Analyzed, 22:23	Strength training, 30-35 minutes, 3 x weekly, 16 weeks	None	TUG, BBS, 6MWT, BI	All scores improved in the IG, with BI reaching statistical significance (*p* = 0.003) but not for the CG
5	Bird (2012)	RCT, Crossover trial, Individual randomization	Randomized, 17:15; Analyzed, 14:13	Pilates, 60 minutes, 2 x weekly, 5 weeks (6 week washout period)	None	TUG	Pooled data at study completion showed significant improvements for TUG in the IG (*p* = <0.001) but not the CG

6	Borges (2012)	RCT, Parallel trial, Individual randomization	Randomized, 80 (total); Analyzed, 39:36	Dancing, 50 minutes, 3 x weekly, 8 months	None	FA	The IG significantly improved in FA (*p* = <0.001), but no improvement was found in the CG
7	Buchner (1997)	RCT, Parallel trial, Individual randomization	Randomized, IG1, 25; IG2, 25; CG, 30; Analyzed, IG1, 21; IG2, 22; CG, 29;	IG1 stationary cycling; IG2 strength training. 60 minutes, 3 x weekly, 6 months	None	IADL	There were no changes in IADL for any group (*p* = >0.05)
8	Cassilhas (2007)	RCT, Parallel trial, Individual randomization	Randomized, IG1, 20; IG2, 19; CG, 23; Analyzed,	IG1 strength training (50% 1RM); IG2 strength training (80% 1RM). 60 minutes,	Light exercises	SF36-PF	Groups did not differ significantly on SF36-PF measures (p = >0.05)

			IG1, 20; IG2, 19; CG, 23	3 x weekly, 24 weeks			
9	Chin A Paw (2006)	RCT, Parallel trial, Individual randomization	Randomized, IG1, 57; IG2, 60; CG, 51; Analyzed, IG1, 40; IG2, 44; CG, 31	IG1 strength training (45-60 minutes); IG2 functional skills training (40-55 minutes). 2 x weekly, 6 months	Educational program	5STS	No significant differences between groups were observed (*p* = >0.05)
10	Cruz-Ferreira (2015)	RCT, Parallel trial, Individual randomization	Randomized, 39:39; Analyzed, 32:25	Dancing 50 minutes, 3 x weekly, 6 months	None	8FUAG, 6MWT	The IG significantly improved 8FUAG (*p* = 0.02) and 6MWT (*p* = 0.1) compared with the CG

11	Day (2012)	RCT, Parallel trial, Individual randomization	Randomized, 250:253; Analyzed, 190:171	Tai Chi 60 minutes, 2 x weekly, 24 weeks	Flexibility exercise	TUG, 6MWT, BBS-Mod	Little difference was observed within or between the two groups for TUG, 6MWT or BBS (p = >0.05)
12	De Vreede (2005)	RCT, Parallel trial, Individual randomization	Randomized, IG1, 33; IG2, 34; CG, 31; Analyzed, IG1, 30; IG2, 28; CG, 26	IG1 Functional training; IG2 Strength training. 60 minutes, 3 x weekly, 12 weeks	None	ADAP, TUG, SF36-PF	ADAP scores improved significantly more in IG1 compared with IG2 (p = 0.007) and CG (p = 0.001). Groups did not differ in TUG (p = 1.0). SF36-PF scores increased more in IG2 (p = 0.02) compared with the other groups.
13	Dechamps (2010)	RCT, Parallel trial,	Randomized, 51:60; Analyzed,	Tai chi, 30 minutes, 4 x weekly, 6 months	Usual care	Katz ADL, TUG, 5STS	The CG significantly declined in ADL (p = <0.001), TUG (p = 0.003)

		Individual randomization	45:54				and 5STS (p = <0.001) whereas IG scores did not change (p = >0.05).
14	Eyigor (2009)	RCT, Parallel trial, Individual randomization	Randomized, 40 (total); Analyzed, 19:18	Dancing, 60 minutes, 3 x weekly, 8 weeks	None	6MWT, BBS, SF36-PF	The IG improved significantly in 6MWT, BBS and SF36-PF (p = <0.05), while the CG showed no change
15	Faber (2006)	RCT, Parallel trial, Cluster randomization	Randomized, IG1, 80; IG2, 94; CG, 104; Analyzed, IG1, 54; IG2, 70; CG, 84	IG1 functional training; IG2 balance training 90 minutes, 1 x weekly, 4 weeks, then 2 x weekly, 16 weeks	Usual activity	GARS	Compared with the CG, the IG1 demonstrated small, significant improvements in GARS ($p < 0.05$).

16	Fahlman (2007)	RCT, Parallel trial, Individual randomization	Randomized, 39:33; Analyzed, 39:33	Strength training 40 minutes, 3 x weekly, 16 weeks	None	6MWT	All groups improved 6MWT performance (*p* = <0.5),
17	Federici (2005)	RCT, Parallel trial, Individual randomization	Randomized, 20:20; Analyzed, 20:20	Dancing, 60 minutes, 2 x weekly, 3 months	None	SUG	Compared with the CG, the IG significantly improved in SUG scores (*p* = <0.001)
18	Gothe (2015)	RCT, Parallel trial, Individual randomization	Randomized, 61:57; Analyzed, 58:50	Yoga, 60 minutes, 3 x weekly, 8 weeks	Stretching	8FUAG	Both groups showed improvements, with a significant time effect for 8FUAG (*p* = <0.001)
19	Granacher (2012)	RCT, Parallel trial, Individual randomization	Randomized, 16:16; Analyzed, 16:16	Core instability strength training, 60 minutes, 2 x weekly, 9 weeks	None	TUG	The IG significantly improved TUG scores (*p* = <0.05) whereas the CG showed no change

20	Holmerova´ (2010)	RCT, Parallel trial, Individual randomization	Randomized, 90 (total); Analyzed, 27:25	Dancing, 75 minutes, 1 x weekly, 12 weeks	None	TUG	The IG significantly outperformed the CG in TUG (*p* = 0.14)
21	Hosseini (2011)	RCT, Parallel trial, Individual randomization	Randomized, 15:15; Analyzed, 15:15	Aquafit, 60 minutes, 3 x weekly, 8 weeks	None	BBS, 5STS, TUG	BBS, 5STS and TUG scores improved significantly in the IG (*p* = <0.05) whereas the CG showed no change
22	Jorgensen (2013)	RCT, Parallel trial, Individual randomization	Randomized, 28:30; Analyzed, 27:30	Wii fit, 40 minutes, 2 x weekly, 10 weeks	Usual activity	TUG	The IG improved significantly in TUG (*p* = 0.01) compared to the CG
23	Kalapotharakos (2006)	RCT, Parallel trial,	Randomized, 12:11; Analyzed,	Walking, 20-40 minutes, 3 x weekly, 12 weeks	None	6MWT, 5STS	The IG significantly improved in 6MWT and 5STS (*p* = <0.05), whereas

		Individual randomization	12:10				no improvement was seen in the CG
24	Kovách (2013)	RCT, Parallel trial, Individual randomization	Randomized, IG1, 22; IG2, 17; CG, 15; Analyzed, IG1, 22; IG2, 17; CG, 15	IG1 Pilates; IG2 aquafit. 60 minutes, 3 x weekly, 6 months	None	6MWT, 8FUAG	Both IG's significantly improved in 6MWT (p = <0.001) and 8FUAG (IG1, p = <0.001; IG2, p = <0.01), with the IG1 improving the most, whereas the CG showed little change
25	Maillot (2012)	RCT, Parallel trial, Individual randomization	Randomized, 16:16; Analyzed, 15:15	Exergaming (Wii), 60 minutes, 2 x weekly, 12 weeks	None	6MWT, 8FUAG	The IG significantly improved in both measures (p = <0.5) compared with the CG.

26	McKinley (2008)	RCT, Parallel trial, Individual randomization	Randomized, 15:15; Analyzed, 14:11	Dancing, 90 minutes, 2 x weekly, 10 weeks	Walking	5STS	Both groups improved, with the IG reaching statistical significance (*p* = <0.5)
27	McMurdo (1993)	RCT, Parallel trial, Cluster randomization	Randomized, 20:29; Analyzed, 15:26	Strength training 45 minutes, 2 x weekly, 7 months	Reminiscence sessions	BI	The IG post-test BI scores were significantly different to the CG (*p* = <0.5)
28	Mesquita (2015)	RCT, Parallel trial, Individual randomization	Randomized, IG1, 21; IG2, 21; CG, 21; Analyzed, IG1, 20; IG2, 20; CG, 18	IG1 Stretching; IG2 Pilates. 50 minutes, 3 x weekly, 4 weeks	None	BBS, TUG	Both IG's improved significantly in TUG (*p* = <0.001) and BBS (*p* = 0.001) with little change in the CG

29	Moore-Harrison (2008)	RCT, Parallel trial, Individual randomization	Randomized, 13:13; Analyzed, 12:12	Walking, 30-60 minutes, 3 x weekly, 16 weeks	Nutritional intervention	SF36-PF	The IG significantly improved in SF36-PF (*p* = <0.001), while the CG showed little change
30	Nagai (2012)	RCT, Parallel trial, Individual randomization	Randomized , 24:24; Analyzed, 24:24	Balance training, 40 minutes, 2 x weekly, 8 weeks	None	TUG	The IG improved significantly in TUG (*p* = <0.5) whereas the CG did not change
31	Ni (2014)	RCT, Parallel trial, Individual randomization	Randomized, IG1, 16; IG2, 16; CG, 16; Analyzed, IG1, 11; IG2, 13; CG, 15	IG1 Tai chi; IG2 yoga 60 minutes, 2 x weekly, 12 weeks	Standard balance	8FUAG	Significant 8FUAG improvements were observed in all groups (*p* = <0.5), with the IG2 showing the greatest improvement
32	Oken (2006)	RCT, Parallel trial,	Randomized,	IG1 Yoga, 90 minutes, 1 x	None	SF36-PF, 5STS	SF36-PF scores did not change in either IG,

		Individual randomization	IG1, 44; IG2, 47; CG, 42; Analyzed, IG1, 38; IG2, 38; CG, 42	weekly, 6 months; IG2 Walking, 60 minutes, 1 x weekly, 6 months			whereas the CG scores declined (*p* = 0.62). Small improvements in 5STS were seen in IG1 and CG, whereas the IG2 declined in performance (*p* = 0.5)
33	Oliveira (2015)	RCT, Parallel trial, Individual randomization	Randomized, 16:16; Analyzed, 16:16	Pilates, 60 minutes, 2 x weekly, 12 weeks	Stretching	BBS, TUG, SF36-PF	The IG significantly improved in TUG, BBS and SF36-PF (*p* = <0.05). The CG showed no change
34	Pinto (2014)	RCT, Parallel trial, Individual randomization	Randomized, 19:17; Analyzed, 19:17	Strength training, 35-40 minutes, 2 x weekly, 6 weeks	None	8FUAG	The IG significantly improved in 8FUAG (*p* = <0.001) while the CG showed no change

35	Rendon (2012)	RCT, Parallel trial, Individual randomization	Randomized, 20:20; Analyzed, 16:18	Exergaming, 35-45 minutes, 3 x weekly, 6 weeks	None	8FUAG	The IG significantly improved in 8FUAG compared with the CG (p = 0.0385)
36	Rodrigues (2010)	RCT, Parallel trial, Individual randomization	Randomized, 27:25; Analyzed, 27:25	Pilates, 60 minutes, 2 x weekly, 8 weeks	None	FA	The IG significantly improved in FA compared with the CG (p = 0.0003)
37	Saravanakumar (2014)	RCT, Parallel trial, Individual randomization	Randomized, IG1, 11; IG2, 11; CG, 11 Analyzed, IG1, 8; IG2, 5; CG, 10	IG1 Tai chi; IG2 Yoga. 30 minutes, 2 x weekly, 14 weeks	Usual care	BBS	IG2 was the only group to show an improvement in BBS, while the other groups declined in performance (p = 0.456)
38	Sato (2007)	RCT, Parallel trial,	Randomized,	Aquafit	Recreation activities	SF36-PF, FIM	Significant pre-post differences were found for

		Individual randomization	IG1, 10; IG2, 12; CG, 8; Analyzed, IG1, 10; IG2, 11; CG, 8	60 minutes, once/twice x weekly, 6 months			IG1 (*p* = 0.004) and IG2 (*p* = 0.002) in FIM. No significant differences were observed in SF36-PF (*p* = >0.05)
39	Shimanda (2003)	RCT, Parallel trial, Individual randomization	Randomized, IG1 12, IG2 12, CG 10; Analyzed, IG1 12, IG2 11, CG 9	IG1 balance training; IG2 walking 40 minutes, 2-3 x weekly, 12 weeks	Usual care (physiotherapy)	TUG	All three groups improved in TUG scores, with only IG2 scores reaching statistical significance (*p* = <0.05).
40	Stanziano (2009)	RCT, Parallel trial, Individual randomization	Randomized, 8:9; Analyzed, 5:8	Active, assisted stretching, 30 minutes, 2 x weekly, 8 weeks	Arts and crafts	8FUAG	The IG showed significant improvement in the 8FUAG (*p* = 0.041) while the CG significantly

							declined in performance (*p* = 0.007)
41	Tiedemann (2013)	RCT, Parallel trial, Individual randomization	Randomized, 27:27; Analyzed, 27:25	Yoga, 60 minutes, 2 x weekly, 12 weeks	None	5STS	The IG improved significantly in 5STS (*p* = <0.001) whereas the CG showed a decline in scores.
42	Tousignant (2012)	RCT, Parallel trial, Individual randomization	Randomized, 76:76; Analyzed, 26:34	Tai chi, 60 minutes, 2 x weekly, 15 weeks	Physiotherapy	BBS, TUG	Both groups improved similarly over time in both measures (*p* = .0.001)
43	Tsang (2013)	RCT, Parallel trial, Individual randomization	Randomized, 69:65; Analyzed, 42:35	Qigong 60 minutes, 2 x weekly, 12 weeks	Newspaper reading	TUG	TUG scores improved in the IG and declined in the CG, but this did not reach statistical significance (*p* = 0.54)

44	Tse (2010)	RCT, Parallel trial, Cluster randomization	Randomized, 26:27; Analyzed, 26:27	Gardening, 1 hour per week (over 3-5 days), 8 weeks	Normal care	BI	There were no significant differences in BI for either group (*p* = >0.05)
45	Varela (2011)	RCT, Parallel trial, Individual randomization	Randomized, IG1, 27; IG2, 26; CG, 15; Analyzed, IG1, 27; IG2, 26; CG, 15	IG 1 stationary cycling (40% HRR); IG 2 stationary cycling (60% HRR). 30 minutes, 3 x weekly, 12 weeks	Recreation activities	TUG	TUG scores improved across all groups, but did not reach statistical significance (*p* = >0.05)
46	Wei (2014)	RCT, Parallel trial, Individual randomization	Randomized, 30:30; Analyzed, 30:30	Handball 30 minutes, 5 x weekly, 6 months	None	IADL	ADL decreased in the IG group (*p* = <0.05), while there were no changes in the CG

47	Wolf (2001)	RCT, Parallel trial, Individual randomization	Randomized, 47:47; Analyzed, 37:40	Balance training 30 minutes, 2-3 x weekly, 4-6 weeks (12 sessions total)	Arts and crafts	BBS	The IG improved significantly in BBS compared with the CG (p = <0.001)

Note. ID = Study Identification; QA = Quality Assessment; IG = Intervention Group; CG = Control Group; RCT = Randomized Controlled Trial; FITT = Frequency, Intensity, Time, Type; 5STS = 5-times-Sit-to-Stand; 6MWT = 6-meter Walk Test; 8FUG = 8-Foot Up-and-Go; ADAP = Assessment of Daily Activity Performance; BBS = Berg Balance Scale; BI = Barthel Index; FIM = Functional Independence Measure; FA = GDLAM's protocol of Functional Autonomy evaluation; GARS = Groningen Activities Restriction Scale; IADL = Lawton Instrumental Activities of Daily Living; Katz ADL = Katz Index of Independence in Activities of Daily Living; PPT = Physical Performance Test; SUG = Sit-Up-and-Go; SF36-PF = MOS Short form, physical functioning subscale; TUG = Timed Up-and-Go.

Figure 1. Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram of identification and selection of studies

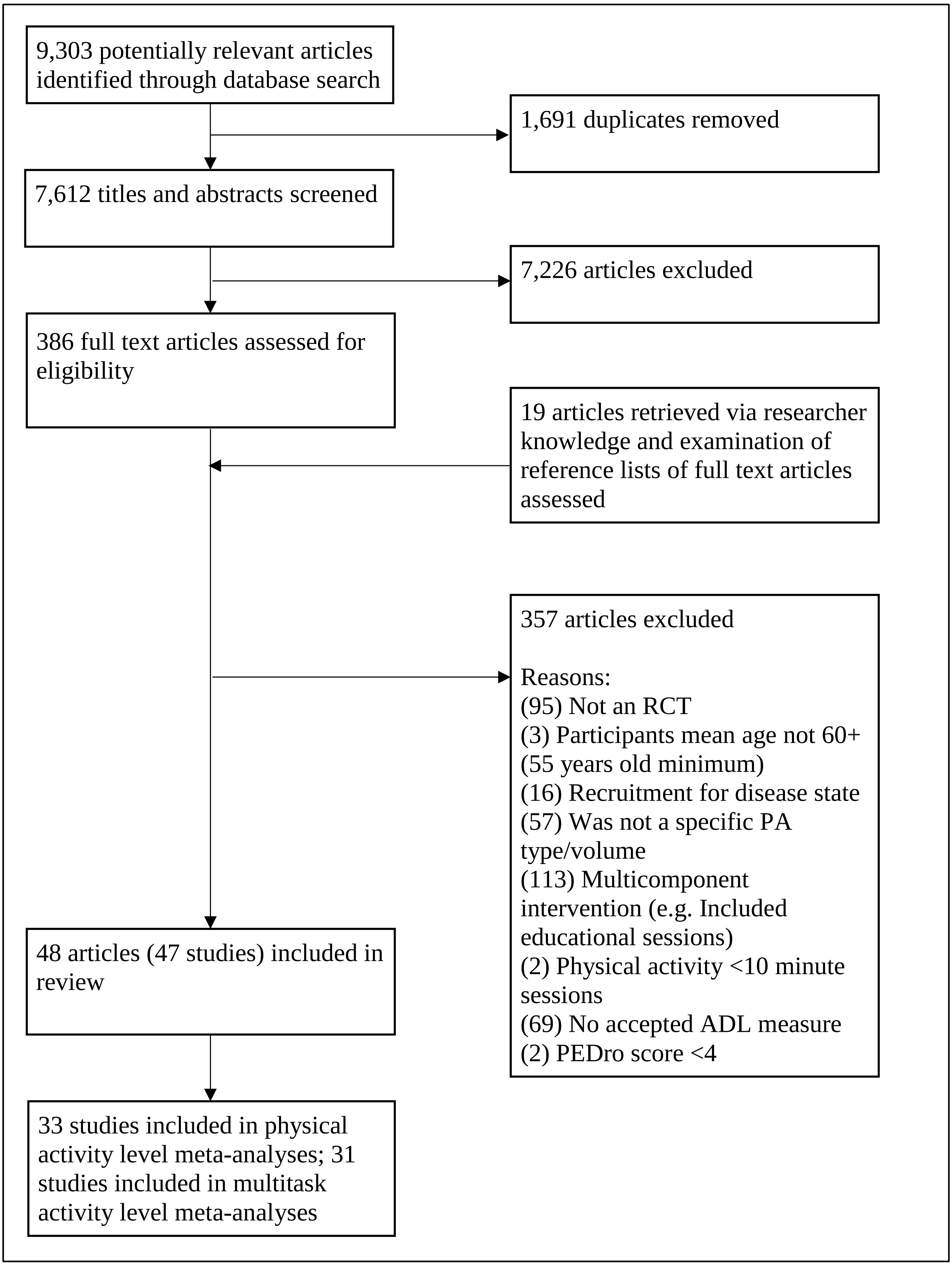


Figure 2. Physical Activity Level (with *low*, *moderate* and *high* subgroups) versus control on physical performance ADL outcomes

	Experimental			Control				Std. Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
1.1.2 *Low* physical activity level								
Barrett (2002)	-10.2	2.3	20	-9.2	1.2	20	3.5%	-0.53 [-1.17, 0.10]
Benavent-Caballer (2014)	-10.97	3.09	22	-12.41	7.42	23	3.6%	0.25 [-0.34, 0.83]
Fahlman (2007)	-1,327	437.15	39	-1,404	413.61	33	3.8%	0.18 [-0.29, 0.64]
Granacher (2012)	-9.1	0.6	16	-9.8	0.8	16	3.3%	0.96 [0.23, 1.70]
Holmerova (2010)	-11.7	5.9	27	-23.4	14.5	25	3.6%	1.06 [0.47, 1.64]
Jorgensen (2013)	-9	3.2	27	-10.9	5.1	30	3.7%	0.44 [-0.09, 0.96]
Kalapotharakos (2006)	-11.5	1.4	12	-12.1	1.7	10	3.1%	0.37 [-0.47, 1.22]
Nagai (2012)	-7.5	1.7	24	-9.2	2.3	24	3.6%	0.83 [0.24, 1.42]
Ni (2014)	-6.65	0.04	24	-7.23	0.39	15	3.1%	2.35 [1.50, 3.20]
Oken (2006)	-9.6	2.55	76	-9.1	2.1	42	4.0%	-0.21 [-0.58, 0.17]
Oliveira (2015)	-5.7	1	16	-7.4	1.1	16	3.2%	1.58 [0.77, 2.38]
Pinto (2014)	-3.83	0.35	19	-4.74	0.59	17	3.2%	1.86 [1.06, 2.66]
Rodrigues (2010)	-23.58	3.96	27	-27.19	3.58	25	3.6%	0.94 [0.36, 1.52]
Saravanakumar (2014)	33.57	16.57	13	29.6	14.3	10	3.1%	0.24 [-0.58, 1.07]
Shimanda (2003)	-23.17	17.76	23	-17	4.9	9	3.2%	-0.39 [-1.17, 0.39]
Stanziano (2009)	-7.6	2.4	5	-14.6	11	8	2.4%	0.73 [-0.43, 1.90]
Tiedmann (2013)	-8.8	2.6	27	-13.6	6.1	25	3.6%	1.02 [0.44, 1.60]
Tousignant (2012)	-20.5	6.8	26	-21.7	3	34	3.8%	0.24 [-0.28, 0.75]
Tsang (2013)	-22.18	12.7	42	-22.17	11.72	35	3.9%	-0.00 [-0.45, 0.45]
Wolf (2001)	42.5	11.11	37	38	12.75	40	3.9%	0.37 [-0.08, 0.82]
Subtotal (95% CI)			**522**			**457**	**69.2%**	**0.57 [0.29, 0.86]**
Heterogeneity: Tau² = 0.32; Chi² = 85.22, df = 19 (P < 0.00001); I² = 78%								
Test for overall effect: Z = 3.92 (P < 0.0001)								
1.1.4 *Moderate* physical activity level								
Borges (2012)	-55.56	8.21	39	-62.34	9.58	36	3.8%	0.75 [0.28, 1.22]
Cruz-Ferreira (2015)	-6.57	0.2	32	-9.01	0.76	25	2.7%	4.59 [3.57, 5.61]
Eyigor (2009)	55.3	0.85	19	53.9	1.7	18	3.4%	1.03 [0.34, 1.72]
Federici (2005)	-6.3	0.5	20	-6.9	0.6	20	3.4%	1.06 [0.40, 1.73]
Gothe (2015)	-5.23	0.8	58	-5.52	1.03	50	4.0%	0.32 [-0.07, 0.70]
Hosseini (2011)	-6.75	0.38	15	-7.59	0.52	15	3.0%	1.79 [0.93, 2.66]
Kovach (2013)	-5.2	0.62	39	-5.6	0.8	15	3.6%	0.59 [-0.02, 1.19]
McKinley (2008)	-12.36	4.4	14	-12.31	3.39	11	3.2%	-0.01 [-0.80, 0.78]
Varela (2011)	-16.92	3.29	53	-17.65	6.81	15	3.6%	0.17 [-0.41, 0.74]
Subtotal (95% CI)			**289**			**205**	**30.8%**	**1.07 [0.44, 1.70]**
Heterogeneity: Tau² = 0.81; Chi² = 74.58, df = 8 (P < 0.00001); I² = 89%								
Test for overall effect: Z = 3.34 (P = 0.0008)								
1.1.6 *High* physical activity level								
Subtotal (95% CI)			**0**			**0**		**Not estimable**
Heterogeneity: Not applicable								
Test for overall effect: Not applicable								
Total (95% CI)			**811**			**662**	**100.0%**	**0.72 [0.45, 1.00]**
Heterogeneity: Tau² = 0.45; Chi² = 166.16, df = 28 (P < 0.00001); I² = 83%								
Test for overall effect: Z = 5.16 (P < 0.00001)								
Test for subgroup differences: Chi² = 1.98, df = 1 (P = 0.16), I² = 49.6%								

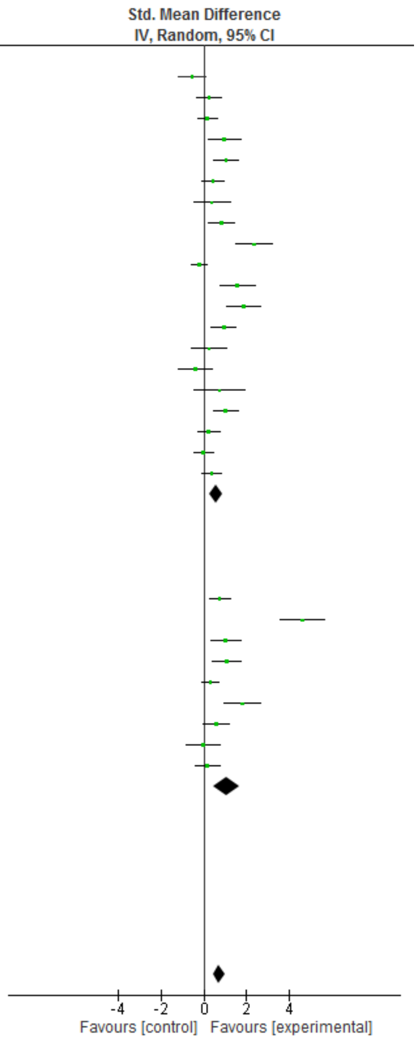


Figure 3. Physical Activity Level (with *low*, *moderate* and *high* subgroups) versus control on self-reported ADL outcomes

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.1.1 *Low* physical activity level								
Barrett (2002)	73.8	19	20	78.5	16.9	20	11.4%	-0.26 [-0.88, 0.37]
Benavent-Caballer (2014)	92.22	6.69	22	93.33	6.51	23	11.6%	-0.17 [-0.75, 0.42]
Oken (2006)	83.55	14.92	76	86.7	9.6	42	12.6%	-0.24 [-0.61, 0.14]
Oliveira (2015)	93.4	10.9	16	76.2	22.6	16	10.7%	0.95 [0.21, 1.68]
Subtotal (95% CI)			**134**			**101**	**46.3%**	**0.02 [-0.46, 0.49]**
Heterogeneity: Tau² = 0.15; Chi² = 8.49, df = 3 (P = 0.04); I² = 65%								
Test for overall effect: Z = 0.07 (P = 0.95)								
1.1.3 *Moderate* physical activity level								
Antunes (2005)	97.82	2.53	23	91.08	6.56	23	11.2%	1.33 [0.69, 1.98]
Eyigor (2009)	88.8	12.2	19	79.6	16	18	11.1%	0.64 [-0.03, 1.30]
Moore-Harrison (2008)	85.8	13.6	12	65	16.4	12	9.7%	1.33 [0.43, 2.23]
Sato (2007)	30.19	8.75	21	16.1	12.8	8	9.7%	1.38 [0.48, 2.27]
Subtotal (95% CI)			**75**			**61**	**41.8%**	**1.12 [0.74, 1.49]**
Heterogeneity: Tau² = 0.00; Chi² = 3.00, df = 3 (P = 0.39); I² = 0%								
Test for overall effect: Z = 5.86 (P < 0.00001)								
1.1.5 *High* physical activity level								
Wei (2014)	14.43	0.639	30	15.47	1.66	30	11.9%	-0.82 [-1.34, -0.29]
Subtotal (95% CI)			**30**			**30**	**11.9%**	**-0.82 [-1.34, -0.29]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 3.03 (P = 0.002)								
Total (95% CI)			**239**			**192**	**100.0%**	**0.41 [-0.12, 0.94]**
Heterogeneity: Tau² = 0.55; Chi² = 52.84, df = 8 (P < 0.00001); I² = 85%								
Test for overall effect: Z = 1.51 (P = 0.13)								
Test for subgroup differences: Chi² = 36.84, df = 2 (P < 0.00001), I² = 94.6%								

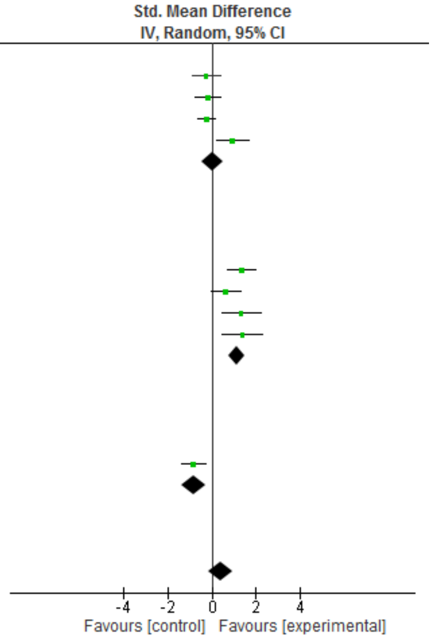


Figure 4. Multitask Activity Level (with *low*, *moderate* and *high* subgroups) versus control on physical performance ADL outcomes

	Experimental			Control				Std. Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
1.1.1 *Low* multitask activity level								
Barrett (2002)	-10.2	2.3	20	-9.2	1.2	20	3.8%	-0.53 [-1.17, 0.10]
Benavent-Caballer (2014)	-10.97	3.09	22	-12.41	7.42	23	3.9%	0.25 [-0.34, 0.83]
Fahlman (2007)	-1,327	437.15	39	-1,404	413.61	33	4.2%	0.18 [-0.29, 0.64]
Granacher (2012)	-9.1	0.6	16	-9.8	0.8	16	3.6%	0.96 [0.23, 1.70]
Kalapotharakos (2006)	-11.5	1.4	12	-12.1	1.7	10	3.3%	0.37 [-0.47, 1.22]
Pinto (2014)	-3.83	0.35	19	-4.74	0.59	17	3.4%	1.86 [1.06, 2.66]
Stanziano (2009)	-7.6	2.4	5	-14.6	11	8	2.6%	0.73 [-0.43, 1.90]
Varela (2011)	-16.92	3.29	33	-17.65	6.81	15	3.8%	0.15 [-0.46, 0.77]
Subtotal (95% CI)			**166**			**142**	**28.6%**	**0.45 [-0.01, 0.91]**
Heterogeneity: Tau² = 0.31; Chi² = 25.44, df = 7 (P = 0.0006); I² = 72%								
Test for overall effect: Z = 1.91 (P = 0.06)								
1.1.2 *Moderate* multitask activity level								
Gothe (2015)	-5.23	0.8	58	-5.52	1.03	50	4.3%	0.32 [-0.07, 0.70]
Hosseini (2011)	-6.75	0.38	15	-7.59	0.52	15	3.3%	1.79 [0.93, 2.66]
Jorgensen (2013)	-9	3.2	27	-10.9	5.1	30	4.0%	0.44 [-0.09, 0.96]
Kovach (2013)	-5.2	0.62	39	-5.6	0.8	15	3.9%	0.59 [-0.02, 1.19]
Nagai (2012)	-7.5	1.7	24	-9.2	2.3	24	3.9%	0.83 [0.24, 1.42]
Ni (2014)	-6.65	0.04	24	-7.23	0.39	15	3.3%	2.35 [1.50, 3.20]
Oliveira (2015)	-5.7	1	16	-7.4	1.1	16	3.4%	1.58 [0.77, 2.38]
Rodrigues (2010)	-23.58	3.96	27	-27.19	3.58	25	3.9%	0.94 [0.36, 1.52]
Saravanakumar (2014)	33.57	16.57	13	29.6	14.3	10	3.3%	0.24 [-0.58, 1.07]
Tiedmann (2013)	-8.8	2.6	27	-13.6	6.1	25	3.9%	1.02 [0.44, 1.60]
Tousignant (2012)	-20.5	6.8	26	-21.7	30	34	4.1%	0.05 [-0.46, 0.56]
Tsang (2013)	-22.18	12.7	42	-22.17	11.72	35	4.2%	-0.00 [-0.45, 0.45]
Wolf (2001)	42.5	11.11	37	38	12.75	40	4.2%	0.37 [-0.08, 0.82]
Subtotal (95% CI)			**375**			**334**	**49.7%**	**0.74 [0.41, 1.06]**
Heterogeneity: Tau² = 0.25; Chi² = 48.70, df = 12 (P < 0.00001); I² = 75%								
Test for overall effect: Z = 4.48 (P < 0.00001)								
1.1.3 *High* multitask activity level								
Borges (2012)	-55.56	8.21	39	-62.34	9.58	36	4.2%	0.75 [0.28, 1.22]
Cruz-Ferreira (2015)	-6.57	0.2	32	-9.01	0.76	25	2.9%	4.59 [3.57, 5.61]
Eyigor (2009)	55.3	0.85	19	53.9	1.7	18	3.7%	1.03 [0.34, 1.72]
Federici (2005)	-6.3	0.5	20	-6.9	0.6	20	3.7%	1.06 [0.40, 1.73]
Holmerova (2010)	-11.7	5.9	27	-23.4	14.5	25	3.9%	1.06 [0.47, 1.64]
McKinley (2008)	-12.36	4.4	14	-12.31	3.39	11	3.4%	-0.01 [-0.80, 0.78]
Subtotal (95% CI)			**151**			**135**	**21.8%**	**1.36 [0.46, 2.26]**
Heterogeneity: Tau² = 1.13; Chi² = 54.92, df = 5 (P < 0.00001); I² = 91%								
Test for overall effect: Z = 2.95 (P = 0.003)								
Total (95% CI)			**692**			**611**	**100.0%**	**0.79 [0.51, 1.07]**
Heterogeneity: Tau² = 0.44; Chi² = 145.97, df = 26 (P < 0.00001); I² = 82%								
Test for overall effect: Z = 5.51 (P < 0.00001)								
Test for subgroup differences: Chi² = 3.20, df = 2 (P = 0.20), I² = 37.5%								

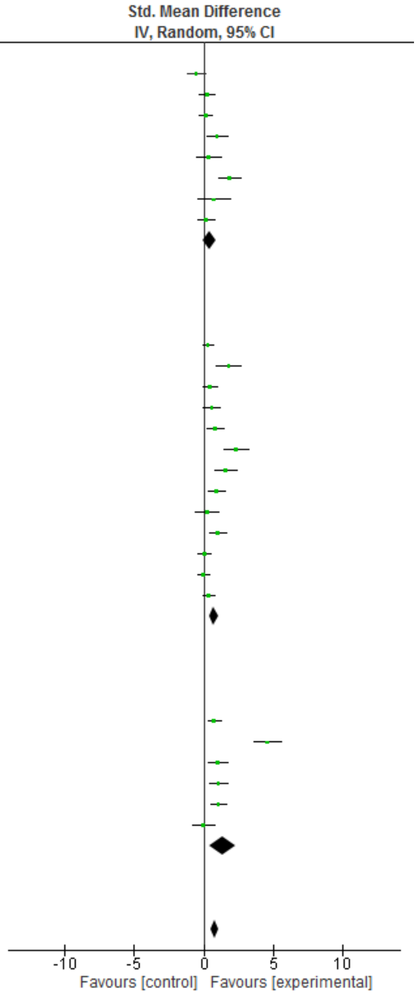


Figure 5. Multitask Activity Level (with *low*, *moderate* and *high* subgroups) versus control on self-reported ADL outcomes

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.1.4 *Low* multitask activity level								
Antunes (2005)	97.82	2.53	23	91.08	6.56	23	12.8%	1.33 [0.69, 1.98]
Barrett (2002)	73.8	19	20	78.5	16.9	20	12.9%	-0.26 [-0.88, 0.37]
Benavent-Caballer (2014)	92.22	6.69	22	93.33	6.51	23	13.1%	-0.17 [-0.75, 0.42]
Moore-Harrison (2008)	85.8	13.6	12	65	16.4	12	11.3%	1.33 [0.43, 2.23]
Subtotal (95% CI)			**77**			**78**	**50.2%**	**0.53 [-0.34, 1.40]**
Heterogeneity: Tau² = 0.66; Chi² = 20.02, df = 3 (P = 0.0002); I² = 85%								
Test for overall effect: Z = 1.20 (P = 0.23)								
1.1.5 *Moderate* multitask activity level								
Oliveira (2015)	93.4	10.9	16	76.2	22.6	16	12.3%	0.95 [0.21, 1.68]
Sato (2007)	30.19	8.75	21	16.1	12.8	8	11.3%	1.38 [0.48, 2.27]
Subtotal (95% CI)			**37**			**24**	**23.6%**	**1.12 [0.55, 1.69]**
Heterogeneity: Tau² = 0.00; Chi² = 0.53, df = 1 (P = 0.47); I² = 0%								
Test for overall effect: Z = 3.85 (P = 0.0001)								
1.1.6 *High* multitask activity level								
Eyigor (2009)	88.8	12.2	19	79.6	16	18	12.7%	0.64 [-0.03, 1.30]
Wei (2014)	14.43	0.639	30	15.47	1.66	30	13.4%	-0.82 [-1.34, -0.29]
Subtotal (95% CI)			**49**			**48**	**26.2%**	**-0.10 [-1.53, 1.32]**
Heterogeneity: Tau² = 0.96; Chi² = 11.27, df = 1 (P = 0.0008); I² = 91%								
Test for overall effect: Z = 0.14 (P = 0.89)								
Total (95% CI)			**163**			**150**	**100.0%**	**0.51 [-0.11, 1.13]**
Heterogeneity: Tau² = 0.67; Chi² = 46.99, df = 7 (P < 0.00001); I² = 85%								
Test for overall effect: Z = 1.62 (P = 0.11)								
Test for subgroup differences: Chi² = 3.09, df = 2 (P = 0.21), I² = 35.3%								

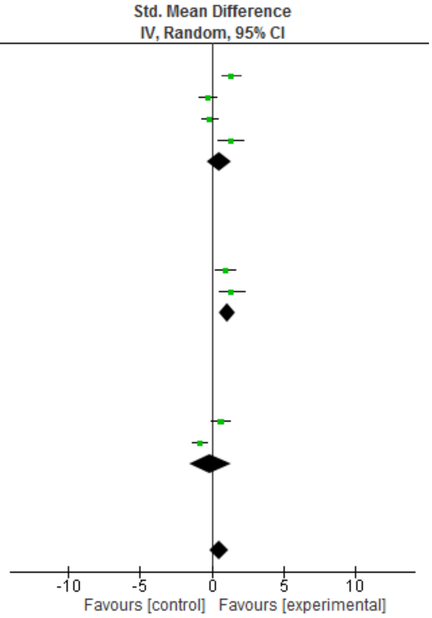
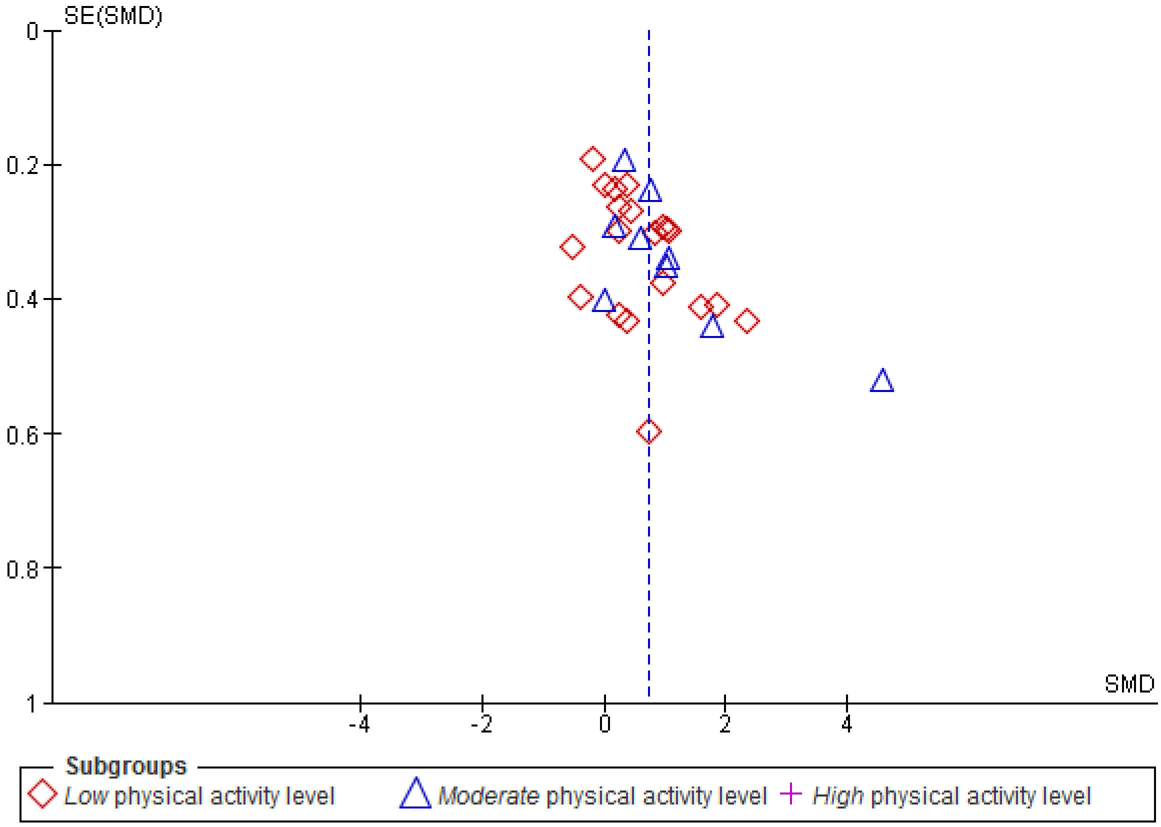
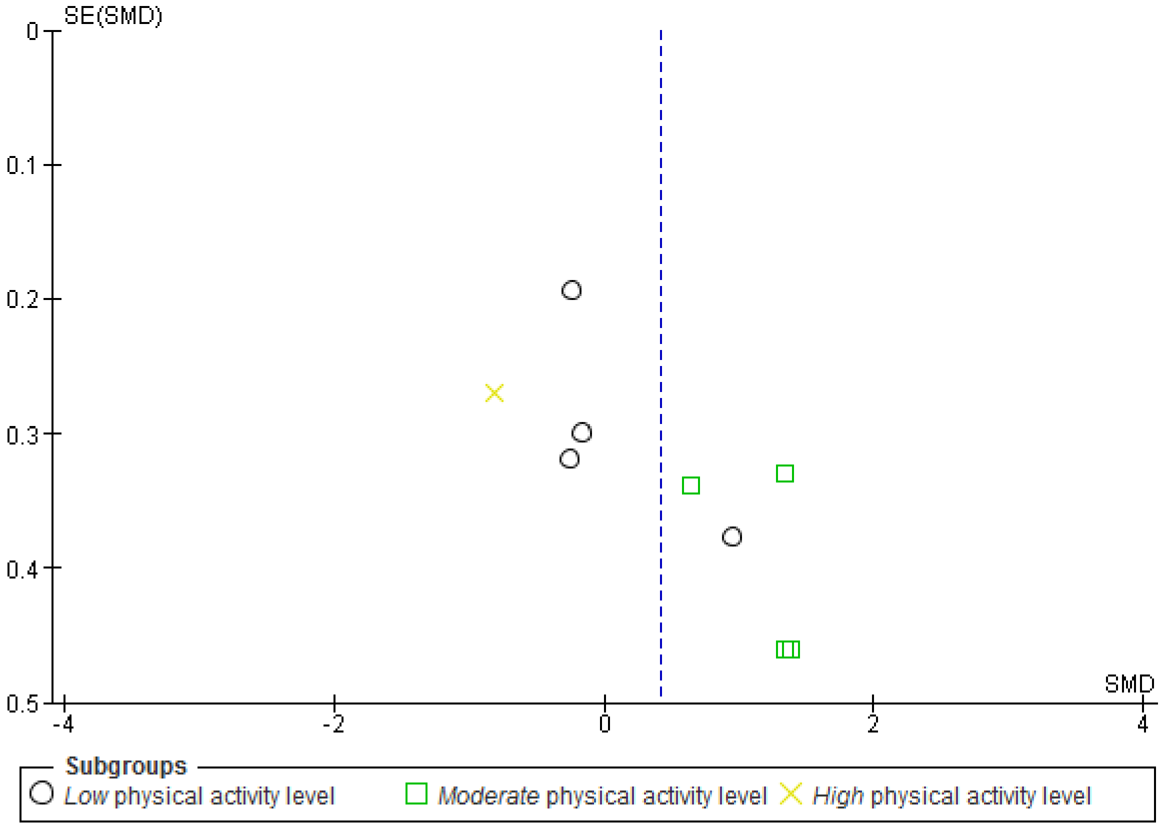


Figure 6. Funnel plot of physical activity level (subcategorized as *low*, *moderate* and *high*) versus control on ADL physical performance measures



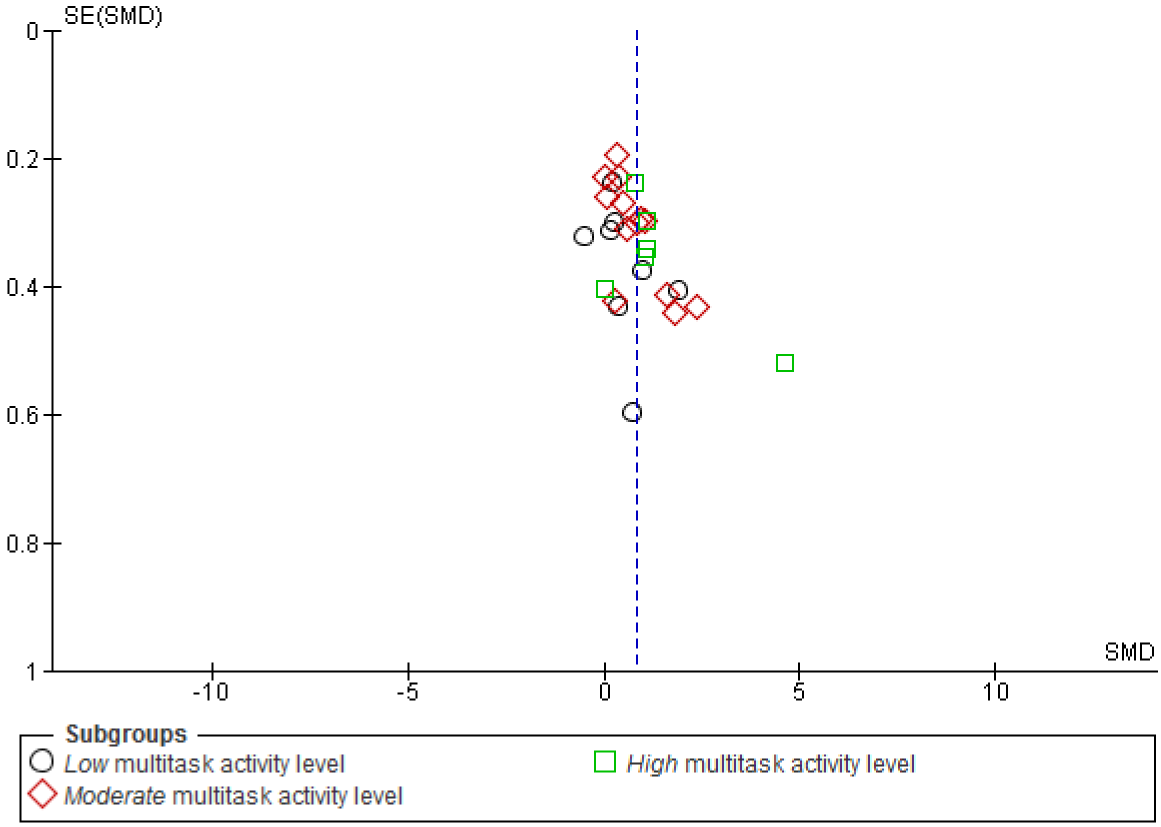
Note. *SMD* = Standardized Mean Difference

Figure 7. Funnel plot of physical activity level (subcategorized as *low*, *moderate* and *high*) versus control on ADL self-reported measures



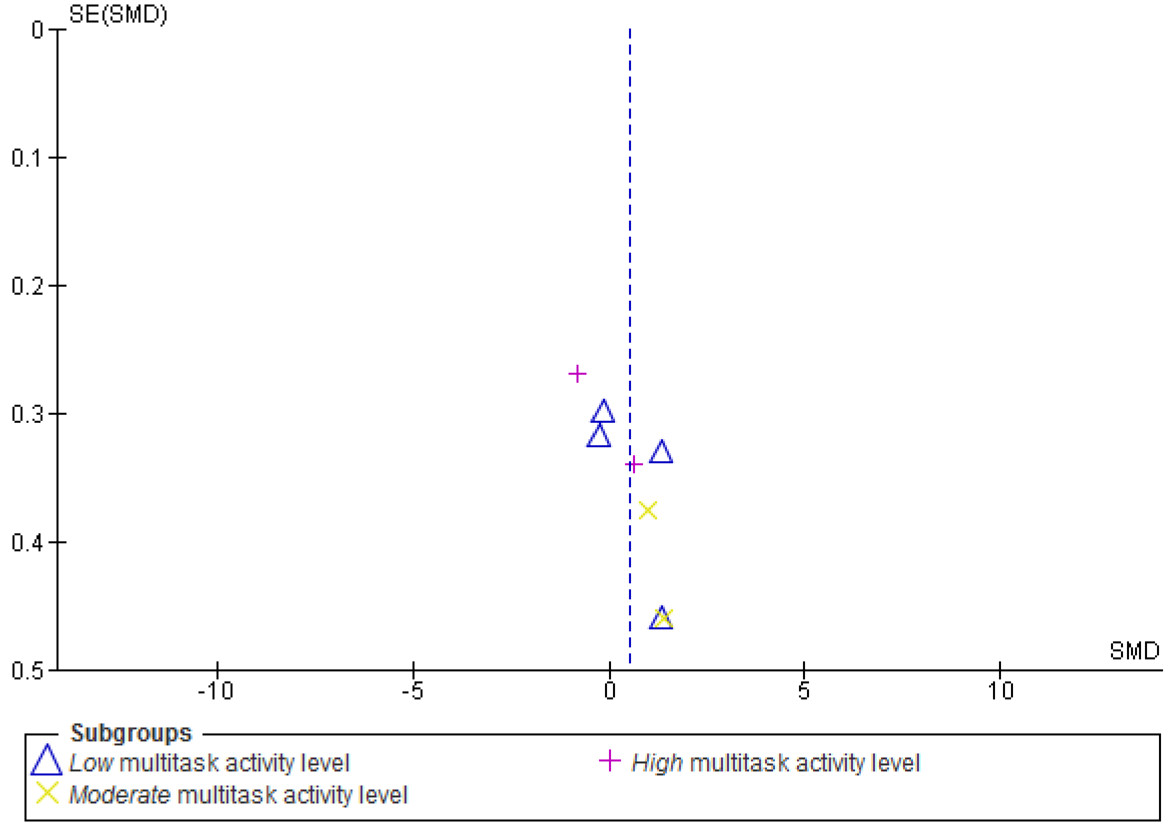
Note. *SMD* = Standardized Mean Difference

Figure 8. Funnel plot of multitask activity level (subcategorized as *low*, *moderate* and *high*) versus control on ADL physical performance measures



Note. *SMD* = Standardized Mean Difference

Figure 9. Funnel plot of multitask activity level (subcategorized as *low*, *moderate* and *high*) versus control on ADL self-reported measures



Note. *SMD* = Standardized Mean Difference

Supplementary File 1: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

1. exp exercise/
2. recreation/ or camping/ or dancing/ or gardening/ or hobbies/
3. exp sports/
4. exp exercise movement techniques/
5. (physical adj2 (activit$ or inactivit$)).ti.
6. exercis$.ti.
7. or/1-7
8. "Activities of Daily Living"/
9. geriatric assessment/
10. disability Evaluation/
11. mobility limitation/
12. Disabled Persons/
13. Hypokinesia/
14. Cognitive Disorders/ or mild cognitive impairment/
15. ((cognitive or cognition or physical or mobility or functional) adj2 (limit$ or impair$ or deteriorat$ or decreas$ or declin$ or status or independence)).ti.
16. ((cognitive or cognition or physical or mobility) adj2 (status or function$ or assess$ or evaluat$)).ti.
17. or/8-16
18. exp aged/
19. (aged or elder$ or geriatric or old).ti.
20. 18 or 19 (2492671)

21. 7 and 17 and 20 (5308)

22. 21 not (letter or editoral or comment or case reports).pt. (4860)

23. limit 22 to english language (4530)

24. remove duplicates from 24 (4447)

Supplementary File 2: References of excluded studies

Alexander NB, Galecki AT, Grenier ML, Nyquist LV, Hofmeyer MR, Grunawalt JC, et al. (2001). Task-specific resistance training to improve the ability of activities of daily living-impaired older adults to rise from a bed and from a chair. Journal of the American Geriatrics Society, 49(11), 1418-1427.

Alpert PT, Miller SK, Wallmann H, Havey R, Cross C, Chevalia T, et al. (2009). The effect of modified jazz dance on balance, cognition, and mood in older adults. Journal of the American Academy of Nurse Practitioners, 21(2), 108-115.

Anton, S. D., Manini, T. M., Milsom, V. A., Dubyak, P., Cesari, M., Cheng, J., et al. (2011). Effects of a weight loss plus exercise program on physical function in overweight, older women: A randomized controlled trial. Clinical Interventions in Aging, 6(1), 141-149.

Arai T, Obuchi S, Inaba Y, Shiba Y, & Satake K. (2009). The relationship between physical condition and change in balance functions on exercise intervention and 12-month follow-up in Japanese community-dwelling older people. Archives of Gerontology & Geriatrics, 48(1), 61-66.

Ashmead, J. C., & Bocksnick, J. G. (2002). Home-based circuit training for elderly women: An exploratory investigation. Activities, Adaptation & Aging, 26(4), 47-60.

Avelar NC, Simao AP, Tossige-Gomes R, Neves CD, Rocha-Vieira E, Coimbra CC, et al. (2011). The effect of adding whole-body vibration to squat training on the functional performance and self-report of disease status in elderly patients with knee osteoarthritis: A randomized, controlled clinical study. Journal of Alternative & Complementary Medicine, 17(12), 1149-1155.

Baker LD, Frank LL, Foster-Schubert K, Green PS, Wilkinson CW, McTiernan A, et al. (2010). Effects of aerobic exercise on mild cognitive impairment: A controlled trial. Archives of Neurology, 67(1), 71-79.

Ballard, J. E., McFarland, C., Wallace, L. S., Holiday, D. B., & Roberson, G. (2004). The effect of 15 weeks of exercise on balance, leg strength, and reduction in falls in 40 women aged 65 to 89 years. Journal of the American Medical Women's Association (1972), 59(4), 255-261.

Banez C, Tully S, Amaral L, Kwan D, Kung A, Mak K, et al. (2008). Development, implementation, and evaluation of an interprofessional falls prevention program for older adults. Journal of the American Geriatrics Society, 56(8), 1549-1555.

Barnes, D. E., Santos-Modesitt, W., Poelke, G., Kramer, A. F., Castro, C., Middleton, L. E., et al. (2013). The mental activity and exercise (MAX) trial: A randomized controlled trial to enhance cognitive function in older adults. JAMA Internal Medicine, 173(9), 797-804.

Baruth, M., Wilcox, S., Wegley, S., Buchner, D. M., Ory, M. G., Phillips, A., et al. (2011). Changes in physical functioning in the active living every day program of the active for life initiative. International Journal of Behavioral Medicine, 18(3), 199-208.

Batista, L. H., Vilar, A. C., De Almeida Ferreira, J. J., Rebelatto, J. R., & Salvini, T. F. (2009). Active stretching improves flexibility, joint torque, and functional mobility in older women. American Journal of Physical Medicine and Rehabilitation, 88(10), 815-822.

Bean J, Herman S, Kiely DK, Callahan D, Mizer K, Frontera WR, et al. (2002). Weighted stair climbing in mobility-limited older people: A pilot study. Journal of the American Geriatrics Society, 50(4), 663-670.

Bean JF, Kiely DK, LaRose S, Goldstein R, Frontera WR, & Leveille SG. (2010). Are changes in leg power responsible for clinically meaningful improvements in mobility in older adults? Journal of the American Geriatrics Society, 58(12), 2363-2368.

Beaudart, C., Maquet, D., Mannarino, M., Buckinx, F., Demonceau, M., Crielaard, J. M., et al. (2013). Effects of 3 months of short sessions of controlled whole body vibrations on the risk of falls among nursing home residents. BMC Geriatrics, 13, 42.

Beck AM, Damkjaer K, & Sorbye LW. (2010). Physical and social functional abilities seem to be maintained by a multifaceted randomized controlled nutritional intervention among old (>65 years) Danish nursing home residents. Archives of Gerontology & Geriatrics, 50(3), 351-355.

Beltran Valls, M. R., Dimauro, I., Brunelli, A., Tranchita, E., Ciminelli, E., Caserotti, P., et al. (2014). Explosive type of moderate-resistance training induces functional, cardiovascular, and molecular adaptations in the elderly. Age, 36(2), 759-772.

Benloucif, S., Orbeta, L., Ortiz, R., Janssen, I., Finkel, S. I., Bleiberg, J., et al. (2004). Morning or evening activity improves neuropsychological performance and subjective sleep quality in older adults. Sleep, 27(8), 1542-1551.

Binder EF, Schechtman KB, Ehsani AA, Steger-May K, Brown M, Sinacore DR, et al. (2002). Effects of exercise training on frailty in community-dwelling older adults: Results of a randomized, controlled trial. Journal of the American Geriatrics Society, 50(12), 1921-1928.

Bird, M., Hill, K., Ball, M., & Williams, A. D. (2009). Effects of resistance- and flexibility-exercise interventions on balance and related measures in older adults. Journal of Aging and Physical Activity, 17(4), 444-545.

Bogaerts A, Delecluse C, Boonen S, Claessens AL, Milisen K, & Verschueren SM. (2011). Changes in balance, functional performance and fall risk following whole body vibration training and vitamin D supplementation in institutionalized elderly women. A 6 month randomized controlled trial. Gait & Posture, 33(3), 466-472.

Bonnefoy M, Boutitie F, Mercier C, Gueyffier F, Carre C, Guetemme G, et al. (2012). Efficacy of a home-based intervention programme on the physical activity level and functional ability of older people using domestic services: A randomised study. Journal of Nutrition, Health & Aging, 16(4), 370-377.

Brill, P. A., Probst, J. C., Greenhouse, D. L., Schell, B., & Macera, C. A. (1998). Clinical feasibility of a free-weight strength-training program for older adults. The Journal of the American Board of Family Practice / American Board of Family Practice, 11(6), 445-451.

Brittle, N., Patel, S., Wright, C., Baral, S., Versfeld, P., & Sackley, C. (2009). An exploratory cluster randomized controlled trial of group exercise on mobility and depression in care home residents. Clinical Rehabilitation, 23(2), 146-154.

Brovold T, Skelton DA, & Bergland A. (2012). The efficacy of counselling and progressive resistance home-exercises on adherence, health-related quality of life and function after discharge from a geriatric day-hospital. Archives of Gerontology & Geriatrics, 55(2), 453-459.

Brown, M., Sinacore, D. R., Ehsani, A. A., Binder, E. F., Holloszy, J. O., & Kohrt, W. M. (2000). Low-intensity exercise as a modifier of physical frailty in older adults. Archives of Physical Medicine & Rehabilitation, 81(7), 960-965.

Bruce-Brand RA, Walls RJ, Ong JC, Emerson BS, O'Byrne JM, & Moyna NM. (2012). Effects of home-based resistance training and neuromuscular electrical stimulation in knee osteoarthritis: A randomized controlled trial. BMC Musculoskeletal Disorders, 13, 118.

Buccello-Stout RR, Bloomberg JJ, Cohen HS, Whorton EB, Weaver GD, & Cromwell RL. (2008). Effects of sensorimotor adaptation training on functional mobility in older adults. Journals of Gerontology Series B-Psychological Sciences & Social Sciences, 63(5), p295-300.

Bunout B, Barrera G, de la Maza P, Avendano M, Gattas V, Petermann M, et al. (2004). Effects of nutritional supplementation and resistance training on muscle strength in free living elders: Results of one year follow. Journal of Nutrition, Health & Aging, 8(2), 68-75.

Burke, T. N., Franca, F. J., Ferreira de Meneses, S. R., Cardoso, V. I., & Marques, A. P. (2010). Postural control in elderly persons with osteoporosis: Efficacy of an intervention program to improve balance and muscle strength: A randomized controlled trial. American Journal of Physical Medicine & Rehabilitation / Association of Academic Physiatrists, 89(7), 549-556.

Callahan, L. F., Cleveland, R. J., Shreffler, J., Hootman, J. M., Mielenz, T. J., & Schoster, B. (2014). Evaluation of active living every day in adults with arthritis. Journal of Physical Activity and Health, 11(2), 285-295.

Capodaglio P, Capodaglio Edda M, Facioli M, & Saibene F. (2007). Long-term strength training for community-dwelling people over 75: Impact on muscle function, functional ability and life style. European Journal of Applied Physiology, 100(5), 535-542.

Capodaglio P, Capodaglio EM, Ferri A, Scaglioni G, Marchi A, & Saibene F. (2005). Muscle function and functional ability improves more in community-dwelling older women with a mixed-strength training programme. Age & Ageing, 34(2), 141-147.

Capodaglio P, Facioli M, Burroni E, Giordano A, Ferri A, & Scaglioni G. (2002). Effectiveness of a home-based strengthening program for elderly males in Italy. A preliminary study. Aging-Clinical & Experimental Research, 14(1), 28-34.

Cetin, E., Top, E. C., Sahin, G., Ozkaya, Y. G., Aydin, H., & Toraman, F. (2010). Effect of vitamin e supplementation with exercise on cognitive functions and total antioxidant capacity in older people. Journal of Nutrition, Health and Aging, 14(9), 763-769.

Chang JY, Tsai PF, Beck C, Hagen JL, Huff DC, Anand KJ, et al. (2011). The effect of tai chi on cognition in elders with cognitive impairment. MEDSURG Nursing, 20(2), 63-69.

Chao, Y. -., Scherer, Y. K., Montgomery, C. A., Lucke, K. T., & Wu, Y. -. (2014). Exergames-based intervention for assisted living residents: A pilot study. Journal of Gerontological Nursing, 40(11), 36-43.

Chen KM, Hsu YC, Chen WT, & Tseng HF. (2007). Well-being of institutionalized elders after yang-style tai chi practice. Journal of Clinical Nursing, 16(5), 845-852.

Chen KM, Lin JN, Lin HS, Wu HC, Chen WT, Li CH, et al. (2008). The effects of a simplified tai-chi exercise program (STEP) on the physical health of older adults living in long-term care facilities: A single group design with multiple time points. International Journal of Nursing Studies, 45(4), 501-507.

Cheng SP, Tsai TI, Lii YK, Yu S, Chou CL, & Chen IJ. (2009). The effects of a 12-week walking program on community-dwelling older adults. Research Quarterly for Exercise & Sport, 80(3), 524-532.

Chin A Paw MJ, de Jong N, Schouten EG, Hiddink GJ, & Kok FJ. (2001). Physical exercise and/or enriched foods for functional improvement in frail, independently living elderly: A randomized controlled trial. Archives of Physical Medicine & Rehabilitation, 82(6), 811-817.

Chin A Paw MJ, de Jong N, Schouten EG, van Staveren WA, & Kok FJ. (2002). Physical exercise or micronutrient supplementation for the wellbeing of the frail elderly? A randomised controlled trial. British Journal of Sports Medicine, 36(2), 126-131.

Chomiuk, T., Folga, A., & Mamcarz, A. (2013). The influence of systematic pulse-limited physical exercise on the parameters of the cardiovascular system in patients over 65 years of age. Archives of Medical Science, 9(2), 201-209.

Chyu, M. C., James, C. R., Sawyer, S. F., Brismee, J. M., Xu, K. T., Poklikuha, G., et al. (2010). Effects of tai chi exercise on posturography, gait, physical function and quality of life in postmenopausal women with osteopaenia: A randomized clinical study. Clinical Rehabilitation, 24(12), 1080-1090.

Clegg, A., Barber, S., Young, J., Iliffe, S., & Forster, A. (2014). The home-based older people's exercise (HOPE) trial: A pilot randomised controlled trial of a home-based exercise intervention for older people with frailty. Age and Ageing, 43(5) (pp 687-695), Arte Number: afu033.

Clemson, L., Fiatarone Singh, M. A., Bundy, A., Cumming, R. G., Manollaras, K., O'Loughlin, P., et al. (2012). Integration of balance and strength training into daily life activity to reduce rate of falls in older people (the LiFE study): Randomised parallel trial. Bmj, (Online), Arte Number: e4547.

Clemson, L., Singh, M. F., Bundy, A., Cumming, R. G., Weissel, E., Munro, J., et al. (2010). LiFE pilot study: A randomised trial of balance and strength training embedded in daily life activity to reduce falls in older adults. Australian Occupational Therapy Journal, 57(1), 42-50.

Cochrane, T., Munro, J., Davey, R., & Nicholl, J. (1998). Exercise, physical function and health perceptions of older people. Physiotherapy, 84(12), 598-602.

Courtney M, Edwards H, Chang A, Parker A, Finlayson K, & Hamilton K. (2009). Fewer emergency readmissions and better quality of life for older adults at risk of hospital readmission: A randomized controlled trial to determine the effectiveness of a 24-week exercise and telephone follow-up program. Journal of the American Geriatrics Society, 57(3), 395-402.

Courtney MD, Edwards HE, Chang AM, Parker AW, Finlayson K, Bradbury C, et al. (2012). Improved functional ability and independence in activities of daily living for older adults at high risk of hospital readmission: A randomized controlled trial. Journal of Evaluation in Clinical Practice, 18(1), 128-134.

Cress ME, Buchner DM, Questad KA, Esselman PC, deLateur BJ, & Schwartz RS. (1999). Exercise: Effects on physical functional performance in independent older adults. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 54(5), M242-8.

Crilly RG, Willems DA, Trenholm KJ, Hayes KC, & Delaquerriere-Richardson LF. (1989). Effect of exercise on postural sway in the elderly. Gerontology, 35(2-3), 137-143.

Crispim Nascimento, C. M., Pereira, J. R., de Andrade, L. P., Garuffi, M., Ayan, C., Kerr, D. S., et al. (2015). Physical exercise improves peripheral BDNF levels and cognitive functions in mild cognitive impairment elderly with different BDNF Val66Met genotypes. Journal of Alzheimer's Disease, 43(1), 81-91.

Crispim Nascimento, C. M., Pereira, J. R., de Andrade, L. P., Garuffi, M., Ayan, C., Kerr, D. S., et al. (2015). Physical exercise improves peripheral BDNF levels and cognitive functions in mild cognitive impairment elderly with different BDNF Val66Met genotypes. Journal of Alzheimer's Disease, 43(1), 81-91.

Curi Perez, V. S., Haas, A. N., & Wolff, S. S. (2014). Analysis of activities in the daily lives of older adults exposed to the Pilates method. Journal of Bodywork and Movement Therapies, 18(3), 326-331.

Daniel, F. D. N. R., Vale, R., Giani, T., Bacellar, S., & Dantas, E. (2010). Effects of a physical activity program on static balance and functional autonomy in elderly women. Macedonian Journal of Medical Sciences, 3(1), 21-26.

Daniel, F. N. R., Vale, R. G. S., Giani, T. S., Bacelar, S., & Dantas, E. H. M. (2012). Functional autonomy of elderly women enrolled in a physical activity program. [Autonomia funcional de mulheres idosas participantes de um programa de atividades fisicas.] Acta Scientiarum - Health Sciences, 34(2), 151-156.

Dannhauser, T. M., Cleverley, M., Whitfield, T. J., Fletcher, B. C., Stevens, T., & Walker, Z. A (2014) Complex multimodal activity intervention to reduce the risk of dementia in mild cognitive impairment-ThinkingFit: Pilot and feasibility study for a randomized controlled trial. BMC Psychiatry, 5, 14-129.

Davidson, L. E., Hudson, R., Kilpatrick, K., Kuk, J. L., McMillan, K., Janiszewski, P. M., et al. (2009). Effects of exercise modality on insulin resistance and functional limitation in older adults: A randomized controlled trial. Archives of Internal Medicine, 169(2), 122-131.

Davis JC, Bryan S, Marra CA, Sharma D, Chan A, Beattie BL, et al. (2013). An economic evaluation of resistance training and aerobic training versus balance and toning exercises in older adults with mild cognitive impairment. PLoS ONE [Electronic Resource], 8(5), e63031.

de Bruin ED, & Murer K. (2007). Effect of additional functional exercises on balance in elderly people. Clinical Rehabilitation, 21(2), 112-121.

de Groot, L. C. (2014). Effect of resistance-type exercise training with or without protein supplementation on cognitive functioning in frail and pre-frail elderly: Secondary analysis of a randomized, double-blind, placebo-controlled trial. Mechanisms of Ageing and Development, 136-137 (Pp 85-93)

de Souza Santos, C. A., Dantas, E. E. M., & Moreira, M. H. R. (2011). Correlation of physical aptitude; functional capacity, corporal balance and quality of life (QoL) among elderly women submitted to a post-menopausal physical activities program. Archives of Gerontology and Geriatrics, 53(3), 344-349.

De Vreede, P. L., Samson, M. M., Van Meeteren, N. L., Van Der Bom, J. G., Duursma, S. A., & Verhaar, H. J. (2004). Functional tasks exercise versus resistance exercise to improve daily function in older women: A feasibility study. Archives of Physical Medicine and Rehabilitation, 85(12), 1952-1961.

De Vries, O. J., Peeters, G. M. E. E., Elders, P. J. M., Muller, M., Knol, D. L., Danner, S. A., et al. (2010). Multifactorial intervention to reduce falls in older people at high risk of recurrent falls: A randomized controlled trial. Archives of Internal Medicine, 170(13), 1110-1117.

Delbaere, K., Bourgois, J., Van Den Noortgate, N., Vanderstraeten, G., Willems, T., & Cambier, D. (2006). A home-based multidimensional exercise program reduced physical impairment and fear of falling. Acta Clinica Belgica, 61(6), 340-350.

DeSure, A. R., Peterson, K., Gianan, F. V., & Pang, L. (2013). An exercise program to prevent falls in institutionalized elderly with cognitive deficits: A crossover pilot study. Hawai'i Journal of Medicine & Public Health: A Journal of Asia Pacific Medicine & Public Health, 72(11), 391-395.

Devereux, K., Robertson, D., & Briffa, N. K. (2005). Effects of a water-based program on women 65 years and over: A randomised controlled trial. Australian Journal of Physiotherapy, 51(2), 102-108.

Dobek JC, White KN, & Gunter KB. (2007). The effect of a novel ADL-based training program on performance of activities of daily living and physical fitness. Journal of Aging & Physical Activity, 15(1), 13-25.

Doi, T., Makizako, H., Shimada, H., Yoshida, D., Tsutsumimoto, K., Sawa, R., et al. (2013). Effects of multicomponent exercise on spatial-temporal gait parameters among the elderly with amnestic mild cognitive impairment (aMCI): Preliminary results from a randomized controlled trial (RCT). Archives of Gerontology and Geriatrics, 56(1), 104-108.

Donat H, & Ozcan A. (2007). Comparison of the effectiveness of two programmes on older adults at risk of falling: Unsupervised home exercise and supervised group exercise. Clinical Rehabilitation, 21(3), 273-283.

Dougherty, J., Kancel, A., Ramar, C., Meacham, C., & Derrington, S. (2011). The effects of a multi-axis balance board intervention program in an elderly population. Missouri Medicine, 108(2), 128-132.

Drey M, Zech A, Freiberger E, Bertsch T, Uter W, Sieber CC, et al. (2012). Effects of strength training versus power training on physical performance in prefrail community-dwelling older adults. Gerontology, 58(3), 197-204.

Dyer CA, Taylor GJ, Reed M, Dyer CA, Robertson DR, & Harrington R. (2004). Falls prevention in residential care homes: A randomised controlled trial. Age & Ageing, 33(6), 596-602.

Elaine Cress, M., Buchner, D. M., Questad, K. A., Esselman, P. C., DeLateur, B. J., & Schwartz, R. S. (1999). Exercise: Effects on physical functional performance in independent older adults. Journals of Gerontology - Series A Biological Sciences and Medical Sciences, 54(5), M242-M248.

Elley CR, Robertson MC, Garrett S, Kerse NM, McKinlay E, Lawton B, et al. (2008). Effectiveness of a falls-and-fracture nurse coordinator to reduce falls: A randomized, controlled trial of at-risk older adults. Journal of the American Geriatrics Society, 56(8), 1383-1389.

Engels HJ, Drouin J, Zhu W, & Kazmierski JF. (1998). Effects of low-impact, moderate-intensity exercise training with and without wrist weights on functional capacities and mood states in older adults. Gerontology, 44(4), 239-244.

Etkin, C. D., Prohaska, T. R., Harris, B. A., Latham, N., & Jette, A. (2006). Feasibility of implementing the strong for life program in community settings. Gerontologist, 46(2), 284-292.

Ettinger WH Jr, Burns R, Messier SP, Applegate W, Rejeski WJ, Morgan T, et al. (1997). A randomized trial comparing aerobic exercise and resistance exercise with a health education program in older adults with knee osteoarthritis: The fitness arthritis and seniors trial (FAST). Jama, 277(1), 25-31.

Evers, A., Klusmann, V., Schwarzer, R., & Heuser, I. (May 2011). Improving cognition by adherence to physical or mental exercise: A moderated mediation analysis. Aging & Mental Health, 15(4), 446-455.

Fabre C, Chamari K, Mucci P, Masse-Biron J, & Prefaut C. (2002). Improvement of cognitive function by mental and/or individualized aerobic training in healthy elderly subjects. International Journal of Sports Medicine, 23(6), 415-421.

Fabre, C., MasseBiron, J., Chamari, K., Varray, A., Mucci, P., & Prefaut, C. (Jan-Feb 1999). Evaluation of quality of life in elderly healthy subjects after aerobic and/or mental training. Archives of Gerontology and Geriatrics, 28(1), 9-22.

Fahlman MM, McNevin N, Boardley D, Morgan A, & Topp R. (2011). Effects of resistance training on functional ability in elderly individuals. American Journal of Health Promotion, 25(4), 237-243.

Fahlman, M. M., Topp, R., McNevin, N., Morgan, A. L., & Boardley, D. J. (2007). Structured exercise in older adults with limited functional ability: Assessing the benefits of an aerobic plus resistance training program. Journal of Gerontological Nursing, 33(6), 32-39.

Fairhall, N., Sherrington, C., Lord, S. R., Kurrle, S. E., Langron, C., Lockwood, K., et al. (2014). Effect of a multifactorial, interdisciplinary intervention on risk factors for falls and fall rate in frail older people: A randomised controlled trial. Age and Ageing, 43(5), 616-622.

Ferri A, Scaglioni G, Pousson M, Capodaglio P, Van Hoecke J, & Narici MV. (2003). Strength and power changes of the human plantar flexors and knee extensors in response to resistance training in old age. Acta Physiologica Scandinavica, 177(1), 69-78.

Fiatarone MA, O'Neill EF, Doyle N, Clements KM, Roberts SB, Kehayias JJ, et al. (1993). The Boston FICSIT study: The effects of resistance training and nutritional supplementation on physical frailty in the oldest old. Journal of the American Geriatrics Society, 41(3), 333-337.

Fiatarone, M. A., O'Neill, E. F., Ryan, N. D., Clements, K. M., Solares, G. R., Nelson, M. E., et al. (1994). Exercise training and nutritional supplementation for physical frailty in very elderly people. New England Journal of Medicine, 330(25), 1769-1775.

Fielding RA, Katula J, Miller ME, Abbott-Pillola K, Jordan A, Glynn NW, et al. (2007). Activity adherence and physical function in older adults with functional limitations. Medicine & Science in Sports & Exercise, 39(11), 1997-2004.

Fitzpatrick, S. E., Reddy, S., Lommel, T. S., Fischer, J. G., Speer, E. M., Stephens, H., et al. (2008). Physical activity and physical function improved following a community-based intervention in older adults in georgia senior centers. Journal of Nutrition for the Elderly, 27(1-2), 135-154.

Flint-Wagner HG, Lisse J, Lohman TG, Going SB, Guido T, Cussler E, et al. (2009). Assessment of a sixteen-week training program on strength, pain, and function in rheumatoid arthritis patients. JCR: Journal of Clinical Rheumatology, 15(4), 165-171.

Focht, B. C., Rejeski, W. J., Ambrosius, W. T., Katula, J. A., & Messier, S. P. (Oct 2005). Exercise, self-efficacy, and mobility performance in overweight and obese older adults with knee osteoarthritis. Arthritis & Rheumatism: Arthritis Care & Research, 53(5), 659-665.

Foley A, Hillier S, & Barnard R. (2011). Effectiveness of once-weekly gym-based exercise programmes for older adults post discharge from day rehabilitation: A randomised controlled trial. British Journal of Sports Medicine, 45(12), 978-986.

Forte R, Boreham CA, Leite JC, De Vito G, Brennan L, Gibney ER, et al. (2013). Enhancing cognitive functioning in the elderly: Multicomponent vs resistance training. Clinical Interventions in Aging, 8, 19-27.

Fox PJ, Vazquez L, Tonner C, Stevens JA, Fineman N, & Ross LK. (2010). A randomized trial of a multifaceted intervention to reduce falls among community-dwelling adults. Health Education & Behavior, 37(6), 831-848.

Foy, C. G., Lewis, C. E., Hairston, K. G., Miller, G. D., Lang, W., Jakicic, J. M., et al. (2011). Intensive lifestyle intervention improves physical function among obese adults with knee pain: Findings from the look AHEAD trial. Obesity, 19(1), 83-93.

Fraga MJ, Cader SA, Ferreira MA, Giani TS, & Dantas EH. (2011). Aerobic resistance, functional autonomy and quality of life (QoL) of elderly women impacted by a recreation and walking program. Archives of Gerontology & Geriatrics, 52(1), e40-3.

Fransen M, Margiotta E, Crosbie J, & Edmonds J. (1997). A revised group exercise program for osteoarthritis of the knee. Physiotherapy Research International, 2(1), 30-41.

Frye, B., Scheinthal, S., Kemarskaya, T., & Pruchno, R. (2007). Tai chi and low impact exercise: Effects on the physical functioning and psychological well-being of older people. Journal of Applied Gerontology, 26(5), 433-453.

Gallon, D., Rodacki, A. L. F., Hernandez, S. G., Drabovski, B., Outi, T., Bittencourt, L. R., et al. (2011). The effects of stretching on the flexibility, muscle performance and functionality of institutionalized older women. Brazilian Journal of Medical and Biological Research, 44(3), 229-235.

Geirsdottir OG, Arnarson A, Briem K, Ramel A, Tomasson K, Jonsson PV, et al. (2012). Physical function predicts improvement in quality of life in elderly Icelanders after 12 weeks of resistance exercise. Journal of Nutrition, Health & Aging, 16(1), 62-66.

Gine-Garriga M, Guerra M, & Unnithan VB. (2013). The effect of functional circuit training on self-reported fear of falling and health status in a group of physically frail older individuals: A randomized controlled trial. Aging-Clinical & Experimental Research, 25(3), 329-336.

Goksel Karatepe A, Gunaydin R, Turkmen G, & Kaya T. (2011). Effects of home-based exercise program on the functional status and the quality of life in patients with rheumatoid arthritis: 1-year follow-up study. Rheumatology International, 31(2), 171-176.

Goncalves LC, Vale RG, Barata NJ, Varejao RV, & Dantas EH. (2011). Flexibility, functional autonomy and quality of life (QoL) in elderly yoga practitioners. Archives of Gerontology & Geriatrics, 53(2), 158-162.

Gronstedt, H., Frandin, K., Bergland, A., Helbostad, J. L., Granbo, R., Puggaard, L., et al. (2013). Effects of individually tailored physical and daily activities in nursing home residents on activities of daily living, physical performance and physical activity level: A randomized controlled trial. Gerontology, 59(3), 220-229.

Gudlaugsson J, Gudnason V, Aspelund T, Siggeirsdottir K, Olafsdottir AS, Jonsson PV, et al. (2012). Effects of a 6-month multimodal training intervention on retention of functional fitness in older adults: A randomized-controlled cross-over design. International Journal of Behavioral Nutrition & Physical Activity, 9, 107.

Gusi N, Carmelo Adsuar J, Corzo H, Del Pozo-Cruz B, Olivares PR, & Parraca JA. (2012). Balance training reduces fear of falling and improves dynamic balance and isometric strength in institutionalised older people: A randomised trial. Journal of Physiotherapy, 58(2), 97-104.

Haas R, & Haines TP. (2014). Twelve month follow up of a falls prevention program in older adults from diverse populations in Australia: A qualitative study. Archives of Gerontology & Geriatrics, 58(2), 283-292.

Hagen B, Armstrong-Esther C, & Sandilands M. (2003). On a happier note: Validation of musical exercise for older persons in long-term care settings. International Journal of Nursing Studies, 40(4), 347-357.

Haines TP, Russell T, Brauer SG, Erwin S, Lane P, Urry S, et al. (2009). Effectiveness of a video-based exercise programme to reduce falls and improve health-related quality of life among older adults discharged from hospital: A pilot randomized controlled trial. Clinical Rehabilitation, 23(11), 973-985.

Hale LA, Waters D, & Herbison P. (2012). A randomized controlled trial to investigate the effects of water-based exercise to improve falls risk and physical function in older adults with lower-extremity osteoarthritis. Archives of Physical Medicine & Rehabilitation, 93(1), 27-34.

Hanson ED, Srivatsan SR, Agrawal S, Menon KS, Delmonico MJ, Wang MQ, et al. (2009). Effects of strength training on physical function: Influence of power, strength, and body composition. Journal of Strength & Conditioning Research, 23(9), 2627-2637.

Hariprasad, V. R., Koparde, V., Sivakumar, P. T., Varambally, S., Thirthalli, J., Varghese, M., et al. (2013). Randomized clinical trial of yoga-based intervention in residents from elderly homes: Effects on cognitive function. Indian Journal of Psychiatry, 55(7), S357-S363.

Hartman CA, Manos TM, Winter C, Hartman DM, Li B, & Smith JC. (2000). Effects of T'ai chi training on function and quality of life indicators in older adults with osteoarthritis. Journal of the American Geriatrics Society, 48(12), 1553-1559.

Hashizume H, Yoshimura N, Nagata K, Miyazaki N, Ishimoto Y, Nishiyama R, et al. (2014). Development and evaluation of a video exercise program for locomotive syndrome in the elderly. Modern Rheumatology, 24(2), 250-257.

Hedley L, Suckley N, Robinson L, & Dawson P. (2010). Staying steady: A community-based exercise initiative for falls prevention. Physiotherapy Theory & Practice, 26(7), 425-438.

Hekmatpou D, Shamsi M, & Zamani M. (2013). The effect of a healthy lifestyle program on the elderly's health in arak. Indian Journal of Medical Sciences, 67(3-4), 70-77.

Helbostad JL, Sletvold O, & Moe-Nilssen R. (2004). Home training with and without additional group training in physically frail old people living at home: Effect on health-related quality of life and ambulation. Clinical Rehabilitation, 18(5), 498-508.

Henwood TR, & Taaffe DR. (2005). Improved physical performance in older adults undertaking a short-term programme of high-velocity resistance training. Gerontology, 51(2), 108-115.

Heydarnejad, S., & Dehkordi, A. H. (2010) The effect of an exercise program on the health-quality of life in older adults: A randomized controlled trial. Danish medical bulletin, 57(1):A4113

Hickey, T., Wolf, F. M., Robins, L. S., Wagner, M. B., & Harik, W. (1995). Physical activity training for functional mobility in older persons. Journal of Applied Gerontology, 14(4), 357-371.

Hildreth KL, Barry DW, Moreau KL, Vande Griend J, Meacham RB, Nakamura T, et al. (2013). Effects of testosterone and progressive resistance exercise in healthy, highly functioning older men with low-normal testosterone levels. Journal of Clinical Endocrinology & Metabolism, 98(5), 1891-1900.

Holsgaard-Larsen A, Caserotti P, Puggaard L, & Aagaard P. (2011). Stair-ascent performance in elderly women: Effect of explosive strength training. Journal of Aging & Physical Activity, 19(2), 117-136.

Hruda KV, Hicks AL, & McCartney N. (2003). Training for muscle power in older adults: Effects on functional abilities. Canadian Journal of Applied Physiology, 28(2), 178-189.

Hsu JK, Thibodeau R, Wong SJ, Zukiwsky D, Cecile S, & Walton DM. (2011). A "wii" bit of fun: The effects of adding Nintendo Wii bowling to a standard exercise regimen for residents of long-term care with upper extremity dysfunction. Physiotherapy Theory & Practice, 27(3), 185-193.

Hu, J. -., Guo, Y. -., Wang, F., Zhao, X. -., Zhang, Q. -., & Song, Q. -. (2014). Exercise improves cognitive function in aging patients. International Journal of Clinical and Experimental Medicine, 7(10), 3144-3149.

Huang TT, Yang LH, & Liu CY. (2011). Reducing the fear of falling among community-dwelling elderly adults through cognitive-behavioural strategies and intense tai chi exercise: A randomized controlled trial. Journal of Advanced Nursing, 67(5), 961-971.

Hughes SL, Seymour RB, Campbell R, Pollak N, Huber G, & Sharma L. (2004). Impact of the fit and strong intervention on older adults with osteoarthritis. Gerontologist, 44(2), 217-228.

Hughes, T. F., Flatt, J. D., Fu, B., Butters, M. A., Chang, C. -. H., & Ganguli, M. (2014). Interactive video gaming compared with health education in older adults with mild cognitive impairment: A feasibility study. International Journal of Geriatric Psychiatry, 29(9), 890-898.

Hui, E. Tsan-keung Chui, B. Woo, J. (2009) Effects of dance on physical and psychological well-being in older persons. Archives of Gerontology and Geriatrics, 49, 45–50

Hunt MA, Keefe FJ, Bryant C, Metcalf BR, Ahamed Y, Nicholas MK, et al. (2013). A physiotherapist-delivered, combined exercise and pain coping skills training intervention for individuals with knee osteoarthritis: A pilot study. Knee, 20(2), 106-112.

Hunter GR, Treuth MS, Weinsier RL, Kekes-Szabo T, Kell SH, Roth DL, et al. (1995). The effects of strength conditioning on older women's ability to perform daily tasks. Journal of the American Geriatrics Society, 43(7), 756-760.

Hunter, G. R., Wetzstein, C. J., Mclafferty, C. L., Jr, Zuckerman, P. A., Landers, K. A., et al. (2001). High-resistance versus variable-resistance training in older adults. Medicine and Science in Sports and Exercise, 33(10), 1759-1764.

Jan MH, Tang PF, Lin JJ, Tseng SC, Lin YF, & Lin DH. (2008). Efficacy of a target-matching foot-stepping exercise on proprioception and function in patients with knee osteoarthritis. Journal of Orthopaedic & Sports Physical Therapy, 38(1), 19-25.

Jansen, P., & Dahmen Zimmer, K. (2012). Effects of cognitive, motor, and karate training on cognitive functioning and emotional well-being of elderly people. Frontiers in Psychology, 3 Feb, Art 40-7.

Jansson S, & Soderlund A. (2004). A new treatment programme to improve balance in elderly people--an evaluation of an individually tailored home-based exercise programme in five elderly women with a feeling of unsteadiness. Disability & Rehabilitation, 26(24), 1431-1443.

Jensen, J., Nyberg, L., Rosendahl, E., Gustafson, Y., & Lundin-Olsson, L. (2004). Effects of a fall prevention program including exercise on mobility and falls in frail older people living in residential care facilities. Aging - Clinical and Experimental Research, 16(4), 283-292.

Jeon, S. Y., Han, S. J., Jeong, J. H., & Fregni, F. (2014). Effect of exercise on balance in persons with mild cognitive impairment. Neurorehabilitation, 35(2), 271-278.

Jette AM, Harris BA, Sleeper L, Lachman ME, Heislein D, Giorgetti M, et al. (1996). A home-based exercise program for nondisabled older adults. Journal of the American Geriatrics Society, 44(6), 644-649.

Jette AM, Lachman M, Giorgetti MM, Assmann SF, Harris BA, Levenson C, et al. (1999). Exercise--it's never too late: The strong-for-life program. American Journal of Public Health, 89(1), 66-72.

Jones, C. T., Lowe, A. J., MacGregor, L., Brand, C. A., Tweddle, N., & Russell, D. M. (Sep 2006). A randomised controlled trial of an exercise intervention to reduce functional decline and health service utilisation in the hospitalised elderly. Australasian Journal on Ageing, 25(3), 126-133.

Kahle N, & Tevald MA. (2014). Core muscle strengthening's improvement of balance performance in community-dwelling older adults: A pilot study. Journal of Aging & Physical Activity, 22(1), 65-73.

Kalapotharakos VI, Diamantopoulos K, & Tokmakidis SP. (2010). Effects of resistance training and detraining on muscle strength and functional performance of older adults aged 80 to 88 years. Aging-Clinical & Experimental Research, 22(2), 134-140.

Kamegaya T, Long-Term-Care Prevention Team of Maebashi City, Maki Y, Yamagami T, Yamaguchi T, Murai T, et al. (2012). Pleasant physical exercise program for prevention of cognitive decline in community-dwelling elderly with subjective memory complaints. Geriatrics & Gerontology International, 12(4), 673-679.

Kamegaya, T., Araki, Y., Kigure, H., & Yamaguchi, H. (2014). Twelve-week physical and leisure activity programme improved cognitive function in community-dwelling elderly subjects: A randomized controlled trial. Psychogeriatrics, 14(1), 47-54.

Kamijo T, & Murakami M. (2009). Regular physical exercise improves physical motor functions and biochemical markers in middle-age and elderly women. Journal of Physical Activity & Health, 6(1), 55-62.

Kao, M. -., Wu, M. -., Tsai, M. -., Chang, W. -., & Wu, S. -. (2012). The effectiveness of a self-management program on quality of life for knee osteoarthritis (OA) patients. Archives of Gerontology and Geriatrics, 54(2), 317-324.

Karatay, G., & Akkus, Y. (2011). The effectiveness of a stimulation program on cognitive capacity among individuals older than 60. Western Journal of Nursing Research, 33(1), 26-44.

Karinkanta S, Heinonen A, Sievanen H, Uusi-Rasi K, Pasanen M, Ojala K, et al. (2007). A multi-component exercise regimen to prevent functional decline and bone fragility in home-dwelling elderly women: Randomized, controlled trial. Osteoporosis International, 18(4), 453-462.

Karinkanta S, Nupponen R, Heinonen A, Pasanen M, Sievanen H, Uusi-Rasi K, et al. (2012). Effects of exercise on health-related quality of life and fear of falling in home-dwelling older women. Journal of Aging & Physical Activity, 20(2), 198-214.

Kattenstroth, J., Kalisch, T., Holt, S., Tegenthoff, M., & Dinse, H. R. (2013). Six months of dance intervention enhances postural, sensorimotor, and cognitive performance in elderly without affecting cardio-respiratory functions. Frontiers in Aging Neuroscience, 5 Feb, Art 5-16.

Kenny AM, Boxer RS, Kleppinger A, Brindisi J, Feinn R, & Burleson JA. (2010). Dehydroepiandrosterone combined with exercise improves muscle strength and physical function in frail older women. Journal of the American Geriatrics Society, 58(9), 1707-1714.

Keogh JW, Power N, Wooller L, Lucas P, & Whatman C. (2014). Physical and psychosocial function in residential aged-care elders: Effect of Nintendo Wii sports games. Journal of Aging & Physical Activity, 22(2), 235-244.

Kim TH, Eke Dogra S, Al-Sahab B, & Tamim H. (2014). Comparison of functional fitness outcomes in experienced and inexperienced older adults after 16-week tai chi program. Alternative Therapies in Health & Medicine, 20(3), 20-25.

Kim, H., Suzuki, T., Kim, M., Kojima, N., Ota, N., Shimotoyodome, A., et al. (2015). Effects of exercise and milk fat globule membrane (MFGM) supplementation on body composition, physical function, and hematological parameters in community-dwelling frail Japanese women: A randomized double blind, placebo-controlled, follow-up trial. Plos One, 10 (2):e0116256

Kimura K, Obuchi S, Arai T, Nagasawa H, Shiba Y, Watanabe S, et al. (2010). The influence of short-term strength training on health-related quality of life and executive cognitive function. Journal of Physiological Anthropology, 29(3), 95-101.

King AC, Pruitt LA, Phillips W, Oka R, Rodenburg A, & Haskell WL. (2000). Comparative effects of two physical activity programs on measured and perceived physical functioning and other health-related quality of life outcomes in older adults. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 55(2), M74-83.

King MB, Whipple RH, Gruman CA, Judge JO, Schmidt JA, & Wolfson LI. (2002). The performance enhancement project: Improving physical performance in older persons. Archives of Physical Medicine & Rehabilitation, 83(8), 1060-1069.

Klein, D. A., Stone, W. J., Phillips, W. T., Gangi, J., & Hartman, S. (Oct 2002). PNF training and physical function in assisted-living older adults. Journal of Aging and Physical Activity, 10(4), 476-488.

Kobayashi, R., Nakadaira, H., Ishigami, K., Muto, K., Anesaki, S., & Yamamoto, M. (2006). Effects of physical exercise on fall risk factors in elderly at home in intervention trial. Environmental Health and Preventive Medicine, 11(5), 250-255.

Kolbe-Alexander TL, Lambert EV, & Charlton KE. (2006). Effectiveness of a community based low intensity exercise program for older adults. Journal of Nutrition, Health & Aging, 10(1), 21-29.

Kovacs E, Prokai L, Meszaros L, & Gondos T. (2013). Adapted physical activity is beneficial on balance, functional mobility, quality of life and fall risk in community-dwelling older women: A randomized single-blinded controlled trial. European Journal of Physical & Rehabilitation Medicine, 49(3), 301-310.

Kovacs E, Sztruhar Jonasne I, Karoczi CK, Korpos A, & Gondos T. (2013). Effects of a multimodal exercise program on balance, functional mobility and fall risk in older adults with cognitive impairment: A randomized controlled single-blind study. European Journal of Physical & Rehabilitation Medicine, 49(5), 639-648.

Krebs DE, Jette AM, & Assmann SF. (1998). Moderate exercise improves gait stability in disabled elders. Archives of Physical Medicine & Rehabilitation, 79(12), 1489-1495.

Krebs, D. E., Scarborough, D. M., & McGibbon, C. A. (2007). Functional vs. strength training in disabled elderly outpatients. American Journal of Physical Medicine and Rehabilitation, 86(2), 93-103.

Krist L, Dimeo F, & Keil T. (2013). Can progressive resistance training twice a week improve mobility, muscle strength, and quality of life in very elderly nursing-home residents with impaired mobility? A pilot study. Clinical Interventions in Aging, 8, 443-448.

Kudelka, C. (2014). Effects of cognitive training with and without aerobic exercise on cognitively demanding everyday activities. Psychology and Aging, 29(3), 717-730.

Kutner NG, Barnhart H, Wolf SL, McNeely E, & Xu T. (1997). Self-report benefits of tai chi practice by older adults. Journals of Gerontology Series B-Psychological Sciences & Social Sciences, 52(5), P242-6.

Kwok TC, Lam KC, Wong PS, Chau WW, Yuen KS, Ting KT, et al. (2011). Effectiveness of coordination exercise in improving cognitive function in older adults: A prospective study. Clinical Interventions in Aging, 6, 261-267.

Kwok TM, & Tong CY. (2014). Effects on centre-based training and home-based training on physical function, quality of life and fall incidence in community dwelling older adults. Physiotherapy Theory & Practice, 30(4), 243-248.

Kyrdalen, I. L., Moen, K., Røysland, A. S., & Helbostad, J. L. (2014). The otago exercise program performed as group training versus home training in fall-prone older people: A randomized controlled trial. Physiotherapy Research International, 19(2), 108-116.

Lam LC, Chau RC, Wong BM, Fung AW, Lui VW, Tam CC, et al. (2011). Interim follow-up of a randomized controlled trial comparing Chinese style mind body (tai chi) and stretching exercises on cognitive function in subjects at risk of progressive cognitive decline. International Journal of Geriatric Psychiatry, 26(7), 733-740.

Lam LC, Chau RC, Wong BM, Fung AW, Tam CW, Leung GT, et al. (2012). A 1-year randomized controlled trial comparing mind body exercise (tai chi) with stretching and toning exercise on cognitive function in older Chinese adults at risk of cognitive decline. Journal of the American Medical Directors Association, 13(6), 568.e15-568.e20.

Langlois F, Vu TT, Chasse K, Dupuis G, Kergoat MJ, & Bherer L. (2013). Benefits of physical exercise training on cognition and quality of life in frail older adults. Journals of Gerontology Series B-Psychological Sciences & Social Sciences, 68(3), 400-404.

Lautenschlager NT, Cox KL, Flicker L, Foster JK, van Bockxmeer FM, Xiao J, et al. (2008). Effect of physical activity on cognitive function in older adults at risk for alzheimer disease: A randomized trial. Jama, 300(9), 1027-1037.

Law LL, Barnett F, Yau MK, & Gray MA. (2013). Development and initial testing of functional task exercise on older adults with cognitive impairment at risk of alzheimer's disease--FcTSim programme--a feasibility study. Occupational Therapy International, 20(4), 185-197.

Law, L. L. F., Barnett, F., Yau, M. K., & Gray, M. A. (2014). Effects of functional tasks exercise on older adults with cognitive impairment at risk of alzheimer's disease: A randomised controlled trial. Age and Ageing, 43(6), 813-820.

Lazowski DA, Ecclestone NA, Myers AM, Paterson DH, Tudor-Locke C, Fitzgerald C, et al. (1999). A randomized outcome evaluation of group exercise programs in long-term care institutions. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 54(12), M621-8.

Lee HJ, Park HJ, Chae Y, Kim SY, Kim SN, Kim ST, et al. (2009). Tai chi qigong for the quality of life of patients with knee osteoarthritis: A pilot, randomized, waiting list controlled trial. Clinical Rehabilitation, 23(6), 504-511.

Lee LY, Lee DT, & Woo J. (2007). Effect of tai chi on state self-esteem and health-related quality of life in older Chinese residential care home residents. Journal of Clinical Nursing, 16(8), 1580-1582.

Lee, H. Chang, K. Tsauo, J. Hung, J. Huang, Y. & Lin, S. (2013). Effects of a multifactorial fall prevention program on fall incidence and physical function in community-dwelling older adults with risk of falls. Archives of Physical Medicine and Rehabilitation, 94(4), 606-615.

Legault, C., Jennings, J. M., Katula, J. A., Dagenbach, D., Gaussoin, S. A., Sink, K. M., et al. (2011). Designing clinical trials for assessing the effects of cognitive training and physical activity interventions on cognitive outcomes: The seniors health and activity research program pilot (SHARP-P) study, a randomized controlled trial. BMC Geriatrics, 11, 27.

Leng CH, & Wang JD. (2013). Long term determinants of functional decline of mobility: An 11-year follow-up of 5464 adults of late middle aged and elderly. Archives of Gerontology & Geriatrics, 57(2), 215-220.

Li F, Harmer P, Liu Y, & Chou LS. (2014). Tai ji quan and global cognitive function in older adults with cognitive impairment: A pilot study. Archives of Gerontology & Geriatrics, 58(3), 434-439.

Li F, Harmer P, McAuley E, Duncan TE, Duncan SC, Chaumeton N, et al. (2001). An evaluation of the effects of tai chi exercise on physical function among older persons: A randomized controlled trial. Annals of Behavioral Medicine, 23(2), 139-146.

Li F, Harmer P, McAuley E, Fisher KJ, Duncan TE, & Duncan SC. (2001). Tai chi, self-efficacy, and physical function in the elderly. Prevention Science, 2(4), 229-239.

Li, F. (2014). The effects of tai ji quan training on limits of stability in older adults. Clinical Interventions in Aging, 9, 1261-1268.

LIFE Study Investigators, Pahor M, Blair SN, Espeland M, Fielding R, Gill TM, et al. (2006). Effects of a physical activity intervention on measures of physical performance: Results of the lifestyle interventions and independence for elders pilot (LIFE-P) study. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 61(11), 1157-1165.

Lihavainen K, Sipila S, Rantanen T, Seppanen J, Lavikainen P, Sulkava R, et al. (2012). Effects of comprehensive geriatric intervention on physical performance among people aged 75 years and over. Aging-Clinical & Experimental Research, 24(4), 331-338.

Lim YM, & Hong GR. (2010). Effect of 16-week kouk-sun-do exercise on physical fitness, emotional state, and immunoglobulin: A in community-dwelling elders in Korea. Applied Nursing Research, 23(2), 91-100.Lin MR, Wolf SL, Hwang HF, Gong SY, &

Chen CY. (2007). A randomized, controlled trial of fall prevention programs and quality of life in older fallers. Journal of the American Geriatrics Society, 55(4), 499-506.

Linde, K., & Alfermann, D. (Jul 2014). Single versus combined cognitive and physical activity effects on fluid cognitive abilities of healthy older adults: A 4-month randomized controlled trial with follow-up. Journal of Aging and Physical Activity, 22(3), 302-313.

Littbrand H, Lundin-Olsson L, Gustafson Y, & Rosendahl E. (2009). The effect of a high-intensity functional exercise program on activities of daily living: A randomized controlled trial in residential care facilities. Journal of the American Geriatrics Society, 57(10), 1741-1749.

Liu-Ambrose, T., Nagamatsu, L. S., Graf, P., Beattie, B. L., Ashe, M. C., & Handy, T. C. (2010). Resistance training and executive functions: A 12-month randomized controlled trial. Archives of Internal Medicine, 170(2), 170-178.

Logsdon RG, McCurry SM, Pike KC, & Teri L. (2009). Making physical activity accessible to older adults with memory loss: A feasibility study. Gerontologist, 49(Suppl 1), S94-9.

Lord SR, Castell S, Corcoran J, Dayhew J, Matters B, Shan A, et al. (2003). The effect of group exercise on physical functioning and falls in frail older people living in retirement villages: A randomized, controlled trial. Journal of the American Geriatrics Society, 51(12), 1685-1692.

Lord SR, Ward JA, Williams P, & Zivanovic E. (1996). The effects of a community exercise program on fracture risk factors in older women. Osteoporosis International, 6(5), 361-367.

Lord, S. R., Matters, B., St. George, R., Thomas, M., Bindon, J., Chan, D. K., et al. (2006). The effects of water exercise on physical functioning in older people. Australasian Journal on Ageing, 25(1), 36-41.

Lorenz RA, Gooneratne N, Cole CS, Kleban MH, Kalra GK, & Richards KC. (2012). Exercise and social activity improve everyday function in long-term care residents. American Journal of Geriatric Psychiatry, 20(6), 468-476.

Lu, X., Hui-Chan, C. W. Y., & Tsang, W. W. N. (2013). Tai chi, arterial compliance, and muscle strength in older adults. European Journal of Preventive Cardiology, 20(4), 613-619.

MacRae PG, Asplund LA, Schnelle JF, Ouslander JG, Abrahamse A, & Morris C. (1996). A walking program for nursing home residents: Effects on walk endurance, physical activity, mobility, and quality of life. Journal of the American Geriatrics Society, 44(2), 175-180.

Madureira, M. M., Bonfa, E., Takayama, L., & Pereira, R. M. R. (2010). A 12-month randomized controlled trial of balance training in elderly women with osteoporosis: Improvement of quality of life. Maturitas, 66(2), 206-211.

Madureira, M. M., Takayama, L., Gallinaro, A. L., Caparbo, V. F., Costa, R. A., & Pereira, R. M. R. (2007). Balance training program is highly effective in improving functional status and reducing the risk of falls in elderly women with osteoporosis: A randomized controlled trial. Osteoporosis International, 18(4), 419-425.

Maki Y, Ura C, Yamaguchi T, Murai T, Isahai M, Kaiho A, et al. (2012). Effects of intervention using a community-based walking program for prevention of mental decline: A randomized controlled trial. Journal of the American Geriatrics Society, 60(3), 505-510.

Makizako H, Doi T, Shimada H, Yoshida D, Tsutsumimoto K, Uemura K, et al. (2012). Does a multicomponent exercise program improve dual-task performance in amnestic mild cognitive impairment? A randomized controlled trial. Aging-Clinical & Experimental Research, 24(6), 640-646.

Mangione KK, McCully K, Gloviak A, Lefebvre I, Hofmann M, & Craik R. (1999). The effects of high-intensity and low-intensity cycle ergometry in older adults with knee osteoarthritis. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 54(4), M184-90.

Manini TM, Newman AB, Fielding R, Blair SN, Perri MG, Anton SD, et al. (2010). Effects of exercise on mobility in obese and nonobese older adults. Obesity, 18(6), 1168-1175.

Marmeleira, J. F., Godinho, M. B., & Fernandes, O. M. (2009). The effects of an exercise program on several abilities associated with driving performance in older adults. Accident; Analysis and Prevention, 41(1), 90-97.

Marques EA, Wanderley F, Machado L, Sousa F, Viana JL, Moreira-Goncalves D, et al. (2011). Effects of resistance and aerobic exercise on physical function, bone mineral density, OPG and RANKL in older women. Experimental Gerontology, 46(7), 524-532.

Marsh AP, Chmelo EA, Katula JA, Mihalko SL, & Rejeski WJ. (2009). Should physical activity programs be tailored when older adults have compromised function?. Journal of Aging & Physical Activity, 17(3), 294-306.

Martin, K., Fontaine, K. R., Nicklas, B. J., Dennis, K. E., Goldberg, A. P., & Hochberg, M. C. (2001). Weight loss and exercise walking reduce pain and improve physical functioning in overweight postmenopausal women with knee osteoarthritis. Journal of Clinical Rheumatology, 7(4), 219-223.

Maughan KK, Lowry KA, Franke WD, & Smiley-Oyen AL. (2012). The dose-response relationship of balance training in physically active older adults. Journal of Aging & Physical Activity, 20(4), 442-455.

McDaniel MA, Binder EF, Bugg JM, Waldum ER, Dufault C, Meyer A, et al. (2014). Effects of cognitive training with and without aerobic exercise on cognitively demanding everyday activities. Psychology & Aging, 29(3), 717-730.

McMurdo, M. E. T., & Johnstone, R. (1995). A randomized controlled trial of a home exercise programme for elderly people with poor mobility. Age and Ageing, 24(5), 425-428.

Messier SP, Loeser RF, Miller GD, Morgan TM, Rejeski WJ, Sevick MA, et al. (2004). Exercise and dietary weight loss in overweight and obese older adults with knee osteoarthritis: The arthritis, diet, and activity promotion trial. Arthritis & Rheumatism, 50(5), 1501-1510.

Messier SP, Loeser RF, Mitchell MN, Valle G, Morgan TP, Rejeski WJ, et al. (2000). Exercise and weight loss in obese older adults with knee osteoarthritis: A preliminary study. Journal of the American Geriatrics Society, 48(9), 1062-1072.

Messier, S. P., Thompson, C. D., Ettinger, J., & W.H. (1997). Effects of long-term aerobic or weight training regimens on gait in an older, osteoarthritic population. Journal of Applied Biomechanics, 13(2), 205-225.

Meuleman, J. R., Brechue, W. F., Kubilis, P. S., & Lowenthal, D. T. (2000). Exercise training in the debilitated aged: Strength and functional outcomes. Archives of Physical Medicine & Rehabilitation, 81(3), 312-318.

Mezzaroba, P. V., & Prati, A. R. C. (2012). Influence of strength training on variables related to elderly autonomy. [Influencia do treinamento de forca sobre variaveis relacionadas a autonomia de idosos.] Acta Scientiarum - Health Sciences, 34(2), 157-162.

Mian, O. S., Thom, J. M., Ardigo, L. P., Morse, C. I., Narici, M. V., & Minetti, A. E. (2007). Effect of a 12-month physical conditioning programme on the metabolic cost of walking in healthy older adults. European Journal of Applied Physiology, 100(5), 499-505.

Mihalko, S. L., & McAuley, E. (1996). Strength training effects on subjective well-being and physical function in the elderly. Journal of Aging & Physical Activity, 4(1), 56-68.

Miller LA, Spitznagel MB, Busko S, Potter V, Juvancic-Heltzel J, Istenes N, et al. (2011). Structured exercise does not stabilize cognitive function in individuals with mild cognitive impairment residing in a structured living facility. International Journal of Neuroscience, 121(4), 218-223.

Misic MM, Valentine RJ, Rosengren KS, Woods JA, & Evans EM. (2009). Impact of training modality on strength and physical function in older adults. Gerontology, 55(4), 411-416.

Miszko TA, Cress ME, Slade JM, Covey CJ, Agrawal SK, & Doerr CE. (2003). Effect of strength and power training on physical function in community-dwelling older adults. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 58(2), 171-175.

Morey MC, & Zhu CW. (2003). Improved fitness narrows the symptom-reporting gap between older men and women. Journal of Women's Health, 12(4), 381-390.

Morey MC, Peterson MJ, Pieper CF, Sloane R, Crowley GM, Cowper PA, et al. (2009). The veterans learning to improve fitness and function in elders study: A randomized trial of primary care-based physical activity counselling for older men. Journal of the American Geriatrics Society, 57(7), 1166-1174.

Muscari A, Giannoni C, Pierpaoli L, Berzigotti A, Maietta P, Foschi E, et al. (2010). Chronic endurance exercise training prevents aging-related cognitive decline in healthy older adults: A randomized controlled trial. International Journal of Geriatric Psychiatry, 25(10), 1055-1064.

Nagamatsu, L. S., Chan, A., Davis, J. C., Beattie, B. L., Graf, P., Voss, M. W., et al. (2013). Physical activity improves verbal and spatial memory in older adults with probable mild cognitive impairment: A 6-month randomized controlled trial. Journal of Aging Research, 2013

Nakamura Y, Tanaka K, Yabushita N, Sakai T, & Shigematsu R. (2007). Effects of exercise frequency on functional fitness in older adult women. Archives of Gerontology & Geriatrics, 44(2), 163-173.

Nascimento CM, Pereira JR, Pires de Andrade L, Garuffi M, Ayan C, Kerr DS, et al. (2015). Physical exercise improves peripheral BDNF levels and cognitive functions in mild cognitive impairment elderly with different bdnf Val66Met genotypes. Journal of Alzheimer's Disease, 43(1), 81-91.

Naylor, E., Penev, P. D., Orbeta, L., Janssen, I., Ortiz, R., Colecchia, E. F., et al. (2000). Daily social and physical activity increases slow-wave sleep and daytime neuropsychological performance in the elderly. Sleep, 23(1), 87-95.

Nelson ME, Layne JE, Bernstein MJ, Nuernberger A, Castaneda C, Kaliton D, et al. (2004). The effects of multidimensional home-based exercise on functional performance in elderly people. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 59(2), 154-160.

Nguyen, M. H., & Kruse, A. (2012). A randomized controlled trial of tai chi for balance, sleep quality and cognitive performance in elderly Vietnamese. Clinical Interventions in Aging, 7, 185-190.

Ni GX, Song L, Yu B, Huang CH, & Lin JH. (2010). Tai chi improves physical function in older Chinese women with knee osteoarthritis. JCR: Journal of Clinical Rheumatology, 16(2), 64-67.

Nosek MA, Hughes RB, Robinson-Whelen S, Taylor HB, & Howland CA. (2006). Physical activity and nutritional behaviours of women with physical disabilities: Physical, psychological, social, and environmental influences. Womens Health Issues, 16(6), 323-333.

Nowalk MP, Prendergast JM, Bayles CM, D'Amico FJ, & Colvin GC. (2001). A randomized trial of exercise programs among older individuals living in two long-term care facilities: The FallsFREE program. Journal of the American Geriatrics Society, 49(7), 859-865.

Ohtake M, Morikagi Y, Suzuki I, Kanoya Y, & Sato C. (2013). Effects of exercise on the prevention of conditions leading to the need for long-term care. Aging-Clinical & Experimental Research, 25(1), 49-57.

Oida Y, Kitabatake Y, Nishijima Y, Nagamatsu T, Kohno H, Egawa K, et al. (2003). Effects of a 5-year exercise-centered health-promoting programme on mortality and ADL impairment in the elderly. Age & Ageing, 32(6), 585-592.

Ouyang P, Yatsuya H, Toyoshima H, Otsuka R, Wada K, Matsushita K, et al. (2009). Changes in activities of daily living, physical fitness, and depressive symptoms after six-month periodic well-rounded exercise programs for older adults living in nursing homes or special nursing facilities. Nagoya Journal of Medical Science, 71(3-4), 115-126.

Pahor M, Guralnik JM, Ambrosius WT, Blair S, Bonds DE, Church TS, et al. (2014). Effect of structured physical activity on prevention of major mobility disability in older adults: The LIFE study randomized clinical trial. Jama, 311(23), 2387-2396.

Pahor, M., Blair, S. N., Espeland, M., Fielding, R., Gill, T. M., Guralnik, J. M., et al. (2006). Effects of a physical activity intervention on measures of physical performance: Results of the lifestyle interventions and independence for elders pilot (LIFE-P) study. Journals of Gerontology - Series A Biological Sciences and Medical Sciences, 61(11), 1157-1165.

Penninx BW, Messier SP, Rejeski WJ, Williamson JD, DiBari M, Cavazzini C, et al. (2001). Physical exercise and the prevention of disability in activities of daily living in older persons with osteoarthritis. Archives of Internal Medicine, 161(19), 2309-2316.

Peri, K., Kerse, N., Robinson, E., Parsons, M., Parsons, J., & Latham, N. (2008). Does functionally based activity make a difference to health status and mobility? A randomised controlled trial in residential care facilities (the promoting independent living study; PILS). Age and Ageing, 37(1), 57-63.

Pernambuco CS, Borba-Pinheiro CJ, Vale RG, Di Masi F, Monteiro PK, & Dantas EH. (2013). Functional autonomy, bone mineral density (BMD) and serum osteocalcin levels in older female participants of an aquatic exercise program (AAG). Archives of Gerontology & Geriatrics, 56(3), 466-471.

Perrig-Chiello, P., Perrig, W. J., Ehrsam, R., Staehelin, H. B., & Krings, F. (1998). The effects of resistance training on well-being and memory in elderly volunteers. Age and Ageing, 27(4), 469-475.

Perula LA, Varas-Fabra F, Rodriguez V, Ruiz-Moral R, Fernandez JA, Gonzalez J, et al. (2012). Effectiveness of a multifactorial intervention program to reduce falls incidence among community-living older adults: A randomized controlled trial. Archives of Physical Medicine & Rehabilitation, 93(10), 1677-1684.

Petrella RJ, & Bartha C. (2000). Home based exercise therapy for older patients with knee osteoarthritis: A randomized clinical trial. Journal of Rheumatology, 27(9), 2215-2221.

Petrofsky, J. S., Cuneo, M., Dial, R., Pawley, A. K., & Hill, J. (2005). Core strengthening and balance in the geriatric population. Journal of Applied Research, 5(3), 423-433.

Phillips, W. T., Broman, T. E., Burkett, L. N., & Swann, P. D. (2003). Single set strength training increases strength, endurance and functional fitness in community living older adults. Activities, Adaptation & Aging, 27(3), 1-18.

Pieramico V, Esposito R, Sensi F, Cilli F, Mantini D, Mattei PA, et al. (2012). Combination training in aging individuals modifies functional connectivity and cognition, and is potentially affected by dopamine-related genes. PLoS ONE [Electronic Resource], 7(8), e43901.

Pluchino A, Lee SY, Asfour S, Roos BA, & Signorile JF. (2012). Pilot study comparing changes in postural control after training using a video game balance board program and 2 standard activity-based balance intervention programs. Archives of Physical Medicine & Rehabilitation, 93(7), 1138-1146.

Pollock RD, Martin FC, & Newham DJ. (2012). Whole-body vibration in addition to strength and balance exercise for falls-related functional mobility of frail older adults: A single-blind randomized controlled trial.Clinical Rehabilitation, 26(10), 915-923.

Protas EJ, & Tissier S. (2009). Strength and speed training for elders with mobility disability. Journal of Aging & Physical Activity, 17(3), 257-271.

Rabaglietti, E., Liubicich, M. E., & Ciairano, S. (2011). Gender differences in the relationships between physical activity and the psychological and physical self-reported condition of the elderly in a residential care facility. Psychology, 2(1), 35-41.

Rabelo, H. T., Oliveira, R. J., & Bottaro, M. (2004). Effects of resistance training on activities of daily living in older women. Biology of Sport, 21(4), 325-336.

Ramsbottom R, Ambler A, Potter J, Jordan B, Nevill A, & Williams C. (2004). The effect of 6 months training on leg power, balance, and functional mobility of independently living adults over 70 years old. Journal of Aging & Physical Activity, 12(4), 497-510.

Reid KF, Callahan DM, Carabello RJ, Phillips EM, Frontera WR, & Fielding RA. (2008). Lower extremity power training in elderly subjects with mobility limitations: A randomized controlled trial. Aging-Clinical & Experimental Research, 20(4), 337-343.

Resnick B, Luisi D, & Vogel A. (2008). Testing the senior exercise self-efficacy project (2008) for use with urban dwelling minority older adults. Public Health Nursing, 25(3), 221-234.

Ribeiro Ados S, & Pereira JS. (2005). Balance improvement and reduction of likelihood of falls in older women after cawthorne and cooksey exercises. Revista Brasileira De Otorrinolaringologia, 71(1), 38-46.

Ribeiro, F., Teixeira, F., Brochado, G., & Oliveira, J. (2009). Impact of low cost strength training of dorsi- and plantar flexors on balance and functional mobility in institutionalized elderly people. Geriatrics and Gerontology International, 9(1), 75-80.

Rogers CE, Nseir S, & Keller C. (2013). Sign chi do and physical function: A pilot study. Geriatric Nursing, 34(1), 12-18.

Rogers ME, Sherwood HS, Rogers NL, & Bohlken RM. (2002). Effects of dumbbell and elastic band training on physical function in older inner-city african-american women. Women & Health, 36(4), 33-41.

Roma MF, Busse AL, Betoni RA, Melo AC, Kong J, Santarem JM, et al. (2013). Effects of resistance training and aerobic exercise in elderly people concerning physical fitness and ability: A prospective clinical trial. Einstein, 11(2), 153-157.

Rosenberg DE, Kerr J, Sallis JF, Norman GJ, Calfas K, & Patrick K. (2012). Promoting walking among older adults living in retirement communities. Journal of Aging & Physical Activity, 20(3), 379-394.

Rosenberg, D., Kerr, J., Sallis, J. F., Patrick, K., Moore, D. J., & King, A. (2009). Feasibility and outcomes of a multilevel place-based walking intervention for seniors: A pilot study. Health and Place, 15(1), 173-179.

Rosendahl E, Lindelof N, Littbrand H, Yifter-Lindgren E, Lundin-Olsson L, Haglin L, et al. (2006). High-intensity functional exercise program and protein-enriched energy supplement for older persons dependent in activities of daily living: A randomised controlled trial. Australian Journal of Physiotherapy, 52(2), 105-113.

Rosie J, & Taylor D. (2007). Sit-to-stand as home exercise for mobility-limited adults over 80 years of age--GrandStand system may keep you standing?. Age & Ageing, 36(5), 555-562.

Ross MC, Bohannon AS, Davis DC, & Gurchiek L. (1999). The effects of a short-term exercise program on movement, pain, and mood in the elderly: results of a pilot study. Journal of Holistic Nursing, 17(2), 139-147.

Ruscheweyh, R., Willemer, C., Kruger, K., Duning, T., Warnecke, T., Sommer, J., et al. (2011). Physical activity and memory functions: An interventional study. Neurobiology of Aging, 32(7), 1304-1319.

Rydwik E, Frandin K, & Akner G. (2010). Effects of a physical training and nutritional intervention program in frail elderly people regarding habitual physical activity level and activities of daily living--a randomized controlled pilot study. Archives of Gerontology & Geriatrics, 51(3), 283-289.

Rydwik E, Lammes E, Frandin K, & Akner G. (2008). Effects of a physical and nutritional intervention program for frail elderly people over age 75. A randomized controlled pilot treatment trial. Aging-Clinical & Experimental Research, 20(2), 159-170.

Sakamoto, K., Endo, N., Harada, A., Sakada, T., Tsushita, K., Kita, K., et al. (2013). Why not use your own body weight to prevent falls? A randomized, controlled trial of balance therapy to prevent falls and fractures for elderly people who can stand on one leg for <15 s. Journal of Orthopaedic Science, 18(1), 110-120.

Sakiyama Y, & Sakuma H. (2005). A field study of step-up exercises with touch for elderly people. Perceptual & Motor Skills, 101(3), 835-839.

Sakurai R, Yasunaga M, Saito K, Fukaya T, Kim MJ, Tsunoda N, et al. (2013). Effects of a comprehensive intervention program, including hot bathing, on physical function in community-dwelling healthy older adults: A pilot randomized controlled trial. Aging-Clinical & Experimental Research, 25(4), 453-461.

Salminen, M. J., Vahlberg, T. J., Salonoja, M. T., Aarnio, P. T. T., & Kivela, S. (2009). Effect of a risk-based multifactorial fall prevention program on the incidence of falls. Journal of the American Geriatrics Society, 57(4), 612-619.

Salminen, M., Vahlberg, T., Sihvonen, S., Piirtola, M., Isoaho, R., Aarnio, P., et al. (2008). Effects of risk-based multifactorial fall prevention program on maximal isometric muscle strength in community-dwelling aged: A randomized controlled trial. Aging Clinical and Experimental Research, 20(5), 487-493.

Sarkisian CA, Prohaska TR, Davis C, & Weiner B. (2007). Pilot test of an attribution retraining intervention to raise walking levels in sedentary older adults. Journal of the American Geriatrics Society, 55(11), 1842-1846.

Sasai H, Matsuo T, Numao S, Sakai T, Mochizuki M, Kuroda K, et al. (2010). Aotake: A modified stepping exercise as a useful means of improving lower-extremity functional fitness in older adults. Geriatrics & Gerontology International, 10(3), 244-250.

Sato D, Kaneda K, Wakabayashi H, & Nomura T. (2009). Comparison of 2-year effects of once and twice weekly water exercise on activities of daily living ability of community dwelling frail elderly. Archives of Gerontology & Geriatrics, 49(1), 123-128.

Sato D, Kaneda K, Wakabayashi H, & Nomura T. (2009). Comparison two-year effects of once-weekly and twice-weekly water exercise on health-related quality of life of community-dwelling frail elderly people at a day-service facility. Disability & Rehabilitation, 31(2), 84-93.

Satoh M, Ogawa J, Tokita T, Nakaguchi N, Nakao K, Kida H, et al. (2014). The effects of physical exercise with music on cognitive function of elderly people: Mihama-kiho project. PLoS ONE [Electronic Resource], 9(4), e95230.

Scherder EJ, Van Paasschen J, Deijen JB, Van Der Knokke S, Orlebeke JF, Burgers I, et al. (2005). Physical activity and executive functions in the elderly with mild cognitive impairment. Aging & Mental Health, 9(3), 272-280.

Schilke JM, Johnson GO, Housh TJ, & O'Dell JR. (1996). Effects of muscle-strength training on the functional status of patients with osteoarthritis of the knee joint. Nursing Research, 45(2), 68-72.

Schoenfelder DP, & Rubenstein LM. (2004). An exercise program to improve fall-related outcomes in elderly nursing home residents. Applied Nursing Research, 17(1), 21-31.

Seco J, Abecia LC, Echevarria E, Barbero I, Torres-Unda J, Rodriguez V, et al. (2013). A long-term physical activity training program increases strength and flexibility, and improves balance in older adults. Rehabilitation Nursing Journal, 38(1), 37-47.

Shatil, E. (2013). Does combined cognitive training and physical activity training enhance cognitive abilities more than either alone? A four-condition randomized controlled trial among healthy older adults. Frontiers in Aging Neuroscience, 5 Mar, Art 8-12.

Sherrington C, Pamphlett PI, Jacka JA, Olivetti LM, Nugent JA, Hall JM, et al. (2008). Group exercise can improve participants' mobility in an outpatient rehabilitation setting: A randomized controlled trial. Clinical Rehabilitation, 22(6), 493-502.

Sherrington, C., Lord, S. R., Vogler, C. M., Close, J. C. T., Howard, K., Dean, C. M., et al. (2014). A post-hospital home exercise program improved mobility but increased falls in older people: A randomised controlled trial. Plos One, 9 (9):e104412.

Shigematsu, R., Okura, T., Nakagaichi, M., Tanaka, K., Sakai, T., Kitazumi, S., et al. (2008). Square-stepping exercise and fall risk factors in older adults: A single-blind, randomized controlled trial. Journals of Gerontology - Series A Biological Sciences and Medical Sciences, 63(1), 76-82.

Shin, Y. (1999). The effects of a walking exercise program on physical function and emotional state of elderly Korean women. Public Health Nursing, 16(2), 146-154.

Silsupadol P, Lugade V, Shumway-Cook A, van Donkelaar P, Chou LS, Mayr U, et al. (2009). Training-related changes in dual-task walking performance of elderly persons with balance impairment: A double-blind, randomized controlled trial. Gait & Posture, 29(4), 634-639.

Simao AP, Avelar NC, Tossige-Gomes R, Neves CD, Mendonca VA, Miranda AS, et al. (2012). Functional performance and inflammatory cytokines after squat exercises and whole-body vibration in elderly individuals with knee osteoarthritis. Archives of Physical Medicine & Rehabilitation, 93(10), 1692-1700.

Simons, R., & Andel, R. (2006). The effects of resistance training and walking on functional fitness in advanced old age. Journal of Aging and Health, 18(1), 91-105.

Sjosten NM, Salonoja M, Piirtola M, Vahlberg TJ, Isoaho R, Hyttinen HK, et al. (2007). A multifactorial fall prevention programme in the community-dwelling aged: Predictors of adherence. European Journal of Public Health, 17(5), 464-470.

Skelton DA, Young A, Greig CA, & Malbut KE. (1995). Effects of resistance training on strength, power, and selected functional abilities of women aged 75 and older. Journal of the American Geriatrics Society, 43(10), 1081-1087.

Skelton, D. A., & McLaughlin, A. W. (1996). Training functional ability in old age. Physiotherapy, 82(3), 159-167.

Smee, D. J., Berry, H. L., Waddington, G. S., & Anson, J. M. (2014). A balance-specific exercise intervention improves falls risk but not total physical functionality in community-dwelling older adults. Physical & Occupational Therapy in Geriatrics, 32(4), 310-320.

Smith JC, Nielson KA, Antuono P, Lyons JA, Hanson RJ, Butts AM, et al. (2013). Semantic memory functional MRI and cognitive function after exercise intervention in mild cognitive impairment. Journal of Alzheimer's Disease, 37(1), 197-215.

Song R, June KJ, Kim CG, & Jeon MY. (2004). Comparisons of motivation, health behaviours, and functional status among elders in residential homes in Korea. Public Health Nursing, 21(4), 361-371.

Song R, Lee EO, Lam P, & Bae SC. (2003). Effects of tai chi exercise on pain, balance, muscle strength, and perceived difficulties in physical functioning in older women with osteoarthritis: A randomized clinical trial. Journal of Rheumatology, 30(9), 2039-2044.

Song R, Roberts BL, Lee EO, Lam P, & Bae SC. (2010). A randomized study of the effects of tai chi on muscle strength, bone mineral density, and fear of falling in women with osteoarthritis. Journal of Alternative & Complementary Medicine, 16(3), 227-233.

Stiggelbout M, Popkema DY, Hopman-Rock M, de Greef M, & van Mechelen W. (2004). Once a week is not enough: Effects of a widely implemented group based exercise programme for older adults; a randomised controlled trial. Journal of Epidemiology & Community Health, 58(2), 83-88.

Stolee P, Zaza C, & Schuehlein S. (2012). Evaluation of a volunteer-led in-home exercise program for home-bound older adults. Work, 41(3), 339-354.

Strasser, B., Keinrad, M., Haber, P., & Schobersberger, W. (2009). Efficacy of systematic endurance and resistance training on muscle strength and endurance performance in elderly adults - A randomized controlled trial. Wiener Klinische Wochenschrift, 121(23-24), 757-764.

Studenski S, Perera S, Hile E, Keller V, Spadola-Bogard J, & Garcia J. (2010). Interactive video dance games for healthy older adults. Journal of Nutrition, Health & Aging, 14(10), 850-852.

Sugimoto H, Demura S, Nagasawa Y, & Shimomura M. (2014). Changes in the physical functions of pre-frail elderly women after participation in a 1-year preventative exercise program. Geriatrics & Gerontology International, 14(4), 975-982.

Suksom D, Siripatt A, Lapo P, & Patumraj S. (2011). Effects of two modes of exercise on physical fitness and endothelial function in the elderly: Exercise with a flexible stick versus tai chi. Journal of the Medical Association of Thailand, 94(1), 123-132.

Sullivan T, Allegrante JP, Peterson MG, Kovar PA, & MacKenzie CR. (1998). One-year follow up of patients with osteoarthritis of the knee who participated in a program of supervised fitness walking and supportive patient education. Arthritis Care & Research, 11(4), 228-233.

Sung, K. (2009). The effects of 16-week group exercise program on physical function and mental health of elderly Korean women in long-term assisted living facility. Journal of Cardiovascular Nursing, 24(5), 344-351.

Suomi R, & Collier D. (2003). Effects of arthritis exercise programs on functional fitness and perceived activities of daily living measures in older adults with arthritis. Archives of Physical Medicine & Rehabilitation, 84(11), 1589-1594.

Suzuki T, Shimada H, Makizako H, Doi T, Yoshida D, Ito K, et al. (2013). A randomized controlled trial of multicomponent exercise in older adults with mild cognitive impairment. PLoS ONE [Electronic Resource], 8(4), e61483.

Suzuki T, Shimada H, Makizako H, Doi T, Yoshida D, Tsutsumimoto K, et al. (2012). Effects of multicomponent exercise on cognitive function in older adults with amnestic mild cognitive impairment: A randomized controlled trial. BMC Neurology, 12, 128.

Suzuki, T., Kim, H., Yoshida, H., & Ishizaki, T. (2004). Randomized controlled trial of exercise intervention for the prevention of falls in community-dwelling elderly Japanese women. Journal of Bone and Mineral Metabolism, 22(6), 602-611.

Symons TB, Vandervoort AA, Rice CL, Overend TJ, & Marsh GD. (2005). Effects of maximal isometric and isokinetic resistance training on strength and functional mobility in older adults. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 60(6), 777-781.

Taggart, H. M. (2002). Effects of tai chi exercise on balance, functional mobility, and fear of falling among older women. Applied Nursing Research, 15(4), 235-242.

Taguchi N, Higaki Y, Inoue S, Kimura H, & Tanaka K. (2010). Effects of a 12-month multicomponent exercise program on physical performance, daily physical activity, and quality of life in very elderly people with minor disabilities: An intervention study. Journal of Epidemiology, 20(1), 21-29.

Tamari, K. (2011). Self-reported home exercise and younger age predict improved health-related quality of life among community-dwelling elderly participants in a three-month group exercise class. Journal of Physiological Anthropology, 30(2), 77-85.

Taylor L, Whittington F, Hollingsworth C, Ball M, King S, Patterson V, et al. (2003). Assessing the effectiveness of a walking program on physical function of residents living in an assisted living facility. Journal of Community Health Nursing, 20(1), 15-26.

Taylor-Piliae RE, Newell KA, Cherin R, Lee MJ, King AC, & Haskell WL. (2010). Effects of tai chi and western exercise on physical and cognitive functioning in healthy community-dwelling older adults. Journal of Aging & Physical Activity, 18(3), 261-279.

Teixeira, C. V. L., Gobbi, S., Pereira, J. R., Vital, T. M., Hernandez, S. S. S., Shigematsu, R., et al. (Sep 2013). Effects of square-stepping exercise on cognitive functions of older people. Psychogeriatrics, 13(3), 148-156.

Teut, M., Schnabel, K., Baur, R., Kerckhoff, A., Reese, F., Pilgram, N., et al. (2013). Effects and feasibility of an integrative medicine program for geriatric patients- A cluster-randomized pilot study. Clinical Interventions in Aging, 8, 953-961.

Theill, N., Schumacher, V., Adelsberger, R., Martin, M., & Jancke, L. J. (2013). Effects of simultaneously performed cognitive and physical training in older adults. BMC Neuroscience, 14 Sep, Art 103-14.

Thompson, C. J., Cobb, K. M., & Blackwell, J. (2007). Functional training improves club head speed and functional fitness in older golfers. Journal of Strength & Conditioning Research (Allen Press Publishing Services Inc.), 21(1), 131-137.

Tikkanen P, Lonnroos E, Sipila S, Nykanen I, Sulkava R, & Hartikainen S. (2013). Effects of comprehensive health assessment and targeted intervention on chair rise capacity in active and inactive community-dwelling older people. Gerontology, 59(4), 324-327.

Tomimoto, H. (2014). The effects of physical exercise with music on cognitive function of elderly people: Mihama-kiho project. PloS One, 9(4), e95230.

Topp R, Boardley D, Morgan AL, Fahlman M, & McNevin N. (2005). Exercise and functional tasks among adults who are functionally limited. Western Journal of Nursing Research, 27(3), 252-270.

Toraman NF, Erman A, & Agyar E. (2004). Effects of multicomponent training on functional fitness in older adults. Journal of Aging & Physical Activity, 12(4), 538-553.

Toto PE, Raina KD, Holm MB, Schlenk EA, Rubinstein EN, & Rogers JC. (2012). Outcomes of a multicomponent physical activity program for sedentary, community-dwelling older adults. Journal of Aging & Physical Activity, 20(3), 363-378.

Tsai PF, Chang JY, Beck C, Kuo YF, & Keefe FJ. (2013). A pilot cluster-randomized trial of a 20-week tai chi program in elders with cognitive impairment and osteoarthritic knee: Effects on pain and other health outcomes. Journal of Pain & Symptom Management, 45(4), 660-669.

Tsutsumi T, Don BM, Zaichkowsky LD, & Delizonna LL. (1997). Physical fitness and psychological benefits of strength training in community dwelling older adults. Applied Human Science, 16(6), 257-266.

Valentine-Garzon, M. A., Maynard, M., & Selznick, S. Z. (1992). ROM dance program effects on frail elderly women in an adult day-care center. Physical and Occupational Therapy in Geriatrics, 11(1), 63-83.

van Gool CH, Penninx BW, Kempen GI, Rejeski WJ, Miller GD, van Eijk JT, et al. (2005). Effects of exercise adherence on physical function among overweight older adults with knee osteoarthritis. Arthritis & Rheumatism, 53(1), 24-32.

van Uffelen JG, Chin A Paw MJ, Hopman-Rock M, & van Mechelen W. (2007). The effect of walking and vitamin B supplementation on quality of life in community-dwelling adults with mild cognitive impairment: A randomized, controlled trial. Quality of Life Research, 16(7), 1137-1146.

van Uffelen JG, Chinapaw MJ, Hopman-Rock M, & van Mechelen W. (2009). Feasibility and effectiveness of a walking program for community-dwelling older adults with mild cognitive impairment. Journal of Aging & Physical Activity, 17(4), 398-415.

van Uffelen JG, Chinapaw MJ, van Mechelen W, & Hopman-Rock M. (2008). Walking or vitamin B for cognition in older adults with mild cognitive impairment? A randomised controlled trial. British Journal of Sports Medicine, 42(5), 344-351.

Vaughan, S., Wallis, M., Polit, D., Steele, M., Shum, D., & Morris, N. (2014). The effects of multimodal exercise on cognitive and physical functioning and brain-derived neurotrophic factor in older women: A randomised controlled trial. Age and Ageing, 43(5), 623-629.

Vestergaard S, Kronborg C, & Puggaard L. (2008). Home-based video exercise intervention for community-dwelling frail older women: A randomized controlled trial. Aging-Clinical & Experimental Research, 20(5), 479-486.

Villareal DT, Chode S, Parimi N, Sinacore DR, Hilton T, Armamento-Villareal R, et al. (2011). Weight loss, exercise, or both and physical function in obese older adults. New England Journal of Medicine, 364(13), 1218-1229.

Wallace JI, Buchner DM, Grothaus L, Leveille S, Tyll L, LaCroix AZ, et al. (1998). Implementation and effectiveness of a community-based health promotion program for older adults. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 53(4), M301-6.

Weerdesteyn, V., Nienhuis, B., & Duysens, J. (2008). Exercise training can improve spatial characteristics of time-critical obstacle avoidance in elderly people. Human Movement Science, 27(5), 738-748.

Whitehurst MA, Johnson BL, Parker CM, Brown LE, & Ford AM. (2005). The benefits of a functional exercise circuit for older adults. Journal of Strength & Conditioning Research, 19(3), 647-651.

Wilcox S, Dowda M, Leviton LC, Bartlett-Prescott J, Bazzarre T, Campbell-Voytal K, et al. (2008). Active for life: Final results from the translation of two physical activity programs. American Journal of Preventive Medicine, 35(4), 340-351.

Williams P, & Lord SR. (1997). Effects of group exercise on cognitive functioning and mood in older women. Australian & New Zealand Journal of Public Health, 21(1), 45-52.

Williamson JD, Espeland M, Kritchevsky SB, Newman AB, King AC, Pahor M, et al. (2009). Changes in cognitive function in a randomized trial of physical activity: Results of the lifestyle interventions and independence for elders pilot study. Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 64(6), 688-694.

Wolf SL, Barnhart HX, Kutner NG, McNeely E, Coogler C, & Xu T. (1996). Reducing frailty and falls in older persons: An investigation of tai chi and computerized balance training. Atlanta FICSIT group. Frailty and injuries: Cooperative studies of intervention techniques. Journal of the American Geriatrics Society, 44(5), 489-497.

Wolfson L, Whipple R, Derby C, Judge J, King M, Amerman P, et al. (1996). Balance and strength training in older adults: Intervention gains and tai chi maintenance. Journal of the American Geriatrics Society, 44(5), 498-506.

Yamada M, Aoyama T, Tanaka B, Nagai K, & Ichihashi N. (2011). Seated stepping exercise in a dual-task condition improves ambulatory function with a secondary task: A randomized controlled trial. Aging-Clinical & Experimental Research, 23(5-6), 386-392.

Yamada M, Arai H, Sonoda T, & Aoyama T. (2012). Community-based exercise program is cost-effective by preventing care and disability in Japanese frail older adults. Journal of the American Medical Directors Association, 13(6), 507-511.

Yamada M, Higuchi T, Nishiguchi S, Yoshimura K, Kajiwara Y, & Aoyama T. (2013). Multitarget stepping program in combination with a standardized multicomponent exercise program can prevent falls in community-dwelling older adults: A randomized, controlled trial. Journal of the American Geriatrics Society, 61(10), 1669-1675.

Yang XJ, Hill K, Moore K, Williams S, Dowson L, Borschmann K, et al. (2012). Effectiveness of a targeted exercise intervention in reversing older people's mild balance dysfunction: A randomized controlled trial. Physical Therapy, 92(1), 24-37.

Yeom, H., & Fleury, J. (Jul 2014). A motivational physical activity intervention for improving mobility in older Korean Americans. Western Journal of Nursing Research, 36(6), 713-731.

Yip YB, Sit JW, Fung KK, Wong DY, Chong SY, Chung LH, et al. (2007). Impact of an arthritis self-management programme with an added exercise component for osteoarthritic knee sufferers on improving pain, functional outcomes, and use of health care services: An experimental study. Patient Education & Counseling, 65(1), 113-121.

Yokokawa Y, Hongo M, Urayama H, Nishimura T, & Kai I. (2008). Effects of low-intensity resistance exercise with vascular occlusion on physical function in healthy elderly people. Bioscience Trends, 2(3), 117-123.

Yokoya T, Demura S, & Sato S. (2009). Three-year follow-up of the fall risk and physical function characteristics of the elderly participating in a community exercise class. Journal of Physiological Anthropology, 28(2), 55-62.

Yu, C. H., Kim, U. R., & Kwon, T. K. (2014). Fundamental study of basal physical fitness and activities of daily living for the aged in relation to indoor horse riding exercise. Bio-Medical Materials and Engineering, 24(6), 2407-2415.

Zak M, Swine C, & Grodzicki T. (2009). Combined effects of functionally-oriented exercise regimens and nutritional supplementation on both the institutionalised and free-living frail elderly (double-blind, randomised clinical trial). BMC Public Health, 9, 39.

Zech A, Drey M, Freiberger E, Hentschke C, Bauer JM, Sieber CC, et al. (2012). Residual effects of muscle strength and muscle power training and detraining on physical function in community-dwelling prefrail older adults: A randomized controlled trial. BMC Geriatrics, 12, 68.

Zettergren KK, Lubeski JM, & Viverito JM. (2011). Effects of a yoga program on postural control, mobility, and gait speed in community-living older adults: A pilot study. Journal of Geriatric Physical Therapy, 34(2), 88-94.

Supplementary File 3: Summary of Individual Intervention Arms

Reference, study arm (when more than one IG)	METs	PA level	PA Type	Multi-task level	5STS	6MWT	8FUG	ADAP	BBS	BI	FIM	GARS	FA	IADL	Katz ADL	PPT	SUG	SF36-PF	TUG
Antunes (2005)	576	M	Stationary cycling	L														↑↑	
Barrett (2002)	420	L	Strength training	L	↑↑													↑	
Baum (2003)	450	M	Strength training	L					↑↑							↑↑			↑↑
Benavent-Caballer (2014)	341.3	L	Strength training	L		↑			↑	↑↑									↑
Bird (2012)	540	M	Pilates	M															↑↑
Borges (2012)	450	M	Dancing	H									↑↑						
Buchner (1997) IG1	1224	H	Stationary cycling	L										⇔					
Buchner (1997) IG2	630	M	Strength training	L										⇔					
Cassilhas (2007) IG1	1080	H	Strength training	L														↑	
Cassilhas (2007) IG2	900	H	Strength training	L														↑	
Chin (2006) IG1	367.5	L	Strength training	L	⇔														
Chin (2006) IG2	332.5	L	Functional training	M	↑														
Cruz-Ferreira (2015)	675	M	Dancing	H		↑↑	↑↑												
Day (2012)	360	L	Tai chi	M		⇔			⇔										⇔
De Vreede (2005 &7) IG1	540	M	Functional training	M				↑↑										⇔	⇔
De Vreede (2005/7) IG2	630	M	Strength training	L				↑										↑↑	⇔
Dechamps (2010)	360	L	Tai chi	M	↑↑										↑↑				↑↑
Eyigor (2009)	810	M	Dancing	H		↑↑			↑↑									↑↑	
Faber (2006) IG1	540	M	Functional training	M								↑↑							

Reference, study arm (when more than one IG)	MET score	PA level	PA Type	Multi -task level	5STS	6MWT	8FUG	ADAP	BBS	BI	FIM	GARS	FA	IADL	Katz ADL	PPT	SUG	SF36-PF	TUG
Faber (2006) IG2	540	M	Balance training	M								⇔							
Fahlman (2007)	420	L	Strength training	L		↑													
Federici, (2005)	540	M	Dancing	H													↑↑		
Gothe (2015)	450	M	Yoga	M			↑↑												
Granacher (2013)	336	L	Strength training	L															↑↑
Holmerová (2010)	225	L	Dancing	H															↑↑
Hosseini (2011)	810	M	Aquafit	M	↑↑				↑↑										↑↑
Jorgensen (2013)	184	L	Exergaming	M															↑↑
Kalapotharakos (2006)	315	L	Walking	L	↑↑	↑↑													
Kovách (2013) IG1	540	M	Pilates	M		↑↑	↑↑												
Kovách (2013) IG2	990	H	Aquafit	M		↑↑	↑↑												
Maillot (2012)	456	M	Exergaming	M		↑↑	↑↑												
McKinley (2008)	540	M	Dancing	H	↑↑														
McMurdo (1993)	315	L	Strength training	L						↑↑									
Mesquita (2015) IG1	276	L	Flexibility training	L					↑↑										↑↑
Mesquita (2015) IG2	360	L	Pilates	M					↑↑										↑↑
Moore-Harrison (2008)	472.5	M	Walking	L														↑↑	
Nagai (2012)	184	L	Balance training	M															↑↑
Ni (2014) IG1	360	L	Tai chi	M			↑↑												
Ni (2014) IG2	480	M	Yoga	M			↑↑												
Oken (2006) IG1	225	L	Yoga	M	↑													⇔	

Reference, study arm (when more than one IG)	METs	PA level	PA Type	Multi-task level	5STS	6MWT	8FUG	ADAP	BBS	BI	FIM	GARS	FA	IADL	Katz ADL	PPT	SUG	SF36-PF	TUG
Oken (2006) IG2	210	L	Walking	L	↓													⇔	
Oliveira (2015)	360	L	Pilates	M					↑↑									↑↑	↑↑
Pinto (2014)	375	L	Strength training	L			↑↑												
Rendon (2012)	276	L	Exergaming	M			↑↑												
Rodrigues (2010)	360	L	Pilates	M									↑↑						
Saravanakumar (2014) IG1	180	L	Tai chi	M					↓										
Saravanakumar (2014) IG2	150	L	Yoga	M					↑										
Sato (2007) IG1	330	L	Aquafit	M							↑↑							↑↑	
Sato (2007) IG2	660	M	Aquafit	M							↑↑							↑↑	
Shimanda (2003) IG1	230	L	Balance training	M															↑
Shimanda (2003) IG2	350	L	Walking	L															↑↑
Stanziano (2009)	138	L	Flexibility training	L			↑↑												
Tiedemann (2013)	300	L	Yoga	M	↑↑														
Tousignant (2012)	360	L	Tai chi	M					↑↑										↑↑
Tsang (2013)	360	L	Qigong	M															↑
Tse (2010)	138	L	Gardening	L						⇔									
Varela (2012) IG1	315	L	Stationary cycling	L															↑
Varela (2012) IG2	612	M	Stationary cycling	L															↑
Wei (2014)	1200	H	Handball	H										↓					
Wolf (2001)	207	L	Balance training	M					↑↑										

Note. ID = Identification; IG = Intervention Group; METs = Weekly MET-minutes; PA = Physical Activity; L = Low; M = Moderate; H = High; 5STS = 5-times-Sit-to-Stand; 6MWT = 6-meter Walk Test; 8FUG = 8-Foot Up-and-Go; ADAP = Assessment of Daily Activity Performance; BBS = Berg Balance Scale; BI = Barthel Index; FIM = Functional Independence Measure;

FA = GDLAM’s protocol of Functional Autonomy evaluation; GARS = Groningen Activities Restriction Scale; IADL = Lawton Instrumental Activities of Daily Living; Katz ADL = Katz Index of Independence in Activities of Daily Living; PPT = Physical Performance Test; SUG = Sit-Up-and-Go; SF36-PF = MOS Short form, physical functioning subscale; TUG = Timed Up-and-Go; ↑↑ = a significant ($p<0.05$) effect in favor of the IG; ↑ = an improvement in IG scores that is not statistically significant; ⇔ = no change in IG scores; ↓ = a decline in IG scores that is not statistically significant.

Supplementary File 4: Multitask Activity Level Coding Results

Round 1: Independent scoring by three researchers

Physical activity	Attention/ concentration	Memory	Decision-making and strategy	Social interaction	Flexibility	Balance	Coordination	Speeded reaction
Balance training	A = 1 B = 1 C = 2	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 2 B = 1 C = 2	A = 2 B = 2 C = 2	A = 3 B = 3 C = 3	A = 2 B = 2 C = 2	A = 1 B = 1 C = 1
Functional training	A = 1 B = 1 C = 2	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 2 B = 1 C = 2	A = 1 B = 2 C = 2	A = 2 B = 2 C = 2	A = 2 B = 2 C = 2	A = 1 B = 1 C = 1
Flexibility training	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 2 B = 1 C = 2	A = 2 B = 2 C = 2	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1
Yoga	A = 2 B = 2 C = 2	A = 2 B = 3 C = 2	A = 1 B = 1 C = 1	A = 2 B = 2 C = 2	A = 3 B = 3 C = 3	A = 3 B = 3 C = 3	A = 2 B = 2 C = 2	A = 1 B = 1 C = 1
Pilates	A = 2 B = 2 C = 2	A = 2 B = 2 C = 2	A = 1 B = 1 C = 1	A = 2 B = 2 C = 2	A = 2 B = 3 C = 3	A = 3 B = 3 C = 3	A = 2 B = 2 C = 2	A = 1 B = 1 C = 1
Tai chi	A = 2 B = 3 C = 2	A = 2 B = 3 C = 2	A = 1 B = 1 C = 1	A = 2 B = 2 C = 2	A = 3 B = 2 C = 2	A = 3 B = 3 C = 3	A = 3 B = 2 C = 2	A = 1 B = 1 C = 1
Qigong	A = 2 B = 3 C = 2	A = 2 B = 3 C = 2	A = 1 B = 1 C = 1	A = 2 B = 2 C = 2	A = 3 B = 2 C = 2	A = 3 B = 3 C = 3	A = 3 B = 2 C = 2	A = 1 B = 1 C = 1

Strength training	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 2 B = 2 C = 2	A = 2 B = 2 C = 2	A = 1 B = 2 C = 2	A = 1 B = 2 C = 1	A = 1 B = 1 C = 1
Aqua Fit	A = 2 B = 3 C = 3	A = 2 B = 1 C = 2	A = 1 B = 1 C = 1	A = 3 B = 3 C = 3	A = 2 B = 2 C = 2	A = 1 B = 2 C = 2	A = 2 B = 2 C = 2	A = 1 B = 1 C = 1
Exergaming e.g. Wii Sports	A = 2 B = 2 C = 2	A = 2 B = 1 C = 2	A = 2 B = 1 C = 3	A = 1 B = 1 C = 2	A = 1 B = 1 C = 2	A = 2 B = 2 C = 2	A = 3 B = 2 C = 2	A = 3 B = 2 C = 3
Cycling (stationary)	A = 2 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 2 B = 2 C = 1	A = 2 B = 1 C = 1	A = 2 B = 1 C = 2
Walking	A = 2 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 2 B = 1 C = 2	A = 1 B = 1 C = 1	A = 2 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1
Gardening	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 2 B = 2 C = 2	A = 2 B = 1 C = 2	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1	A = 1 B = 1 C = 1
Handball	A = 2 B = 3 C = 3	A = 2 B = 2 C = 2	A = 2 B = 3 C = 3	A = 3 B = 3 C = 3	A = 1 B = 2 C = 2	A = 2 B = 1 C = 2	A = 2 B = 3 C = 3	A = 3 B = 3 C = 3
Dancing	A = 2 B = 2 C = 2	A = 3 B = 3 C = 3	A = 2 B = 2 C = 2	A = 2 B = 2 C = 2	A = 2 B = 2 C = 3	A = 2 B = 3 C = 3	A = 3 B = 3 C = 3	A = 2 B = 3 C = 3

Note: shaded areas indicate items that did not reach 100% agreement in Round 1; A = researcher 1 scores; B = researcher 2 scores; C = researchers 3 scores; 1 = little or none required; 2 = a moderate amount required; 3 = a high amount required.

Round 2: Group discussion of remaining non-agreed items

Physical activity	Attention/ concentration	Memory	Decision-making and strategy	Social interaction	Flexibility	Balance	Coordination	Speeded reaction
Balance training	2			2				
Functional training	2			2	2			
Flexibility training				2				
Yoga		2						
Pilates					3			
Tai chi	2	3			2		2	
Qigong	2	3			2		2	
Strength training						2	1	
Aqua Fit	2	2				2		
Exergaming e.g. Wii Sports		2	2	2	2		2	2
Cycling (stationary)	1					1	1	1
Walking	1			2		1		
Gardening				1				
Handball	3		2		2	2	3	
Dancing					2	3		2

Note: 1 = little or none required; 2 = a moderate amount required; 3 = a high amount required.

Completed Scores and Assigned Multitask Level

Physical activity	Attention/ concentration	Memory	Decision-making and strategy	Social interaction	Flexibility	Balance	Coordination	Speeded reaction	Total score	Outcome
Balance training	2	1	1	2	2	3	2	1	14	Moderate
Functional training	2	1	1	2	2	2	2	1	13	Moderate
Flexibility training	1	1	1	2	2	1	1	1	10	Low
Yoga	2	2	1	2	3	3	2	1	16	Moderate
Pilates	2	2	1	2	3	3	2	1	16	Moderate
Tai chi	2	3	1	2	2	3	2	1	16	Moderate
Qigong	2	3	1	2	2	3	2	1	16	Moderate
Strength training	1	1	1	2	2	2	1	1	11	Low
Aqua Fit	2	2	1	3	2	2	2	1	15	Moderate
Exergaming e.g. Wii Sports	2	2	2	2	2	2	2	2	16	Moderate
Cycling (stationary)	1	1	1	1	1	1	1	1	8	Low
Walking	1	1	1	2	1	1	1	1	9	Low
Gardening	1	1	2	1	1	1	1	1	9	Low
Handball	3	2	2	3	2	2	3	3	20	High
Dancing	2	3	2	2	2	3	3	2	19	High

Note: 1 = little or none required; 2 = a moderate amount required; 3 = a high amount required. Total score: 8-11 = low; 13-16 = moderate; 19-20 = high.