Public Health England

Protecting and improving the nation's health

Intervention Tables

Changing risk behaviours and promoting cognitive health in older adults

An evidence-based resource for local authorities and commissioners

Prepared by the Cambridge Institute of Public Health, University of Cambridge

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Contents

Table index

Multicomponent

Alcohol

Smoking

Diet

Physical activity

Cognitive stimulation

Social

Leisure

Method

The protocols for the three reviews underpinning this resource were registered on PROSPERO (Kelly 2015a; Lafortune 2015a; Lafortune 2015b) and the approach follows the PRISMA guideline (http://www.prisma-statement.org).

The overarching aim of the systematic evidence reviews is to identify which interventions to promote healthy behaviours and cognitive health in older adults are the most effective and cost-effective. The specific questions addressed in the reviews are:

1. What individual-level interventions targeting unhealthy behaviours in people in older age (55+ years) are effective for the primary prevention or delay of cognitive decline or dementia?
2. What individual-level interventions in people in older age (55+ years) are effective for increasing the uptake and maintenance of healthy behaviours?
3. What issues (barriers and facilitators) prevent or limit, or help and motivate the uptake and maintenance of healthy behaviours in people in older age (55+ years)?

Search strategies

A structured search strategy was developed using a wide range of search terms covering the following concepts and domains: ageing and older adults; health behaviours and risk reduction relating to diet, physical activity, inactivity, alcohol, smoking; risk reduction relating to loneliness and isolation (i.e. leisure, social activities, participation), sun exposure, hearing and vision.

Databases searched include: MEDLINE, EMBASE, PsycINFO, CINAHL, Social Science Index, Cochrane Central Register of Controlled Trials (CENTRAL), The Cochrane Collaboration and Database of Systematic Reviews, Database of Abstracts of Reviews of Effectiveness (DARE), HTA and York CRD databases. The search strategies are easily accessible in the published PROSPERO protocols (Lafortune 2015a; Lafortune 2015b; Kelly 2015a).

Searching was conducted in two stages: 1) searching for systematic reviews in older age using a systematic review filter; 2) searching for published primary studies in older age. By including systematic reviews we captured the bulk of the scientific literature published before our cut-off date and avoided duplication of efforts. With the addiotnal primary studies, we captured the literature where there are no systematic reviews and/or where available systematic reviews are out of date.

Systematic reviews and primary studies published between January 2000 and December 2014 published in English and from countries of the Organisation for Economic Co-operation and Development (OECD) are included. However, studies were not excluded at the title/abstract

screening stage on the basis of language so that the number of studies excluded on the basis of language can be measured and reported. Only studies and systematic reviews that have aimed to include people in older age (55 years and over) living in the community are included.

Types of studies

For questions (1) and (2), we included systematic reviews and primary studies of any type of intervention studies. Study types include: randomised controlled trials; controlled clinical trials; controlled before and after studies; interrupted time series.

For question (3), systematic reviews and primary studies that reported qualitative data specific to barriers and facilitators to uptake or maintenance of modifiable healthy behaviours were included (i.e. physical activity, diet, smoking, alcohol, healthy life style, cognitive activities, leisure, participation, risk reduction related to loneliness and social isolation, sun exposure, hearing and vision health).

Participants/population

Reviews and intervention studies that predominantly included populations with a mean age of 55+, living in the community and in a healthy condition, with pre-conditions such as high cholesterol, high blood pressure, overweight or obesity, or people on medication were included. Reviews and intervention studies from disadvantaged populations, minority groups and vulnerable communities werealso included. These covered low socio-economic status, ethnic minority groups, LGBT groups, travellers and other groups with protected characteristics under the equality and diversity legislation. Reviews and interventions *specifically* focused on populations with previous ill health such as stroke, coronary heart disease or asthma were excluded. Participants with previous health conditions however will have been included in some studies where there were no contra-indications.

Interventions/exposure

Interventions targeting the following behaviours are included:

- increase/maintain levels of physical activity or decrease sedentary lifestyles or maintain balance, strength and weight-bearing functions
- improve/maintain good diet and nutrition (including components of diet e.g. fat intake, fruit and vegetable intake)
- reduce/prevent/stop tobacco consumption
- decrease/ prevent excessive alcohol consumption
- maintain/increase cognitive, leisure and social activities, and participation
- maintain hearing and vision
- prevent excessive sun exposure or increase sun exposure in those with inadequate exposure

- promote/improve dental health
- improve/modify multiple behavioural risk factors
- remove barriers/facilitate uptake and maintenance of any unhealthy/healthy behaviours with demonstration of impact.

Interventions delivered in the following settings and using the following mode of delivery are included:

- community settings (including, but not limited to, home, workplace, community and day centres, sheltered housing, primary care)
- interventions at individual, family, community level
- interventions in the private, public, voluntary or commercial sectors
- interventions delivered by healthcare professionals, lay people, home carers, researchers, media, internet

Interventions in the following areas are excluded:

- use of prescription drugs/medication (except for medication available 'over the counter' such as nicotine patches or gum for smoking cessation)
- use of dietary supplements
- management of existing disability, dementia, frailty and common non-communicable chronic disease
- management of obesity, including medical and surgical interventions for obesity;
- national policies, laws and taxation
- screening
- vaccination

No lower time limit was imposed for duration of intervention and follow-up.

Comparators/control

Studies with any comparator or no comparator.

Data extraction, selection and coding

Titles and abstracts were screened independently by two reviewers. Differences between reviewers' results were resolved by discussion and, when necessary, in consultation with a third reviewer. If there was still doubt about the relevance of a study after discussion, it was retained. Full paper copies were obtained for all reviews identified by the title/abstract screening. Full paper screening was conducted independently by two reviewers. We extracted data on study design; population; intervention details, setting and delivery; comparators; type of outcome measures reported; outcome measures (measures of uptake and maintenance of healthy behaviour); design/ delivery of interventions and quantitative or qualitative data relating to implementation issues,

barriers or facilitators and results.

Quality assessment

The methodological quality of systematic reviews in Reviews (1) and (2) was assessed using the AMSTAR tool (www.Amstar.ca). A minimum of 10% of the reviews was fully and double quality assessed. Any discrepancy between reviewers was resolved by discussion. Reviews that adequately reported at least eight of the possible eleven AMSTAR criteria were rated as high quality; between five and seven criteria as moderate quality; reviews adequately reporting fewer than five criteria were considered to be of poor quality. Tables summarising the quality of each systematic review and primary study included in this resource are presented for each risk factors in the Intervention Tables included.

Data synthesis

Findings are narratively synthesised and presented. Findings were initially tabulated to map the evidence in terms of included studies, country, age, population, interventions, comparators, outcome measures and effectiveness to map the level of evidence, quality and gaps.

Consultation

Two two-and-a-half hour consultation events were held in Newcastle (n=12) and Cambridge (n=8) with representatives from local authorities, clinical commissioners, social care commissioners, public health consultants and clinicians to discuss the format of this resource, the level of detail required to inform decisions, the way messages are framed, and any other issues that felt relevant and important. Following a short presentation of the background for the project and the aims of the resource, facilitated group discussions took place using a draft version of the resource, detail findings for selected risk behaviours (i.e. smoking, alcohol, diet), examples of summary tables and key messages. Notes were compiled for each event and the research team implemented these changes. The revised version of the document was then reviewed by one of the public health consultants who attended the Cambridge workshop (Dr Angelique Mavrodaris, Consultant in Public Health, Public Health Directorate, Cambridgeshire County Council) as well as by members of the PHE team.

Table 1: Multicomponent – Interventions with cognitive outcomes: complex multicomponent interventions

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Anstey 2015 Body, Brain Life (BBL)	RCT	Australia	50-60 (mean age 55, SD 2.96)	Cognitively healthy adults living independently, with access to a computer and internet connection at home N=176 randomised **Gender:** 52.8% female **Ethnicity:** Not reported **SES:** Mean years education 18.1 (3.56). Author's comment 'relatively highly educated'	Multidomain web-based intervention to address multiple risk factors for AD using behaviour change principles **Intervention 1:** Body, brain, life (BBL), N=58: One module a week delivered for 1 hour (7 modules in total). The first 2 modules covered general dementia risk and protective factors. Modules 3 to 7 covered PA, diet, social engagement, cognitive engagement, management of chronic conditions **Intervention 2:** BBL plus an additional face-to-face component, N=58: Same intervention as BBL but additionally received 5 face-to-face sessions in small groups to discuss risk factors for dementia, goal setting, and barriers to behavior change Active control, N=60. Received weekly emails with links to health-related website, videos and news items	**Follow-up:** At end of 12-week intervention and at 26 weeks **Lost to follow-up:** BBL: 5.2%; BBL + FF: 1.7%; Control: 5.0% **Outcome measurement:** Primary outcome was the ANU-ADRI validated instrument measuring individual risk profile for dementia. Risk factors included age, sex, low education, diabetes, history of brain injury, smoking, low pesticide exposure, low social engagement, and protective factors included were high PA, high cognitive activity, fish consumption (3 or more times/wk) and light to moderate alcohol consumption	**Overall dementia risk factor outcomes**: In change scores from baseline at 12 weeks and 26 weeks post intervention, there was a significant reduction in risk for both intervention groups but not for the control group: BBL: 12 weeks, p=0.019; 26 weeks post intervention: <0.001; BBL+ FF: 12 weeks, p=0.007; 26 weeks post intervention, p=0.003 **Individual protective factors:** There was a significant increase in cognitive engagement at 12 weeks (odds ratio 2.64; 95% CI 1.21–5.77; p=0.015) and 26 weeks postintervention (OR 4.49; 95% CI, 1.97–10.25; p =0.001). Also, a significant increase in fish consumption at 26 weeks (OR 5.19; 95% CI, 1.51–17.91; p =0.009). 'Consistent between intervention groups' (?) for both outcomes

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Carlson 2008 Experience Corps	RCT (pilot) (cluster randomised by school)	US	Mean: Intervention: 70.1 (6.42) Control : 68.4 (5.15)	Older adults N=149 randomised **Baseline MMSE:** Intervention: 24.96 (3.45); Control: 25.3 (2.60) **Setting:** Community **Gender:** Intervention: 83%; Control 93% **Ethnicity:** Intervention: 94% black; Control: 95% black **SES:** Mean years education: Intervention: 11.9 (2.54) ; Control: 11.2 (2.66); 38% had less than high school education	Experience Corps® places older volunteers in public elementary schools in roles designed to meet schools' needs and increase the social, physical, and cognitive activity of the volunteers Community-based program designed to increase cognitive and physical activity in a social, real-world setting **Intervention (N=70):** Participants randomized to EC trained in teams to help elementary school children with reading achievement, library support, and classroom behaviour for 15 hr/week	**Follow-up:** 4 to 8 months **Lost to follow-up:** Intervention: 11.4%; control: 17.2% Outcome measurement: memory, executive function (EF), and psychomotor Speed: Trail Making Test: Parts A and B Word list memory: Immediate recall Delayed recall Rey-Osterrieth: Copy score Delayed recall	**Cognitive outcomes:** (age and education adjusted) Trail-making test **Part A:** No sig diff between groups **Part B:** Significant difference between intervention and control groups at follow-up ($p<0.05$). Intervention group improved by 1.3 secs from baseline; control group declined 21.7 secs from baseline Word list memory No significant difference between groups for immediate or delayed recall Rey-Osterrieth CFT Copy score: No sig diff between groups Delayed recall: Significant difference between intervention and control groups at follow-up ($p<0.05$). Intervention group improved by 1.0 points and control group declined by 0.7 points

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Clare 2015 The Agewell Trial	RCT (pilot)	UK (Wales)	50+ Mean 68.21 (SD 7.92; range 51–84)	Participants aged over 50 living and functioning independently in the community, recruited through a community Agewell Centre N=75 randomised **Gender:** 86.7% female **Ethnicity:** 100% white British or Irish **SES:** 9.3% unskilled, 13.3% partly skilled, 9.3% skilled manual, 28.0% skilled non-manual, 34.7% managerial and technical, 5.3% professional	**Intervention:** Behaviour change intervention to promote healthy ageing and reduce risk of dementia in later life (aimed at promoting increased cognitive and physical activity and improving mental and physical fitness, diet and health). **3 arms:** Each arm involved a one-to-one interview with a researcher (up to 90 minutes) **Goal-setting (GS) (N=24):** Structured goal-setting interview to identify up to five goals they wished to work on over the coming year relating to physical activity, cognitive activity, physical health and diet, and social engagement **Goal-setting with mentoring (GS+M) (N=24):** GS as above plus an additional 5 follow-up mentoring phone calls **Information (control) N=27:** Interview with information about activities and health and about Centre facilities	**Follow-up:** 12 months **Lost to follow-up:** Information (control) 0%; Goal-setting: 12.5%; GS plus mentoring: 8.3% **Outcome measurement:** Montreal Cognitive Assessment (MoCA), immediate and delayed recall assessed with the California Verbal Learning Test (CVLT), and executive function with two subtests from the Delis-Kaplan Executive Function System, Trail-Making and Verbal Fluency	**Participation outcomes:** Overall in the whole sample, participants undertook 2.70 centre activities (SD 2.50, range 0-13) and attended 34 sessions (range 35.62; 0-131). Between the 2 goal-setting conditions, 137 goals were set (range 1-5; mean 2.85 +/- 1.2). 50 related to PA, 40 to physical health and diet, 24 to cognitive health and 7 to social engagement and 16 relating to a mixture of categories **Cognitive outcomes** Montreal Cognitive Assessment: Significant increase from baseline to follow-up in the goal-setting with mentoring group (from 26.32 (2.64) to 27.23 (2.05), p=0.03. No significant differences in the GS or information control group. CVLT-II immediate recall: No significant differences from baseline to follow-up in any group CVLT-II delayed recall: Significant increase in the information control group from baseline to follow-up from 9.33 (3.21) to 10.90 (2.73), p=0.02. No significant changes in the GS or GS+M group TMT T4-T2: No significant differences from baseline to follow-up in any group Verbal fluency: Significant increase in the GS group from 36.96 (14.58) to 43.47 (15.24, p<0.001 and in the information control group from 38.59 (10.87) to 41.74 (10.74), p=0.05. **Cost-effectiveness:** Mean QALYs (SD); GS: 0.87 (0.17); GS+M 0.83 (0.24); control 0.85 (0.18)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Clark 2012 Lifestyle oriented Well Elderly 2 RCT	RCT	US	60-95 (Mean age 74.9 (7.7)	Ethnically diverse older adults recruited from a variety of community-based sites N=460 53% <$12 000 annual income) **Gender:** 65.9% female **Ethnicity:** 37.4% white; 32.4% black/African American; 20% Hispanic or Latino; 3.9% Asian; 6.3% other **SES:** 53% <$12 000 annual income)	Intervention: Preventive lifestyle-based occupational therapy intervention. Weekly 2h small group sessions and 1rh individual sessions. Focus on involvement in activities, including physical and mental exercise Delivered by trained occupational therapists, trained to deliver the intervention Control: No treatment control group, but underwent assessments	**Follow-up:** 6 month intervention **Lost to follow-up:** intervention 19.4%; control 24.2% **Outcome measurement:** Three cognitive outcome variables, immediate recall, delayed recall and recognition, were measured by the word list procedure. Selective attention was measured by median reaction time on a widely used computer-based visual search task with lower scores indicating higher cognitive functioning; psychomotor speed, assessed by the Digit Symbol Substitution Task of the Weschler Adult Intelligence Scale Revised	**Cognitive outcomes:** No significant intervention effect was found for any cognitive functioning outcome measures **Other outcomes:** Intervention participants, relative to untreated controls, showed more favourable change scores on indices of bodily pain, vitality, social functioning, mental health, composite mental functioning, life satisfaction and depressive symptomatology (ps<0.05) **Cost-effectiveness outcomes:** The intervention group had a significantly greater increment in quality-adjusted life years (p<0.02), which was achieved cost-effectively (US $41 218/UK £24 868 per unit)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Cohen-Mansfield 2015	RCT Note: In-terventions were not conducted simultane-ously	Israel	65+ Mean 73.5 (SD 5.2)	Older adults with memory complaints MMSE 24+ for inclusion (Mean MMSE at baseline 28) N=44 randomised **Setting:** Community **Gender:** 72.7% female **Ethnicity:** Not reported **SES:** Mean years education: 14.82 (3.77); range 5-22	**Health promotion (N=15):** structured format course including lectures, discussions, exercises, handouts and homework; covering health behaviours; dementia and delirium; communication; cognitive activities to keep the mind fit; relationships, depression, and coping; home and travel safety; recreation and leisure; medications and health care providers; physical activity; and lifelong learning **Cognitive training (N=15):** Memory training based on the previous ACTIVE trial with a focus on verbal episodic memory exercises **Participation-centred course (N=14):** Book club was used as a focus to deliver memory, cognitive and organisational strategies and using cognitive-behavioural principles. The course used external strategies (e.g. reading aid and daily planner), internal strategies (e.g. linking meaning to new information), and social interaction strategies (e.g., asking for help and sharing memory difficulties) Control: Wait-list control (N=28)	**Follow-up:** 10 weeks intervention and follow-up **Lost to follow-up:** Health promotion: 20%; cognitive training: 20%; participation: 28.6%. Only completers were analysed for results **Outcome measurement:** Global Cognitive Score assessed using the MindStreams mild cognitive impairment assessment, a computerized cognitive assessment. The Mini-Mental State Examination and the self-report of memory difficulties were also utilized. To assess well-being, the UCLA Loneliness Scale-8 was used. Health was evaluated by self-report instruments	**Cognitive outcomes** No significant differences ($p<0.05$) between intervention groups (health promotion; cognitive training; participation) for any cognitive outcome except for self-reported memory which was higher in the group receiving cognitive training There was a significant difference in change in Global Cognitive Score (GCS) between the cognitive training and wait-list control groups ($p<0.05$). **Loneliness** No significant differences ($p<0.05$) between intervention groups (health promotion; cognitive training; participation) for loneliness as an outcome. There was a significant difference in change in loneliness for the cognitive training group compared to the wait-list control.

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Dannhauser 2014 ThinkingFit Program	Pilot intervention study – crossover design but not randomised	UK	Mean age 73.9 (8.3)	People with MCI and a sedentary lifestyle Mean MMSE at baseline 26.3 (2.6) from N=61 N=67 **Gender:** 58% male of those who completed the programme **Ethnicity:** Not reported **SES:** Not reported	Physical, social and cognitive activities associated with reduced dementia risk Physical activity (3 x 30-45 min sessions/ week, mainly walking), group-based cognitive stimulation (GCST): adult education classes in arts and crafts (1 x week) and individual cognitive stimulation (ICST) 3 x 30 min/week: Training was aimed at improving specific cognitive functions such as attention, speed of processing, working memory, problem solving and reasoning. Training took place on the Lumosity programme that offers different games and puzzles and provides continuous feedback of performance and suggests games and puzzles to ensure balanced training Do something different everyday (DSD) 4 week pre-phase. Engagement and adherence were promoted by applying specific psychological techniques to enhance behavioural flexibility in an early pre-phase and during the course of the intervention **Control:** Same participants during a 6 to 12 week run-in period without intervention	**Follow-up:** 12 significant differences weeks intervention and follow-up plus 4 week behavioural pre-phase **Lost to follow-up:** 67 started the programme and were included in the analysis, and 63 completed more than 50% of the activities offered. (6% drop-out) **Outcome measurement:** Neuropsychological outcome measures: Halstead Trail Making test (TMT) parts A and B; verbal- and category-fluency, and digit span forwards and backwards. Life quality was measured on the World Health Organization Quality of Life (WHOQOL)–BREF and the Alzheimer's Disease Cooperative Study MCI Activities of Daily Living Scale (ADCS-MCI-ADL)	Activity adherence rates were high: physical activity = 71%; GCST = 83%; ICST = 67%. **Cognitive outcomes** Significant effect ($p<0.05$) for cognition - improved working memory [5.3/6.3 items]) Significant improvements at T2 (post intervention) compared to one but not both of T0 (baseline) and T1 (control pre-intervention phase), were found for letter fluency and forward digit span **Physical health and other outcomes** Significant effects ($p <0 .05$) for physical health outcomes (decreased BMI and systolic blood pressure, [pre/post values of 26.3/25.9 kg/m2 and 145/136 mmHg respectively]), fitness (decreased resting and recovery heart rate [68/65 bpm and 75/69 bpm]) and quality of life

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Diamond 2015 Healthy Brain Ageing Cognitive Training (HBA-CT) programme	RCT (Quasi RCT? - eligibility confirmed after randomisation)	Australia	50+ (Range 51-86) Mean 66.5 (8.6)	Older adults 'at risk' of dementia, defined as seeking help for new onset cognitive impairment and/or major depression, with baseline MMSE score 24+. N=90 initially randomised but N=8 in intervention group and N=15 in the control group were subsequently excluded as they did not meet baseline inclusion criteria (based on review of their medical/psychiatric assessment and diagnosis) **Setting:** Clinic **Gender:** Intervention: 25% male; Control: 42.8% **Ethnicity:** Not reported **SES:** Mean years education: Intervention: 14.3 (3.4); Control: 13.7 (3.2) Mean MMSE at baseline 28.4 (1.5); 81% of participants met criteria for MCI	**Intervention:** Group-based psychoeducation about cognitive strategies and modifiable lifestyle factors relating to healthy brain ageing, and computerised cognitive training. Intervention was conducted twice a week for seven weeks. Each group session comprised a maximum of 10 participants and included one-hour of Healthy Brain Ageing psychoeducation (covering memory strategies, diet and exercise, using the internet) and one-hour of computer based cognitive training **Control:** Wait list control group (no contact from researchers but did receive standard clinical care from their usual health-care professionals)	**Follow-up:** 7 week intervention **Lost to follow-up:** N=90 randomised, N=64 analysed (23 excluded as did not meet baseline criteria) and 3 in intervention group and none in control group discontinued intervention (due to personal reasons). **Outcome measurement:** Battery of neuropsychological tests, psychiatric and medical assessment tests:- RAVLT-15 Rey Auditory Verbal Learning Test-total learning over 5 trials; RAVLT%, Rey Auditory Verbal Learning Test-percent retention scores (i.e., (Trial 7 / Trial 5)* 100); LOGMEM-I, total score for stories A and B on Wechsler Memory Scale-III Logical Memory learning trials; LOGMEM%, Wechsler Memory Scale-III Logical Memory percent retention scores (LOGMEM-II delayed recall / [LOGMEM-I story A+ second recall Story B]); RCFT, Rey Osterrieth Complex Figure Test; TMT-A, Trail Making Test Part A; TMT-B, Trail Making Test Part B; GDS, Geriatric Depression Scale (30-item); EMQ, Everyday Memory Questionnaire; PSQI, Pittsburgh Sleep Quality Index; ASS, Age Scaled Score.	**Cognitive outcomes** Intervention showed improvements compared to control for: Verbal Memory: RAVLT % z-score (p = 0.03) Self-reported memory: Everyday Memory Questionnaire (EMQ) (p = 0.03) **Other outcomes** Mood (p = 0.01), and sleep (p = 0.01). None of the other outcomes measured showed significant differences between intervention and control While the improvements in memory (p = 0.03) and sleep (p = 0.02) remained after controlling for improvements in mood, only a trend in verbal memory improvement was apparent after controlling for sleep

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Mendoza-Ruvalcaba 2015	RCT	Mexico	60+ Mean: Intervention: 70.45±6.37; Control 70.82±7.20	Healthy older adults recruited from senior centres N= 64 randomised **Gender:** 93.5% female in intervention group and 84.8% female in control group **Ethnicity:** Not reported **SES:** Mean years education: intervention: 5.55±3.12; control 3.97±3.28 (p=0.054)	"I am Active" program designed to promote active aging by increased physical activity, healthy nutritional habits, and cognitive functioning **Intervention (N=31):** The participants in the intervention group received a "user manual" specifically designed for this purpose. The program lasted 2 months, and consisted of 2-hour group sessions, held twice a week (i.e., 16 sessions in total). Each session included physical activity and reality orientation with eight lessons including nutritional topics and eight sessions cognitive activity **Control (N=33):** Remained on a wait list and participated in the program once the study was completed, participating in the meantime in weekly social activities organized by the senior center	**Follow-up:** 8 weeks intervention, followed up to 6 months Lost to follow-up: Intervention: 13.9%; control: 9.1% **Outcome measurement:** Cognition: Working memory was assessed by the Digit Span Backward Subtest and processing speed by the Digit Symbol Subtest Nutrition: Nutritional status was measured using the Mini Nutritional Assessment	**Cognitive function** Processing speed score: The intervention group had significantly better processing speed at post-test and follow-up than control. **Intervention group:** Significantly increased (P<0.001; for difference from baseline at post-test and follow-up) from 26.06 (9.99) at baseline to 31.16 (10.34) after the intervention and 30.52 (10.21) at follow-up **Control group:** 19.87 (9.22) at baseline; 17.83 (9.18) after the intervention and 19.41 (8.74) at follow-up (not significant) **Working memory:** No significant changes from baseline in working memory performance were found in either group **Other outcomes:** At the end of the intervention (8wks), significant improvement compared with the control group for: physical activity (falls risk, balance, flexibility, self-efficacy), nutrition (self-efficacy and nutritional status), cognitive self-efficacy, and quality of life (general, health and functionality, social and economic status) At follow-up (6 months), improvements remained for self-efficacy for physical activity, self-efficacy for nutrition, nutritional status, quality of life

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Miller 2012	Non-ran-domised controlled study	US	Mean age: 80.9 (SD: 6.0 years)	Older adults living at the independent level of care in continuing care retirement communities and reporting memory complaints >24 on MMSE: mean MMSE score 28.6 (1.3) N=115 assigned to groups **Gender:** 79% female **Ethnicity:** 98% white **SES:** 32% had high school education; 44% bachelor or associate degree; 24% a graduate or professional degree	**Intervention:** 6-week educational program on memory training, physical activity, stress reduction, and healthy diet **Control:** Waiting list control	**Follow-up:** 6 week intervention **Lost to follow-up:** 18.3% **Outcome measurement:** Objective cognitive measures evaluated changes in five domains: immediate verbal memory, delayed verbal memory, retention of verbal information, memory recognition, and verbal fluency	**Cognitive tests** Significant improvements from pre- (control condition) to post intervention on recognition of word pairs ($t[114] = 3.62$, $p < 0.001$); retention of verbal information from list learning ($t[114] = 2.98$, $p < 0.01$); immediate memory ($t[114] = 6.56$, $p < 0.0001$); delayed memory ($t[114] = 2.70$, $p < 0.02$) No improvement was found for verbal fluency

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Ngandu 2015 FINGER Trial	RCT	Finland	60-77 Intervention group: 69·5 (4·6) Control group: 69·2 (4·7)	Inclusion criteria were CAIDE (Cardiovascular Risk Factors, Aging and Dementia) Dementia Risk Score of at least 6 points and cognition at mean level or slightly lower than expected for age Mean MMSE score at baseline 26.8 (2.0) N=1260 randomised **Gender:** Intervention: 45%; Control 47% **Ethnicity:** Not reported **SES:** Education: mean: 10.0 (3.4) in both groups	**Intervention (N=631):** Diet, exercise, cognitive training, and vascular risk monitoring with advice and feedback **Control (N=629):** General health advice. Advice and feedback on metabolic and vascular risk factors also given to the control group	**Follow-up:** 2 year intervention **Lost to follow-up:** 6% intervention; 5% control **Outcome measurement:** **NTB total score:** A composite score based on results from 14 tests (calculated as Z scores standardised to the baseline mean and SD, with higher scores suggesting better performance) **Secondary Outcomes:** Included NTB domain Z scores for executive functioning, processing speed, and memory. The executive functioning domain included category fluency test,19 digit span, concept shifting test (condition C), trail making test (shifting score B – A), and a shortened 40-stimulus version of the original Stroop test (interference score 3 – 2)	**Comprehensive neuropsychological test battery (NTB) Z score:** Estimated mean change in NTB total Z score at 2 years was 0·20 (SE 0·02, SD 0·51) in the intervention group and 0·16 (0·01, 0·51) in the control group. Between-group difference in the change of NTB total score per year was 0·022 (95% CI 0·002–0·042, p=0·030) **Adverse events:** Occurred in 46 (7%) participants in the intervention group compared with six (1%) participants in the control group; the most common adverse event was musculoskeletal pain (32 [5%] individuals for intervention vs no individuals for control)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Pitkala 2011	RCT (pilot) (cluster randomised by school)	US	Mean: Intervention: 70.1 (6.42) Control : 68.4 (5.15)	Older adults N=149 randomised Baseline MMSE: Intervention: 24.96 (3.45); Control: 25.3 (2.60) **Setting:** Community **Gender:** Intervention: 83%; Control 93% **Ethnicity:** Intervention: 94% black; Control: 95% black **SES:** Mean years education: Intervention: 11.9 (2.54) ; Control: 11.2 (2.66); 38% had less than high school education	**Intervention (N=117):** Socially stimulating group intervention aimed at enhancing interaction and friendships between participants and to stimulate them socially. Groups were facilitated by trained professionals. Participants were divided into 3 groups depending on their interests: therapeutic writing (N=48); group exercises (N=92); or art experiences (N=95) and then randomised to intervention or control within those groups. Intervention was once per week and usually lasted for 6 hours and was provided free of charge. Control (N=118): Continued in normal community care. They could participate in their normal hobbies and activities but no intervention was arranged for them	**Follow-up:** 3, 6 months for cognitive outcomes. Lost to follow-up: Intervention: 6.0%; control: 17.8% **Outcome measurement:** Cognition by Alzheimer's disease assessment scale (ADAS-cog) and mental function by 15D measure and psychological wellbeing and HRQoL at 12 months	**ADAS-Cog scale (3 months) Mean changes (all participants)** I: -2.6points (95% CI -3.4 to -1.8) C: -1.6 points (95% CI -2.2 to -1.0) (p=0.023; F1,167.8 = 5.23) Art group I: -2.4 points (95% CI -3.5 to -1.3) C: -1.8 points (95% CI -2.9 to -0.8) (p=0.017; F1,47.2 = 1.88) Exercise group I: -3.2 points (95% CI -4.7 to -1.7) C: -1.6 points (95% CI 2.6 to –0.5) (p=0.60; F1,72.7 = 0.28) Writing group I: -1.7 points (95% CI -2.7 to -0.7) C: -1.2 points (95% CI -2.7 to 0.3) (p=0.033; F1,33.6 = 4.49) 15D index dimension of mental function) over 12 months I: +0.048 (95%CI: +0.013 to +0.085) C: -0.027 (95%CI: -0.063 to +0.010) (p=0.004; t = 2.89, df=187) Note: Cognitive outcomes also measured at 6 months but not reported here

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Tesky 2011 AKTIVA study	RCT	Germany	50+ Mean: 72 (7)	Older adults without dementia or cognitive impairment N=307 randomised **Setting:** **Gender:** 72.3% female **Ethnicity:** 'German ethnicity' reported **SES:** 'Most participants had attended school for about 10 years, and only a few participants had completed an academic university education'	**AKTIVA intervention (n = 126):** Group programme of cognitively stimulating leisure activities (8 weekly sessions and two booster sessions after a break of 4 months) AKTIVA intervention plus nutrition and exercise counselling (n = 84): Control group (n = 97): No intervention	**Follow-up:** 8 week intervention and post-test conducted 1 week after (week 9); 2 booster sessions conducted at 27 to 28 weeks and then follow-up tests conducted 29 weeks after start of intervention **Lost to follow-up:** N=67 (21.8%) withdrew from the study. Those with impaired cognition (N=28) and N=15 Turkish participants excluded from analysis after the programme. **Outcome measurement:** Cognitive outcomes: Mini-Mental Status Test ADAS-Cog: the cognitive part of the Alzheimer's Disease Assessment Scale Part A and B of the Trail-Making Test Clinical Dementia Rating (CDR)	Participation in the group program resulted in positive effects on cognitive function and attitude toward aging for subassembly groups. Older persons (≥75 years) showed enhanced speed of information processing (by TMT Version A) ($F = 4.17^*$, $p < .05$); younger participants (< 75 years) showed an improvement in subjective memory decline (by MAC-Q) ($F = 2.55^*$, $p < .05$). Additionally, AKTIVA enhanced the frequency of activities for leisure activities for subassembly groups. The results of this study suggest that the AKTIVA program can be used to increase cognitively stimulating leisure activities in the elderly. Further research is necessary to identify the long-term effects of this intervention particularly with respect to the prevention of dementia

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Wiegand 2013	RCT	Canada	50-90 recruited Mean age: I: 70.3 (8.2); C 72.1 (9.8)	Community-dwelling older adults without MCI or other medical conditions that affect cognitive ability N=45 randomised **Gender:** 76.2% female **Ethnicity:** Not reported **SES:** Mean years education 14.0 (2.3) in intervention group and 15.1 (2.9) in the control group	**Intervention:** A multidimensional, evidence-based intervention, the Memory and Aging Program, that provides education about memory and memory change, training in the use of practical memory strategies, and support for implementation of healthy lifestyle behaviour changes **Control:** Waitlist control, participated in pre- and post tests	**Follow-up:** 5 weeks intervention, and one month after end of intervention **Lost to follow-up:** 2.4% **Outcome measurement:** Pencil and paper tests and questionnaires For name-learning and fact learning test, after presentation, participants were asked to write down as many as they could remember	**Cognitive/memory tests** Objective tests: (i) Name-learning test: No significant differences (group x time); (ii) Fact-learning task: No significant differences (group x time) **Lifestyle behaviours** Relative to the control group, participants in the program implemented more healthy lifestyle behaviours by the end of the program (p=0.015) and maintained these changes 1 month later (p=0.007). The most common behaviours implemented were relaxation and cognitive engagement (post intervention) and PA (after 1 month) **Intention to seek medical attention for memory** Intervention participants reported a decreased intention to seek unnecessary medical attention for their memory immediately after the program and 1 month later

Table 2: Multicomponent – Interventions with cognitive outcomes: combined PA and cognitive stimulation

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Anderson-Hanley 2012 Am J Prev Med Reg Clin Trial	Cluster RCT	US	55+ Mean: cybercycle 75.7 (9.9); control bike 81.6 (6.2)	Participants recruited from independent living facilities 42.1% had clinical diagnosis of MCI at baseline in the cybercycle group and 34.1% in the control group **Gender:** Cybercycle: 70.7% female; control bike 86.8% female **Ethnicity**: Not reported **SES:** Mean years education: Cybercycle 12.6 (2.2); control bike 14.8 (2.3)	**Intervention (N=38):** Physical exercise plus mental challenge combined in a cybercycle exergame (virtual reality–enhanced exercise that combines physical exercise with computer-simulated environments and interactive videogame features (e.g., the Wii Fit and PlayStation Move) **Control (N=41):** Physical exercise alone (stationary bike identical to the cyber bike except for virtual reality control)	**Follow-up:** 3 months intervention and follow-up **Lost to follow-up:** Intervention: 21.0% **Control:** 19.5%. All participants at baseline included in analysis **Outcome measurement** **Primary cognitive outcome:** Executive function assessed via Color Trails 2-1 difference Score; Stroop C and Digit Span Backwards. **Secondary cognitive outcomes: Attention:** LDST, Letter Digit Symbol Test; Verbal fluency: COWAT, Controlled Oral Word Association Test, categories; Verbal memory (immediate): RAVLT (sum 5 trials score), RAVLT immediate recall); Verbal memory (delayed) RAVLT delayed recall, Fuld delayed recall; Visuospatial skill: Figure copy, clock; visuospatial memory (delayed): figure delayed recall score; Clinical diagnosis of MCI	**Cognitive outcomes** **Executive function:** There were significant differences in change from baseline between intervention and control groups for all 3 tests of executive function: Color Trails p=0.007; Stroop C p=0.05; Digits backward p=0.03. Overall composite executive function score p=0.002 **Other cognitive outcomes** There were no significant between group differences for changes from baseline for other cognitive outcomes (Results above based on intent-to-treat analyses, controlling for age, education, and cluster randomization). Cybercyclists had a 23% relative risk reduction in clinical progression to MCI

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Barnes 2013 Mental Activity and eXercise (MAX) trial Registered clinical trial	RCT (facto-rial design)	US	Mean age 73.4	Inactive, community residing older adults with cognitive complaints N=126 **Gender:** 62.7% female **Ethnicity:** 34.9% Hispanic or non-white **SES:** 15.6 – 16.8 years depending on group (SD 2.1-2.8)	Home-based mental activity (1 h/d, 3 d/wk) plus class-based physical activity (1 h/d, 3 d/wk) in 4 groups: MA-I/EX-1 (intensive computer mental activity/ aerobic exercise) MA-I/EX-C (intensive computer mental activity/ control stretching and toning exercise) MA-C/EX-1 (mental activity control – exercise DVDs)/ aerobic exercise) MA-C/EX-C (mental activity control – exercise DVDs)/control stretching and toning exercise	**Follow-up:** 12 weeks intervention **Lost to follow-up:** computer (aerobic) 28.1%; computer stretching control 19.5%; DVD (aerobic) 9.7%; DVD (stretching control): 25%. **Outcome measurement:** Global cognitive change based on a comprehensive neuropsychological test battery	**Composite cognitive scores** No significant difference between groups but improved significantly from baseline in all groups except MA-C/EX-1. The greatest increase was in the most intensive mental activity and exercise group, but there was no significant difference between groups **Change from baseline:** MA-I/EX-1: 0.22 (0.12 to 0.33), p=<0.001 MA-I/EX-C: 0.17 (0.03 to 0.31), p=0.01 MA-C/EX-1: 0.08 (0.004 to 0.17), p=0.06 MA-C/EX-C :0.16 (0.05 to 0.26), p=0.003 **Visuospatial function (UFOV):** significant between group differences for divided attention and selective attention No significant difference between groups for Verbal learning and memory (RAVL-T); verbal fluency, processing speed (DSST); executive function

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Fabre 2002	RCT	France	60+ (range 60 to 76)	Older adults recruited from (leisure) clubs. None engaged in regular PA at baseline N=32 randomised **Gender:** 15.6% male **Ethnicity:** Not reported **SES:** Mean years education: 11-12 years	**Intervention:** Combined aerobic and cognitive training: incorporating 1 and 2 below **Comparator 1:** Aerobic training alone: 2 supervised one hour exercise sessions per week **Comparator 2:** Cognitive training alone: One 90 min training session per week on 8 themes: perceptive activities, attention, intellectual structuration, association and imagination, language spatial marks, temporal marks, associated recruitment **Control:** Followed usual daily routine activities without training but met as many times as the other groups for leisure activities e.g. painting, singing	**Follow-up:** 2 months intervention **Lost to follow-up:** none reported **Outcome measurement:** French BEC 96 questionnaire to measure cognitive problems: recall, learning, orientation, manipulation and mental problems, verbal fluency, denomination and visual reproduction. Wechsler memory scale: general information, orientation, mental control, logical memory-immediate recall, digit span in order and reverse, visual reconstructions and paired associates learning. The combined results give a memory quotient score	**Wechsler memory quotient:** All 3 intervention groups achieved a statistically significant difference in Wechsler overall memory quotient from baseline to follow-up at 2 months ($F=6.52$, $DF=1$, $p<0.01$). There was no significant improvement in the control group. Memory quotient improved by 9.2% in the combined cognitive and aerobic training group compared to 8.5% in the aerobic training group alone; 7.4% in the cognitive training group alone; and 0.8% in the control group. The mean difference in pre- and post-intervention memory quotient was significantly higher in the combined aerobic and cognitive training group than in the aerobic or cognitive training groups alone ($F=11.60$, $DF=3$, $p<0.001$) **Wechsler subtests:** All 3 intervention groups showed significant improvements in paired associates learning: ($F=5.47$, $DF=1$, $p<0.05$) and logical memory-immediate recall (($F=4.31$, $DF=1$, $p<0.05$) but no significant difference between the intervention groups **BEC 96 questionnaire:** No changes after 2 months for any of the groups

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Hars 2013	Secondary analysis of an RCT	Switzerland	65+ Mean: Intervention: 75 (8); control 76 (6)	Community-dwelling older adults at increased risk of falling (1+ falls aged 65 or over or balance impairment). N=134 randomised **Setting:** Community **Gender:** 96% female **Ethnicity:** Not reported **SES:** Education: Intervention: 11% had completed primary school education; 68% middle school; 28% high school. Control: 19% primary; 66% middle and 15% high school	**Intervention (N=66):** Structured music-based multitask exercise classes (N=66). Group exercise classes once weekly for 1-h over 25 weeks that included multitask exercises of progressive difficulty, sometimes involving the handling of objects, performed individually, in pairs or more. Such as: walking following the piano music; responding directly or oppositely to changes in music's rhythmic patterns; quick reaction exercises and walking out of rhythmic patterns Control (N=68): Control group with delayed intervention (N=68)	**Follow-up:** 6 months intervention **Lost to follow-up:** 15% intervention; 21% control. All participants included in ITT analyses **Outcome measurement:** MMSE, the clock-drawing test, the frontal assessment battery (FAB) and the hospital anxiety (HADS-A) and depression scale	**Cognitive outcomes:** No statistically significant differences between intervention and control for MMSE, clock drawing test or overall FAB score There was an improvement in the sensitivity to interference subtest of the FAB (adjusted between-group mean difference (AMD), 0.12; 95% CI, 0.00 to 0.25; P = 0.047) Within-group analyses showed an increase in MMSE score (P = 0.004) and a reduction in the number of participants with impaired global cognitive performance (i.e., MMSE score ≤23; p = 0.003) in the intervention group **Other outcomes:** Reduction in anxiety level (HADS-A; AMD, −0.88; 95% CI, −1.73 to −0.05; P = 0.039) for intervention participants, compared with the controls

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Hughes 2014	RCT	US	Mean: Intervention: 78.5 (7.1); control: 76.2 (4.3)	Older adults with MCI recruited from a population cohort study Mean MMSE at baseline 27.1 (1.8) N=20 randomised **Setting:** Community **Gender:** Intervention: 80% female; control: 60% female **Ethnicity:** Intervention: 70% white; control: 90% white. **SES:** Mean years education: Intervention 13.8 (2.4); control 13.1 (1.9)	**Intervention (N=10):** Group-based interactive video gaming using Nintendo Wii; 90 mins/ week for 24 weeks The Wii Sports games, including bowling, golf, tennis, and baseball were the core of the sessions. From week 7, participants were introduced to new games for 15-20 mins of the session. In weeks 10 and 20 participants competed in Wii tournaments to encourage enhanced effort and social activation **Control (N=10):** Health education designed to provide a source of passive cognitive stimulation in a socially matched setting ; 90 mins/week for 24 weeks.	**Follow-up:** 24 weeks **Lost to follow-up:** 10% (1 died, 1 did not complete follow-up assessment) **Outcome measurement:** Cognitive function: Computerized Assessment of Mild Cognitive Impairment (CAMCI) Subjective cognitive ability: Cognitive Self-Report Questionnaire-25 Social functioning: Cognitive Self-Report Questionnaire-25 Other outcomes; mood, IADL, gait speed.	**Adherence:** The Wii group attended an average of 23.1 (SD 1.1, range 21–24) sessions compared with 21.8 (SD 3.3, range 14–24) in the control group; 18 participants attended at least 20/24 sessions; and 9 attended all sessions **Cognitive function:** No significant differences between intervention and control groups No significant differences for any other outcomes measured

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Gonzalez-Palau 2014 Long Lasting Memories programme	Before and after study	Spain	60+ Mean 73.4 (7.51)	Healthy elderly and people with MCI recruited from community centres N=50 (11 with MCI; 39 healthy people) **Gender:** 80.5% female **Ethnicity:** Not reported other than 100% Spanish **SES:** Mean years education: 9.1 (3.2)	**Computer-based cognitive and physical training programme:** one hour's physical training and 35 minutes' cognitive training, 3 times a week, conducted at community centres where participants usually went **Cognitive training:** Used Gradior cognitive training software (a neuropsychological assessment system and multi-domain cognitive training program including attention, perception, episodic memory and working memory tasks, and incorporating feedback and difficulty **Physical training:** Used Fit For All game platform that can help elderly people to keep fit and maintain their wellbeing through an innovative, low-cost ICT platform, such as Wii Balance Board	**Follow-up:** 12 weeks intervention (post test 1-2 weeks after end of intervention) **Lost to follow-up:** 12.0% **Outcome measurement:** Battery of cognitive measures that included: MMSE (Spanish version); Digit Span Test of the Wechsler Memory Scale III (WMS III); Logical Memory subtests of the WMS III; The Color Trail Test 1 and 2 (CTT 1 and 2); Hopkins Verbal Learning Test Revised (HVLT-R); Geriatric Depression Scale (GDS)	Global cognitive function (MEC 35): significant pre-and post-test differences in both healthy and MCI participants (p=0.04) Healthy: Pre: 30.91 (3.05); Post: 31.84 (2.50) MCI: Pre: 29.61 (3.53); Post: 30.44 (3.8) Verbal and episodic memory Significant pre- and post-test differences in both healthy and MCI participants HVLT-R: Recognition Healthy: Pre: 10.19 (1.19); Post: 10.61 (1.45); MCI: Pre: 10.06 (2.53); Post: 10.22 (0.943); p=0.006 Free recall Healthy: Pre: 18.00 (5.69); Post: 19.32 (5.02); MCI: Pre: 14.50 (4.85); Post: 18.33 (6.61); p=0.004 Delay recall Healthy: Pre: 4.71 (2.88); Post: 6.32 (2.77); MCI: Pre: 3.00 (3.23); Post: 6.00 (2.97); p<0.0001 WMS III logical memory Significant effects also seen for pre-test/post-test subtests of logical memory (p=0.02; p<0.0001) Attention CTT1: significant effect only for healthy participants (p=0.04) GDS Symptoms of depression decreased in both healthy and MCI participants Overall, study showed an improvement after the training in global cognitive function and verbal memory, which involved recognition, free recall and delay recall, in attention, in episodic memory and in symptoms of depression

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Kamegaya 2014	RCT	Japan	65-87 Mean age 64.9 (5.9)	Community-dwelling elderly people (30.8% with amnestic MCI) N=52 Mean MMSE score at baseline 27.7 (1.8). **Gender:** 90.4% female **Ethnicity:** Not reported **SES:** Mean years education: 11.2 (2.2)	Physical and leisure activity programme for the prevention of cognitive decline, aimed at 'enhancing participants' motivation to participate and support one another by providing a pleasant atmosphere, empathetic communication, praise, and errorless support'. Programme was provided as a community service available to all community dwellers) **Intervention (n=26):** Received intervention once a week (2h programme) at a community centre, conducted by healthcare professionals, with the help of senior citizen volunteers The physical activity programme was the primary content of the programme. The exercise programme included muscle-stretching exercise in a sitting position (17 items), muscle-strengthening exercise in a sitting position (3 items); and encouraged to perform exercise at home. Mean duration was 45 mins. Walking was recommended to participants as a regular exercise Leisure activities, such as cooking, handcrafts and competitive games, were included in the programme to stimulate cognitive function **Control (n=26):** Did not attend a programme	**Follow-up:** 12 weeks **Lost to follow-up:** Intervention: 26.9% (11.5% completed <7 sessions and were excluded); Control: 3.7% **Outcome measurement:** **Cognitive outcomes:** Five-Cog test, which evaluated the cognitive domains of attention, memory, visuospatial function, language, and reasoning. Executive function was evaluated by the Wechsler Digit Symbol Substitution Test (WDSST) and Yamaguchi Kanji-Symbol Substitution Test **Other outcomes:** Subjective health status, level of social support, functional capacity, subjective quality of life, and depressive symptoms were assessed with a questionnaire. Grip strength test, timed up-and-go test, 5-m maximum walking times test, and functional reach test were performed to evaluate physical function	**Between group analyses:** The intervention group showed significant improvement on the analogy task of the Five-Cog test ($F_{1,38} = 4.242$, $P = 0.046$) and improved quality of life ($F_{1,38} = 4.773$, $P = 0.035$) compared to the control group (n = 24) Other between group tests were non-significant **Within-group analyses:** Intervention group: significant changes for: character position ref task, cued recall task, animal name listing, analogy task, WDSST and Satisfaction in Daily Life (SDL: subjective measure of QoL). Control group: significant differences for: character position ref task, cued recall task, WDSST and grip strength

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Legault 2011 The Seniors Health and Activity Research Program Pilot (SHARP-P) Study	RCT (pilot)	US	70-85 Mean 76.4	Community-dwelling older adults at risk for cognitive decline but without MCI Mean 3MSE score 94.8 N=73 randomised **Gender:** 51% women **Ethnicity:** Healthy training/cognitive training/ physical activity training: 6% African American; 94% Caucasian; combined intervention: 21% African American; 79% Caucasian **SES:** 75% had some post high school education	Cognitive training intervention and/or a physical training intervention **Cognitive Training (N=18):** Sessions were centre-based, word recognition tests conducted via computer, carried out with small groups of no more than six individuals, and monitored by skilled trainers. Training consisted of four consecutive 10-12 min sessions per day, twice a day for two months, then one time per week for two additional months **Physical Activity training (N=18):** Centre-based and home-based sessions aimed primarily at aerobic and flexibility training with a targeted duration of 150 minutes/week, with two center-based training sessions per week for four months. The primary focus was walking with the aim of improving cardiovascular fitness. Other endurance activity (e.g., stationary cycling) were used when regular walking was not appropriate **Combined intervention (N=19):** Cognitive and physical training delivered on the same day (cognitive first) **Healthy Ageing Control (N=18):** Healthy ageing education	**Follow-up:** 4 month intervention **Lost to follow-up:** Cognitive training: 11.1%; Physical training 11.1%; Combined: 5.3%; Healthy aging control 5.6%. **Outcome measurement:** The Self-Ordered Pointing Task to measure planning, working memory and monitoring; Eriksen flanker test to measure response inhibition; Task switching test to measure attentional flexibility; Trail making test to measure alternating attention and executive function; Four measures of episodic memory derived from the Hopkins Verbal Learning Test and the Logical Memory task from the Wechsler Memory Scale-III were also included	Intervention attendance: Rates were higher in the cognitive training and combined groups: Cognitive training: 96%; Physical training: 76%; combined 90%. (p=0.004) **Cognitive outcomes** All intervention groups and the control showed improvements from baseline to follow-up in most cognitive outcomes ($p \leq 0.05$) No between-group statistically significant differences in 4-month changes in composite scores of cognitive, executive, and episodic memory function This pilot study concluded that future two-armed full-scale trials may require fewer than 1,000 participants (continuous outcome) or 2,000 participants (categorical outcome) This pilot study is unlikely to be sufficiently powered (see above) – SK comments

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Linde 2014	RCT	Germany	60-75 Mean age 67.1 (3.6)	Community-dwelling older adults recruited through newspapers and senior citizens associations. All independent living and functional N=70 randomised 51% had not regularly participated in regular sports or physical activity in the past year **Gender:** 59% female **Ethnicity:** Not reported **SES:** 47% had a university degree	Comparison is combined exercise and cognitive training versus exercise training alone, cognitive training alone or no intervention control E**xercise training (N=19):** Moderate aerobic endurance training and moderate strength training, 60 mins, twice a week **Cognitive training (N=18):** Primary element was individual editing of worksheets, with some partner and group exercises. Focus on short-term memory, visuo-spatial skills, information processing speed, concentration and logical reasoning; once/week for 30 mins **Combined exercise and cognitive training (N=17):** Consisted of both the exercise training and cognitive interventions above and took place twice/week. Cognitive training was carried out at the first session of the week, before the exercise training **Control (N=16):** Waiting list control	**Follow-up:** 4 month intervention plus a further 3 months follow-up **Lost to follow-up:** Exercise training: 21.0%; Cognitive training: 38.9%; Combination exercise and cognitive training: 5.9%: Control 18.8% Note: participants lost at post-assessment or follow-up stages performed significantly worse on reasoning and spatial relation subtests than those who remained in the study **Outcome measurement:** Reasoning and spatial relations were assessed with a subtest of the LPS 50+ performance test system; concentration measured with the d2:Test of attention; processing speed (Trail making test part A); cognitive speed assessed with the digit-symbol substitution test; short-term memory with the word-list test	All interventions led to an improvement in cognitive performance though only 2 out of 7 cognitive outcomes were enhanced with different patterns in the 3 intervention groups **Concentration:** The exercise, cognitive and combined training groups had improved concentration at the end of the intervention compared to control, however this was only significant for the exercise training group (p=0.01) **Cognitive speed:** The exercise, cognitive and combined training groups had improved concentration at the end of the intervention compared to control, however this was only significant for the combined exercise and cognitive training group (p=0.03) All other cognitive outcomes were not significantly different from the control

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Maillot 2012	RCT	France	65-78 Mean: intervention 73.47 (4.10); control 73.47 (3.00)	Independently living older adults who reported never playing video games and with a sedentary lifestyle Mean MMSE at baseline: Intervention:28.67 (1.17); control 29.27 (0.88) N=32 randomised Gender: 84.4% Ethnicity: Not reported SES: Mean years education: intervention 11.2 (1.78); control 11.40 (2.22)	Intervention (N=16): Exergaming intervention using the Nintendo Wii. Only games of physically simulated sport were selected on this exercise program: Wii Sports, Wii Fit, and Mario & Sonic on Olympic Games Control (n=16): No training, no contact control group	Follow-up: 12 week intervention Lost to follow-up: 6.2% (n=1) in both groups Outcome measurement: Cognitive battery including: Executive control tasks (Trail-Making test, Stroop Color Word Interference test, Letter Sets test, Matrix Reasoning test2, Digit Symbol Substitution test); visuo-spatial tasks (Spatial Span test, Directional Headings test, Mental Rotation test); and processing-speed tasks subdivided into two categories: perceptual speed (Cancellation test and Number Comparison test) and psychomotor speed (the Reaction Time test and Plate Tapping test)	Overall adherence to the intervention was 97.5% Executive function All six measures of executive function showed significant improved changes compared to control ($p<0.05$) Processing speed Out of eight measures of processing speed, all measures showed significant improvement compared to control ($p<0.05$) Visuospatial tests Changes in 4 visuospatial tests were not significant except for Directional headings (number)
McDaniel 2014	RCT	US	55-75 Mean age (combined group) 64 (6)	Older adults living in the community, those with less than 10th grade education excluded N= 96 randomised **Gender:** 60-71% female (depending on group) **Ethnicity:** 71-96% white (depending on group) **SES:** Mean years education 15-17 years	**Intervention 1:** Combined exercise and cognitive intervention **Intervention 2:** Exercise intervention only **Intervention 3:** Cognitive intervention only **Control:** Low intensity home-exercise program for 6 months, and participated in face-to-face health education sessions for 8 weeks (Months 5 and 6, to correspond to the cognitive-training protocol)	**Follow-up:** 6 months intervention and follow-up (cognitive training 2 months) **Lost to follow-up:** 17.7% overall **Outcome measurement:** Primary outcome measures were 3 laboratory tasks that simulated everyday activities: Cooking Breakfast, Virtual Week, and Memory for Health Information	**Cognitive training only:** Significant improvement in memory processing aspects of virtual week test. No significant improvement for cooking breakfast and memory for health information **Exercise only:** No significant effect for any of the 3 tasks. Participants in the two aerobic exercise training groups achieved greater improvements in peak aerobic power than the control group **Combination cognitive training and exercise:** No significant improvement for any of the 3 tasks

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Oswald 2006 The SIMA study	Quasi- RCT (some exceptions from the randomisation)	Germany	75-93 Mean 79.5 (3.5)	Older adults living independently in the community without functional or cognitive decline or hearing loss or visual impairment N=375 assigned **Gender:** 64.8% female **Ethnicity:** Not reported **SES:** 5.3% university graduates; 14.4% German university entrance exam; 39.2% secondary school education; 41.1% primary school education	Combined PA and cognitive or psychoeducational intervention compared to single PA or single cognitive or psychoeducational training. Training every week over 30 sessions, in small groups of 15-30, delivered by trained group leaders with standardised written information manuals 1) Cognitive and physical training (N=32) 2) Psychoeducational and physical training (N=36) 3) Cognitive training alone (N=57): aimed at information processing, attention and memory 4) Physical training alone (N=32): involved training of balance, perceptual and motor coordination, flexibility and overall level of activity 5) Psychoeducational training alone (N=115): aimed at strengthening individual resources to cope with everyday life demands 6) Control (N=103): No treatment control group	**Follow-up:** 5 years Lost to follow-up: 1) 1 year 25%, 5 years 48.5%. 2) 1y 22.2%; 5 y 50%; 3) 1 y 19.3%; 5 y 49.1% 4) 1y 9.4%, 5 y 53.1 % 5) 1y 26.1%, 5y 59.1% 6) 1y 5.8%, 5 y 48.5%. **Outcome measurement** **Cognitive Function:** Speed of information Processing: Number connection test (NC-G), Maze test (MT-G), Digit symbol substitution test (DS-G) (Neuropsychological aging inventory NAI) **Attention:** Alters- (Aging concentration test); Color word test (CWT-G) (Neuropsychological aging inventory NAI) Primary memory: Memory span (MS-G), Sentence test (ST) (Neuropsychological aging inventory NAI) **Secondary memory:** Picture test (PT), Figure test (FT), Word list (WL), Word pairs (WP) (Neuropsychological aging inventory NAI) **Long term memory Information:** (WAIS-Info) (Wechsler adult intelligence scale, German version), Word fluency (Leistungsprüfsystem LPS). **Reasoning:** Similarities (WAIS-Sim) (Wechsler adult intelligence scale, German version) Cognitive Impairment: Interviewer rating (Sandoz clinical assessment geriatrics SCAG).	**Cognitive function (composite):** Significant intervention vs control differences over 5 years for cognitive exercise ($p<0.001$); cognitive and physical exercise ($p<0.001$); psychoed alone ($p<0.05$) and psychoed and physical exercise ($p<0.005$) but not for physical group alone. **Cognitive impairment (composite):** Only significant difference was for cognitive and physical ($p<0.001$). All other groups, no significant difference. **Physical function:** Only significant difference was for cognitive and physical ($p<0.05$). All other groups, no significant difference **Emotional status:** Only significant difference was for cognitive and physical ($p<0.05$). All other groups, no significant difference **Independent living:** Significant difference for cognitive and physical and psychoed and physical ($p<0.05$ for both). All other groups, no significant difference **Everyday competence:** Significant difference for psychoed and physical ($p<0.05$)). All other groups, no significant difference **Health status:** Only significant difference was for cognitive and physical ($p<0.05$). All other groups, no significant difference **Well-being:** Significant difference for cognitive and physical; psychoed and physical a($p<0.001$ for both) and physical alone ($p<0.05$). All other groups, no significant difference

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Satoh 2014 Funded by Yamaha Music Foundation Registered CT	Quasi-RCT (semi-randomly classified) Control group recruited separately from the ExM and Ex groups	Japan	65+ (range 65-84) Mean: Ex + music 73.1 (4.6); exercise only: 73.3 (4.8); control 73.5 (5.6)	Older adults, physically and psychologically healthy, living independently N=119 randomised **Gender:** 85 female ExM/ 87.5% female Ex/ 80% female control **Ethnicity:** Not reported **SES:** Mean years education: 10.3 (1.6) ExM/ 10.8 (1.8) Ex/ 10.0 (2.1) control	Physical exercise with music compared to physical exercise alone **Exercise with music (ExM) (N=40):** Received music in harmony with exercise. Exercise program included aerobic movement, clapping, training of lumbar, limbs and muscles, stretching, dancing and singing **Exercise alone (Ex) (N=40):** Heard only a percussive beat in time to the exercise (as above). For the singing portion only read the lyrics aloud without the melody Weekly 1 hour sessions – 40 sessions over the year **Control (C) (N=39):** No intervention but underwent the same testing as ExM and Ex groups	**Follow-up:** 1 year intervention **Lost to follow-up:** ExM 35%; Ex 30%; Control: 10.2%. (High drop-outs in ExM and Ex groups due to a major flood in the area) **Outcome measurement:** LM: logical memory, MMSE: Mini-Mental State Examination, RCPM: Raven's Coloured Progressive Matrices, standard, TMT: Trail-Making Test, VSRAD: Voxel-based Specific Regional analysis system for Alzheimer's Disease, WF: word fluency, Kruskal Wallace visuo-spatial test	**Visuo-spatial Kruskal-Wallace test** Significant difference in change scores across the groups (p=0.006) with the greatest change in the ExM group 1.7 (1.8) compared to the Ex group 0.57 (1.5) and control group 0.26 (1.5) No significant difference in change scores across groups for any other test. Within group before and after analyses showed significant improvement in visuo-spatial function in the ExM group, and significant improvements in other batteries in all three groups **VSRAD:** The VSRAD score significantly worsened in the ExM and Ex groups (both groups had high levels of drop-outs compared to controls)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Shatil 2013 Funding: not stated but author is CogniFit employee No CTR	RCT	US	Range 65-92 Mean: 79-81 depending on group	Healthy older adults with MMSE score 24+ **Gender:** 65.5 to 71 % depending on group **Ethnicity:** Not reported **SES:** Those with some college education and above: CT/No PA 78.8%; CT/PA 58.6%; No CT/ No PA 79.3%; No CT/PA 90.3%	Cognitive and/or mild aerobic training **Combined cognitive and mild aerobic training (n=29):** Both the cognitive training and the physical activity training as described below so these participants received twice as many training sessions as did the cognitive or physical activity training participants **Cognitive training only (n=33):** CogniFit cognitive training programme for a total of 32h arranged in 48 40-minute sessions (three times weekly for 16 weeks) with at least a 1-day interval between sessions **Mild aerobic training only (n=29):** Senior exercise video including aerobic warm-up, cardiovascular workout seated and standing aerobic cool-down, strength training, and flexibility training **Control (n=31):** Book reading activity	**Follow-up:** 4 month intervention and follow-up **Lost to follow-up:** Combined: 39.6%; CT only 26.7%; PA 31.1%; Control: 31.0% **Outcome measurement:** Validated (in healthy younger adults, against major standard neuropsychological tests), multi-domain computerized cognitive evaluation for older adults (CogniFit neuropsychological evaluation: 15 evaluation tasks measuring a wide range of cognitive abilities such as focused and divided attention, inhibition, shifting, planning, working memory, and eye-hand coordination	Older adults in both cognitive training groups (cognitive training alone or combined cognitive training) showed significant improvement in cognitive performance on hand-eye coordination, global visual memory (GVM), working memory, long-term memory, speed of information processing, visual scanning and naming NB: There is a large amount of data in table 9 – results summarised above

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Singh 2014 Study of Mental and Resistance Training (SMART) study	RCT	US	70.1 (6.7)	Adults with MCI n=100 **Setting:** Clinic **Gender:** 68% female **Ethnicity:** Not reported **SES:** Not reported but results adjusted for education.	**Resistance training and/or cognitive training** Cognitive Training (CT) Intervention plus Sham Exercise (N=24): Computer-based exercises targeting memory, executive function, attention, and speed of information processing using the COGPACK program Progressive resistance training (PRT) plus Sham Cognitive Training (N=22): Pneumatic resistance machines were used for high intensity training for most major muscle groups (chest press, leg press, seated row, standing hip abduction, knee extension). Supervised by exercise physiologists and physiotherapists Combined CT and PRT (N=27): Received both the CT intervention and PRT interventions as above sequentially during the same session Control (N=27): Received both sham cognitive and sham exercise interventions Sham Cognitive Training Consisted of watching 5 short National Geographic videos, followed by a set of 15 questions (3/video) This has had minimal impact in previous trials. Sham Exercise Stretching and seated calisthenics designed not to notably increase heart rate	**Follow-up:** 6 months intervention, 18 month follow-up. **Lost to follow-up:** 6 months: Combined 11.1%; PRT 27.2%; CT 8.3%; control 11.1%. 12 months: Combined 18.5%; PRT 54.5%; CT 16.7%; control 18.5%. All participants included in ITT analysis **Outcome measurement:** Global cognitive function (ADAS-Cog) Executive function, memory, speed attention tests: Executive function (WAISIII) and verbal fluency (Controlled Oral Words Association Test (COWAT) and Animal Naming) Memory tests included auditory Logical Memory I (immediate) and II (delayed) subtests of the (WMS-III)25 and the List Learning subsection of the ADAS-Cog, and visual via Benton Visual Retention Test-Revised 5th Edition (BVRT-R) Attention/speed via Symbol Digit Modalities Test (SDMT) Global Domain included all tests except List Learning, as it was already included within ADAS-Cog total score. Executive Domain included WAIS Similarities and Matrices, COWAT, and Animal Naming. Memory Domain included Logical Memory I and II, List Learning, and BVRT-R	**PRT benefit** 74% higher than the Combined Group (p = 0.02) No significant between group differences for any other cognitive outcomes **Adverse events** 6 adverse musculoskeletal events over 18 months (3 falls during assessments and 3 exacerbations of pre-existing arthritis symptoms during strength testing/training, with 1 unresolved (exacerbation of an underlying rotator cuff tear) Note: high drop-out in PRT group so those who remained may have been those with better general including cognitive function who could cope with the tests

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Yokoyama 2015 PA and cognitive training	RCT	Japan	Mean ages: ST group 74.2 and 3.4 yrs, DT group 74.2 and 4.3 yrs	Sedentary elderly people N=27 randomised **Setting:** University research centre **Gender:** Intervention 91.7% female; control 92.3% female	Both groups received 1-hour exercise training separately, supervised by a trained instructor, three times a week, for 12 weeks **Intervention (N=12):** Cognitive-motor dual-task training, which requires dividing attention between cognitive tasks and exercise (resistance and aerobic exercise). Examples are: arithmetic tasks (subtraction of one digit) or Shiritori, a Japanese word chain game in which one player has to say a word starting with the last character of the word given by the previous player, carried out during thigh-raising exercise; or switching direction, walking either forward or backward, according to patterns of whistling **Control (N=13):** Single-task training comprising aerobic and resistance exercise only.	**Follow-up:** 12 week intervention **Lost to follow-up:** 7.4% overall. **Outcome measurement:** Cognitive function Executive functions: Modified Mini-Mental State (3MS) examination and the Trail-Making Test (TMT) Biomarkers: Plasma amyloid β peptide (Aβ) 42/40 ratio. Other outcomes: Physiological performance, anthropometry.	**3MS outcomes** There were significant between group differences in attention, verbal fluency and understanding, and similarities between the intervention and control group ($p<0.05$) The 3MS total score significantly improved from baseline compared to control ($p<0.05$)

Table 3: Multicomponent – Interventions with cognitive outcomes: combined PA and diet

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Baker 2012 Secondary analysis of Bayer-Carter 2011 paper (DIET section). This analysis examines the modulating effect of PA on outcomes of diet intervention	Secondary analysis RCT	US	67.6/69.3 intervention/control	**Population:** N=49 older adults of which N=29 had amnestic mild cognitive impairment and N=20 were healthy controls **Setting:** Veterans Affairs Medical Center clinical research unit **Gender:** 53.1% female **Ethnicity:** Not reported **SES:** Mean educational level across groups: 13-15 years	**Intervention 1:** High–saturated fat/high–glycemic index diet (HIGH): (fat, 45% [saturated fat,_25%]; carbohydrates, 35%-40% [glycemic index,_70]; and protein, 15%-20%) **Intervention 2:** Diet with a low-saturated fat/low–glycemic index diet (LOW) diet (fat, 25%; [saturated fat,_7%]; carbohydrates, 55%- 60% [glycemic index,_55]; and protein, 15%-20%) Both interventions were conducted in a group of participants with MCI and a group of healthy participants	**Follow-up:** 4 weeks intervention and follow-up **Lost to follow-up:** Not reported (appears to be 0%) **Outcome measurement:** Diet composition measured by self-reported 3 day food intake record PA assessed using 7d questionnaire	For healthy adults, increased hi–PA attenuated the effects of the HIGH diet on CSF Aβ42 whereas in those with MCI, increased hi–PA potentiated the effects of the LOW diet. Authors concluded that normal adults who engage in hi–PA are less vulnerable to the pathological effects of an unhealthy diet, while in MCI, the benefit of a healthy diet on Aβ modulation is greatest when paired with hi–PA. Exercise may thus interact with diet to alter pathological processes that ultimately modify AD risk

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Komulainen 2010 Dose Responses to Exercise Training (DR's EXTRA) Study	RCT (randomised by blocks)	Finland	55-74 Mean age 65.6 (5.4) to 66.9 (5.2) depending on group	Random population sample of older adults N=1410 randomised **Setting:** Community **Gender:** Not reported for baseline sample **Ethnicity:** Not reported **SES:** Mean years education 10.7 (3.7) to 11.4 (4.1)	**6 different groups** **Aerobic exercise (N=234):** prescribed an individualised aerobic exercise programme at intensity 55–65% of VO-2max. Gradually increased during first 6 months. Then subjects randomised into two subgroups with energy expenditure of 1000–1500 kcal/week (5 x 60 min/ week) or > 1500 kcal/week (5 x 90 min/week) **Resistance exercise (N=236):** Supervised, individualised strength-training programme.Gradually increased during the first 6 months. Then subjects randomised into two subgroups with the energy expenditure of 1000–1500 kcal/week (two sessions/ week) or > 1500 kcal/week (three sessions/week).Plus aerobic exercise 150/180 min/week **Diet (N=236):** received individually tailored counselling by nutritionists for the first 6 months based on Finnish nutrition recommendations (FNR). After 6 months, subjects randomly allocated to follow the same guidelines or to a special nutrition group **Combined aerobic exercise and diet (N=234):** **Combined resistance exercise and diet (N=234):** **Control group (N=236):** Verbal advice on diet and physical activity	**Follow-up:** 2 years (interim data); study ongoing (to 4 years). **Lost to follow-up:** 8.4% overall (at 2 years): control: 7.2%; Aerobic: 7.3%; Resistance 11.0%; Diet: 8.5%; Aerobic + Diet: 6.8%; Resistance + Diet 9.4%. **Outcome measurement:** Cognitive function assessed using the Consortium to Establish a Registry for Alzheimer's Disease (CERAD) neuropsychological Tests. Sum scores were calculated for five cognitive domains; immediate memory (sum from three trials of Word List Memory Test), delayed memory (sum from Word List Recall Test, number of correctly identified words from Word List Recognition Test and delayed Constructional Praxis Test), verbal performance (sum from Verbal Fluency Test and Modified Boston Naming Test), visual performance (sum from Constructional Praxis Test and Clock Drawing Test) and MMSE **Other outcomes:** Physical exercise, VO2 max, adverse events	**Cognitive outcomes (2 yrs)** No statistically significant differences between groups for changes in immediate memory, delayed memory, verbal performance, visual performance or MMSE across the study groups **Other outcomes** There was a mean increase in moderate-to-heavy physical exercise in the four exercise groups, but no change in the reference and diet only groups (P < 0.001 between groups VO2max remained unchanged in the groups that included aerobic or resistance exercise, but decreased in the reference and the diet groups (P < 0.001 between groups **Adverse events** Five adverse events were reported (one angina pectoris during a cycle ergometer test, one angina pectoris and three light-headedness episodes during muscle strength training). Based on medical examinations, physicians concluded that it was unlikely any of these events were directly caused by the interventions, and participants remained in the study

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Napoli 2014	RCT	US	65+ Mean age 70 (SD 4)	Obese, older adults (BMI 30+), sedentary with stable body weight in the past year, and on stable medications and with mild-to-moderate frailty Mean BMI at baseline 36-37 **Gender:** 57-67% female (depending on group) **Ethnicity:** 81-89% white (depending on group) **SES:** Mean years education: 15.3-16.9 (depending on group)	**Intervention 1 (N=28):** Combined dietary weight management programme and exercise. Participated in both weight-management and exercise programmes described below separately from the other groups **Intervention 2 (N=26):** Diet/Weight loss only mprescribed a diet that provided a daily energy deficit of 500–750 kcal/d. Groups met with dietitians for food diary review, caloric intake adjustments, and behavioral therapy. The goal was to achieve 10% weight loss for 6 mo and to maintain this weight for the remaining 6 mo of the study **Intervention 3 (N=26):** Exercise only. Participants in the exercise group were counseled on maintaining a weight-stable diet. They participated in a supervised progressive multicomponent exercise training programme. Exercise sessions were 90 min (w15 min flexibility, 30 min aerobic, 30 min resistance training, and 15 min balance exercises) 3 times weekly **Control (N=27):** Received general info about a healthy diet at regular visits by staff	**Follow-up:** 1 year **Lost to follow-up:** 13% did not complete study but all included in ITT analyses **Outcome measurement:** Modified Mini-Mental State Examination, Word List Fluency Test, Trail Making Tests Parts A and B, and Geriatric Depression Scale (GDS) Short Form. Impact of Weight on Quality of Life-Lite (IWQOL)	**Modified Mini-Mental State Examination:** Scores improved more in the diet: 1.7 (0.4), exercise: 2.8 (0.4), and diet-exercise 2.9 (0.4) groups than in the control group 0.1 (0.4) (between-group P = 0.0001–0.04) Scores in the diet-exercise group improved more than in the diet group but not more than in the exercise group **Word Fluency Test:** Scores improved more in the exercise 4.1 (0.8) and diet-exercise 4.2 (0.7) groups than in the control group 20.8 (0.8); both p = 0.001 **Trail Making Test:** Scores in the diet-exercise group 211.8 (1.9) improved more than in the control group 20.8 (1.9) (P = 0.001); similar results were found for the Trail Making Test Part B **IWQOL:** Scores on the IWQOL improved more in the diet 7.6 (1.6), exercise 10.1 (1.6), and diet-exercise 14.0 (1.4) groups than in the control group 0.3 (1.6) (P = 0.0001–0.03); scores in the diet-exercise group improved more than in the diet group but not more than in the exercise group **Weight Changes:** As intended, body weight decreased in the groups that received the dietary weight loss intervention. Weight decreased similarly in the diet and exercise 28.6 (3.8) and diet only groups 29.7 (5.4)

Table 4: Multicomponent – Interventions with cognitive outcomes: combined cognitive and social activation

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Stine-Morrow 2007 Senior Odyssey programme	Quasi-RCT (field experiment). Assigned those from retirement villages to the experimental group because of effort put in to build relationships. So not properly randomised	US	Range 55–93 Mean: I: 73.6, range 60–93 C: 70.2, range 58–85	Older adults living in the community or retirement villages. N=81 randomised **Setting:** Community programme. **Gender:** Not reported **Ethnicity:** Not reported **SES:** Mean years education: intervention: 16.1 (0.4); control: 15.4 (0.7)	**Intervention (N=61):** Engaged lifestyle programme. Team-based, competitive programme of creative problem solving involving repeated opportunities for engagement with ill-defined problems with multiple solutions. (The programme was developed from a well-established programme for children and young adults) **Control (N=20):** Wait-list control	**Follow-up:** 20 week intervention (Note: pre- and post-cognitive tests up to 9 months apart). Only processing speed showed differential positive change in the experimental group relative to the control group; differential change in divergent thinking reached a marginal level of significance. Patterns of change in working memory, inductive reasoning, and visuo-spatial processing were also in the predicted direction but did not reach significance. Furthermore, individuals in the experimental group showed differential positive change in both mindfulness and need for cognition) **Lost to follow-up:** Intervention: 20% (20 wks); control: **Outcome measurement:** Cognitive outcomes 1. Processing speed: Letter and Pattern Comparison tasks and Finding As and Identical Pictures 2. Working memory: Letter–Number Sequencing 3. Inductive reasoning: Letter Sets and Figure Classification. 4. Visual-spatial processing: Card Rotation and Hidden 5. Divergent thinking (fluency): Word Association, Ornamentation, and Opposites	Mean participation: 17.3 weeks out of 20 (86.5%) Only processing speed showed differential positive change in the experimental group relative to the control group; differential change in divergent thinking reached a marginal level of significance **Predisposition toward cognitive engagement. Change (from pre-to-post intervention) (SD)** **Intervention** Mindfulness -0.02 Need for cognition 0.11 Metamemory in adulthood (MIA) self-efficacy -0.06 Perceived activity level -0.11 Processing speed 0.09 Working memory 0.12 Inductive reasoning 0.22 Visuo-spatial processing 0.33 Divergent thinking 0.29 **Control** Mindfulness -0.40 Need for cognition -0.28 MIA self-efficacy -0.09 Perceived activity level 0.15 Processing speed 0.70 Working memory -0.06 Inductive reasoning -0.29 Visuo-spatial processing 0.01 Divergent thinking 0.11 **Between group difference (p)** Mindfulness 2.03 (0.02) Need for cognition 1.85 (0.03) MIA self-efficacy 0.18(>0.20) Perceived activity level -1.80 (0.08) Processing speed 1.76 (0.04) Working memory 0.85 (0.20) Inductive reasoning 1.17 (0.12) Visuo-spatial processing 1.03 (0.15) Divergent thinking 1.32 (0.10)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Stine-Morrow 2007 *(continued)*						Dispositions reflective of cognitive engagement: Mindfulness, need for cognition, memory self-efficacy, activity (not specified?)	**Correlations Between Measures of Perceived Cognitive Engagement and Cognitive Components (p value)** **Mindfulness** Processing speed 0.12 (ns) Working memory 0.12 (ns) Inductive reasoning 0.20 (ns) Visuo-spatial processing 0.14 (ns) Divergent thinking 0.26 (p<0.05) **Need for cognition** Processing speed 0.11 (ns) Working memory 0.20 (ns) Inductive reasoning 0.26 (p<0.05) Visuo-spatial processing 0.30 (p<0.01) Divergent thinking 0.19 (ns) **MIA self-efficacy** Processing speed 0.21 Working memory 0.26 (p<0.05) Inductive reasoning 0.39 (p<0.01) Visuo-spatial processing 0.28 (p<0.01) Divergent thinking .11 **Perceived activity level** Processing speed 0.30 (p<0.01) Working memory 0.25 (p<0.05) Inductive reasoning 0.44 (p<0.01) Visuo-spatial processing 0.39 (p<0.01) Divergent thinking 0.39 (p<0.01)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Stine-Morrow 2008 Senior Odyssey programme (appears to be a different study from Stine-Morrow 2007 above) Note: recruitment was conducted over 2 years/ seasons so data reported in Stine-Morrow 2007 may be first wave of data that may also be reported in this trial	Quasi-RCT (field experiment) Assigned those from retirement villages to the experimental group because of effort put in to build relationships. So not properly randomised	US	**Intervention:** 73.0, range: 59–93 **Control:** 72.0, range: 58–91	Older adults from the community and local retirement communities. N=181 randomised **Setting:** Community **Gender:** Not reported **Ethnicity:** Not reported **SES:** Years of education (mean): Intervention 16.3 (SE 4), Control 16.0 (SE 3).	**Intervention (N=107):** Engaged lifestyle programme. Team-based, competitive program of creative problem solving involving repeated opportunities for engagement with ill-defined problems with multiple solutions. (The programme was developed from a well-established programme for children and young adults) **Control (N=74):** Wait-list control	**Follow-up:** 20 week intervention **Lost to follow-up:** Intervention: 19%; control: 15% completed post-test measures. (Note: n=23 dropped out of intervention group during the 20 weeks but returned for post-test measurement) Those who returned for follow-up scored higher for speed of processing than those who did not **Outcome measurement:** Longevity, resistance to dementia, and enhanced cognitive flexibility	**Adherence to the programme:** Attendance at weekly meetings was variable (6-20 session; mean 15.5 (SE4) **Cognitive tests (one-tailed tests)** Reliable for speed t(146)=1.81, p=0.036 Inductive reasoning t(146)=1.83, p=0.034 Divergent thinking t(147)=1.88, p=0.031 Working memory t(146)=1.01, p=0.136 Visual- spatial processing t(144)=.60, p=0.275 Overall showed differential positive change among those who participated in the cognitive intervention, t(149)=3.11, p=0.001 **Control group vs. experimental group** Self-efficacy, t(133) = −1.59, Mindfulness, t(128)=0.81 Need for cognition, t(130)=0.68

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Stine-Morrow 2014 Senior Odyssey programme versus cognitive training programme	Quasi-RCT Some participants not randomly allocated to meet project deadlines	US	60 to 94 Mean: 72.6	Healthy older adults from the community and local retirement communities N=461 randomised **Setting:** Community **Gender:** Engagement intervention: 71% female; Cognitive training intervention 77% female; Waiting list control: 76% female **Ethnicity:** Not reported **SES:** Years of education (mean): Engagement intervention 15.7 (2.6); Cognitive training intervention 15.2 (2.7); Control 15.4 (2.5)	**Engagement programme (Senior Odyssey) (N=188):** A team-based competitive program in creative problem solving (no explicit instruction) **Cognitive training (N=130):** Home-based inductive reasoning training program (instruction and practice explicit). **Wait-list control (N=143):** No intervention but participated in testing as a control for re-test effects	**Follow-up:** 16 weeks intervention but pre-and post-test were 30 to 32 weeks apart **Lost to follow-up:** Engagement: 16 %; Cognitive training: 12 %; Wait-list: 12% **Outcome measurement:** Processing Speed: Letter and Pattern Comparison tasks and the Finding A's task. Reasoning: Letter Sets, Number Series, Letter Series, and Word Series tasks and the Everyday Problem-Solving (EPS) task. Visual-spatial processing (VSP): Card Rotation and Hidden Patterns Divergent Thinking: Alternate Uses task and the Opposites task. Verbal Episodic Memory: was measured using two indicators derived from performance on the Hopkins Verbal Learning Test; total number of words remembered over three trials (HVLT-Tot) and the delayed recall score (HVLT-DR)	**Adherence to the programmes:** Engagement participants attended an average of 11.0 out of 16 session (SD 4.8) and Training participants completed an average of 12.9 modules out of 16 (SD _5.2); this difference in adherence was significant, $F(1, 317)$ 11.42, $p < 0.001$ **Key results:** Those in the training condition showed selective improvement in inductive reasoning. Training participants showed more change than both Engagement and Wailist participants and Engagement and Waitlist participants did not change from each other Those in the engagement condition showed selective improvement in divergent thinking. Neither the Waitlist or Training group had significant re-test effects. Correlations between baseline characteristics and latent training improvements: **Divergent Thinking: Engagement** Statistically significant ($p<0.05$) differences for age, Montreal Cognitive Assessment (MoCA), verbal, openness, need for cognition, social network index **Inductive Reasoning:** Training Statistically significant differences for MoCA, Verbal. Note: Both Engagement and Training groups showed selective improvement in individual skills that were practiced rather than broad cognitive improvements

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Zacharelli 2013 SOCIABLE programme	RCT	4 European countries: (Italy, Greece, Spain, Norway)	65+	Cognitively intact, elderly patients with MCI and patients with mild Alzheimer's disease (AD) (but reports outcomes for all 3 groups together and each one separately) N=348 randomised **Gender:** Not reported **Ethnicity:** Not reported **SES:** Not reported but had to have a minimum of 5 years education for inclusion	**Intervention:** Computer-based cognitive training and social activation program Training program of 24 sessions of 60 minutes of duration (individual or in group), twice per week for 12 weeks Included cognitive training games with 3 levels of difficulty, and a 'book-of-life' application (a personal diary, created by the elderly, containing life experiences, memories and thoughts, to be shared with other users) **Control:** No intervention (delayed treatment)	**Follow-up:** 3 and 6 months **Lost to follow-up:** 0% (analysis conducted on all those randomised) **Outcome measurement:** GLOBAL COGNITION REASONING Clock Drawing Test MEMORY-VERBAL- Digit Span forward SHORT MEMORY-VERBAL Rey Auditory Verbal; Learning Test (RAVL)- immediate MEMORY-VERBAL- Rey Auditory Verbal LONG Learning test (RA VL) – delayed MEMORY-VISUOSP- Rey's Complex figure - LONG recall PRAXIS Rey's Complex EXECUTIVE Phonological Verbal FUNCTIONS Fluency EXECUTIVE Trail Making Test B FUNCTIONS EXECUTIVE Digit Span FUNCTIONS ATTENTION Trail Making Test LANGUAGE Naming Test	**Cognitive outcomes** Across all population groups (healthy, MCI and mild AD) there were significant differences between intervention and control for: global cognition, verbal memory, praxis, executive function and language **Cognitively healthy group:** significant differences between intervention and control for measures of verbal memory, praxis, executive function and language **MCI group:** Significant differences between intervention and control for measures of global cognition, verbal memory and executive function **Mild AD group (excluded but shown for info):** Significant differences between intervention and control for measures of global cognition, verbal memory and executive function

Table 5: Multicomponent – Interventions to improve uptake/maintenance of healthy behaviours: combined PA/diet

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Burke 2013, Pasalich 2013 The Physical Activity and Nutrition for Seniors (PANS) programme	RCT	Australia	60-70 Mean: I 65.80 (2.95); C 65.75 (3.19)	Insufficiently active low to middle income older adults who resided in suburbs N= 478 randomised **Gender:** Intervention: 52.8% male; control: 50.8% male (of completers) **Ethnicity:** Not reported **SES:** low to medium; 21% of intervention group had university education and 17.6% of control	**Intervention (N=248):** Low-cost, accessible, home-based physical activity and nutrition program that incorporated goal-setting and social support and included a range of supportive resources including written materials, pedometer and resistance band **Control (N=230):** No intervention: completed postal questionnaires at baseline and post-program	**Follow-up:** 6 month intervention plus further 6 month follow-up at 12 months (Pasalich 2013) **Loss to follow-up:** 22.5% **Outcome measurement:** Self-reported; Modified fat and fibre questionnaire for nutritional behaviours, and the International Physical Activity Questionnaire for PA	**Physical activity outcomes:** After controlling for demographic and other confounding factors, the intervention group demonstrated increased participation in strength exercise ($p < 0.001$), walking ($p = 0.029$) and vigorous activity ($p = 0.015$), together with significant reduction in mean sitting time ($p < 0.001$) relative to controls. All pre-test/post-test comparisons were significantly better in the intervention group ($p<0.05$) for strength exercise, walking, moderate activity, vigorous activity, sitting time whereas none of these comparisons were significant for the control group **12 month follow-up:** Sustained improvements were observed for strength exercises. However, mean walking time decreased below baseline levels for both groups. At post-program, the intervention participants had increased time spent in moderate activity ($p > .05$), which declined at follow-up ($p < .05$) **Nutrition outcomes:** Improvements in nutritional behaviours for the intervention group were also evident in terms of fat avoidance ($p < 0.001$), fat intake ($p = 0.021$) and prevalence of frequent fruit intake ($p = 0.008$). No sig differences for fibre intake behaviour and frequency of vegetable intake behaviour **12 month follow-up:** Improvements in fibre intake, fat intake, fat avoidance, body mass index and waist-to-hip ratio were sustained at 12 months **Costs:** Reported but not cost-effectiveness

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Geller 2012	RCT (very small, n=21)	US (Hawaii)	Mean 72.2	Older adults recruited from 2 community housing sites Mean BMI at baseline: 26.14 (SD = 6.57) N=21 randomised **Gender:** 76% female **Ethnicity:** Ethnically diverse population including Japanese 23.8%; Filipino 19.0%; Caucasian 19.0%; Native American 4.8%; Native Hawaiian 4.8%; Hispanic 4.8%; others; 23.8% **SES:** 80% high school graduates	Physical activity OR fruit and vegetable programme Single day PA or fruit and veg intervention based on a decisional balance sheet programme (a promotional tool targeting the perceived pros and cons of behaviour adoption)	**Follow-up:** 1 day intervention, followed up at 2 weeks **Lost to follow-up:** 29% from PA intervention and 47% from fruit and veg intervention **Outcome measurement:** Self-reported using validated measures: PA: International Physical Activity questionnaire (short); Daily fruit and vegetable intake: National Health and Nutrition Examination Survey single item instrument	Both programs were implemented efficiently, and participants in both groups improved their daily physical activity but there were minimal changes in fruit and veg consumption (p values not reported) **Costs:** The program required minimal staff involvement (≈30–40 min) and included minimal paper costs ($0.05 [one decisional balance sheet] × 21 participants = $1.05). Cost-effectiveness not reported Note: high fruit and vegetable consumption at baseline
Jaacks 2014 Diabetes Prevention Program and Diabetes Prevention Program Outcomes Study	RCT (multi-centre)	US	25+ (but reports outcomes separately for older adults)	People at high risk of developing diabetes N=3234 randomised (2 stages of randomisation – n not clear for each group) **Gender:** 68% female **Ethnicity:** 54.7% Caucasian; 19.9% African-American; 15.7% Hispanic; 5.3% American Indian; 4.4% Asian-American. **SES:** (yrs education): <13 y 25.8%; 13-16 y 48.1%; >/=17 y 26.1%.	**Intervention:** (Lifestyle): 16 session core curriculum over the first 24 weeks, followed by individual counselling (at least monthly) with primary goals of achieving and maintaining weight loss of >/= 7% initial body weight and moderate intensity activity of >/=150 min/wk. Participants were advised to reduce dietary fat intake to <25% of total calories **Comparator:** (Metformin) **Comparator:** (Placebo)	**Follow-up:** 1,5,6,9 years after randomisation **Lost to follow-up:** >/= 14% (not clear) **Outcome measurement:** Self-reported, dietary intake was assessed using a food frequency questionnaire administered by trained interviewers	Reports outcomes separately for people aged 60+ For those age 60+, there were trends towards increases in fruit and vegetable intake from baseline over 9 years of follow-up for the lifestyle arm compared to the metformin or placebo comparison groups but between group differences were not statistically significant

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Hageman 2014	RCT	US	40-69 Mean 56.4 (6.3)	Rural women with prehypertension. 18.4% were normal weight, 37.7% were overweight and 43.9% were obese N=289 randomised **Gender:** 100% female **Ethnicity:** 97.9% Caucasian **SES:** 40.8% had college degree or higher	Both intervention groups (internet and print) received initial training about hypertension/ pre-hypertension with discussion of strategies to achieve targets for healthy eating and activity; also blood pressure monitors and pedometers. Both groups also received telephone goal setting counselling and newsletters **Intervention Internet (N=116):** At the second session, those in the internet group received training for using the DASH wellness for women website including monitoring diet, PA and blood pressure **Intervention Print (N=115):** At the second session, received instruction in tracking of their blood pressure, eating, and activity using paper logs **Control (standard advice) N=48:**	**Follow-up:** 12 months with further 12 month follow-up to 24 months **Lost to follow-up:** 6% at 12 months; 11.4% at 24 months (no sig diff between groups) **Outcome measurement:** Self-reported, Web version of the 1998 Block Health Habit and History Questionnaire (HHHQ) to measure diet; Modified 7-Day Activity Interview instrument for PA	**Diet outcomes:** Web-based and print-mailed groups improved more than standard advice group for % daily calories from fat (p = 0.018 and p = 0.030) and saturated fat (p = .049 and p = .013); daily servings of fruit and vegetables (p =0 .008 and p <0 .005); and low fat dairy (p <0 .001 and p = 0.002) However, the standard advice group had greater decline compared to both intervention groups for kilocalorie intake (p = .024 and p = .027) and sodium (p = .030 and p = .026) **Physical activity outcomes:** There were no significant differences between the web-based and print-mailed groups in change on any of the outcomes **Other outcomes:** Blood pressure: The 24-month estimated marginal proportions of women achieving normotensive status were 47% for web-based, and 39% for both print-mailed and standard advice groups, with no group differences (p = .11 and p = .09, respectively) Web-based and print-mailed groups improved more than standard advice group for waist circumference (p = .017 and p = .016, respectively) Greater improvements were observed in web-based versus standard advice groups in systolic blood pressure (p = 0.048) and estimated VO2 max (p = 0.037) There were no significant differences between the web-based and print-mailed groups in change on any of the outcomes

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Kelley 2004	RCT	UK	65+ Mean age of 81.7 years(5.6)	Outpatients from hospital clinics N=252 randomised **Gender:** 69% female **Ethnicity:** Not reported	**Intervention (N=125):** Healthy living booklet designed to promote healthy eating and physical activity amongst older adults Based on behavioural theory with goal-setting prompts **Control (N=127):** Patient satisfaction questionnaire	**Follow-up:** 2 weeks **Lost to follow-up:** 17% **Outcome measurement:** Self reported changes in diet and PA using single item questionnaire	**Diet outcomes:** 50.4% set goals to eat more healthily (e.g. "to eat five portions of fruit and vegetables a day"), and 67% of those who set goals reported 100% success in acting on them **Physical activity outcomes:** Only 34% of intervention participants set an activity goal (e.g. "a five minute walk everyday"), and only 51% reported 100% success in achieving them
Kimura 2013	Cluster RCT	Japan	65-90 Mean age: I 74.3 ± 5.9/ C 74.3 ± 5.0	Community dwelling older adults **Gender:** 79.8% female **Ethnicity:** Not reported **SES:** Not reported	Community-based social health intervention to improve dietary habits and promote physical activity among older adults Delivered in community centres **Intervention group (3 community centers; n = 57):** Participated in social health program "Sumida TAKE10!", an educational program incorporating the "TAKE10! for Older Adults" program (eating regularly from 10 food groups and taking 10 min of physical activity at least 2–3 times per day), once every 2 weeks for 3 months **Control group (3 community centers; n=35):** No intervention but subsequently received same programme as a crossover intervention group	**Follow-up:** 3 months intervention **Lost to follow-up:** control 5.4%; intervention 0% **Outcome measurement:** Self-reported; Food intake was assessed using a questionnaire on food intake frequency covering 1 week for changes in food intake frequency, food frequency score (FFS), dietary variety score (DVS); frequency of walking and exercise using a questionnaire	The mean attendance rate for the intervention classes was 68.1% (range 41-95%) **Diet outcomes:** Compared to baseline, post-intervention food intake frequency for 6 of 10 food groups (meat, fish/shellfish, eggs, potatoes, fruits, and seaweed), FFS, and DVS were significantly increased in the intervention group, and interaction effects of FFS and DVS were seen between the two groups. No significant differences were observed between baseline and post-intervention in the control group **Physical activity outcomes**: Frequency of walking and exercise remained unchanged in both groups, and no significant difference in improvement rate was seen between the groups **Other outcomes:** Self-rated health was significantly increased in the intervention group. Appetite and TMIG Index of Competence score were unchanged in both groups

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Nahm 2010	RCT (pilot)	US	55+ Mean age: 69.3 (7.7) years	Community-dwelling older adults with access to the internet and could use the internet and email independently N=245 randomised **Gender:** 78.4% female **Ethnicity:** 91.0% white **SES:** 85.5% had some college or higher education	**Intervention:** (TSW) for older Social Cognitive Theory (SCT)-based, Structured Hip Fracture Prevention Website adults. Included learning modules about Osteoporosis, Falls and Hip Fractures, Dietary/ Supplementary Calcium Intake, and Exercise. The modules included text material, video, audio, and self-assessment quizzes using in an older adult-friendly format; and relevant discussion boards **Comparator:** Conventional website. Participants also completed 4 learning modules without the discussion boards. Content included hyperlinks to relevant health websites	**Outcomes:** included (1) knowledge (hip fractures and osteoporosis), (2) self-efficacy and outcome expectations, and (3) calcium intake and exercise **Follow-up:** 2 weeks intervention and follow-up at 3 months **Lost to follow-up:** **Outcome measurement:** Self-reported; Dietary calcium intake was assessed using a 22-item measure derived from the Block-National Cancer Institute Health Habits and History Questionnaire (HHHQ) that assesses frequency and portion size; Exercise behaviour was measured using the exercise dimension (6 items) of the Yale Physical Activity Survey (YPAS)	Both groups showed significant improvement in most outcomes For calcium intake, only the TSW group showed improvement. None of the group and time interactions were significant

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Oh 2014	RCT	S. Korea	51–83 mean 66.2 years (8.2)	Post-menopausal older women without cognitive impairment recruited from a healthcare centre in a rural village 75% (n¼31) of the participants had osteoporosis or osteopenia Mean BMI at baseline 23.8 **Gender:** 100% female **Ethnicity:** Not reported **SES:** Not reported	**Intervention (N=21):** Lifestyle intervention to improve bone health Trained community nurse practitioner provided the 3-month intervention in a total of 24 sessions, held 2 times/week at the healthcare center. The intervention included individualized health monitoring; group health education; group exercise, calcium–vitamin D supplementation **Control (N=20):** Received an educational booklet and were instructed to maintain their usual lifestyle behaviour	**Follow-up:** 3 month intervention **Lost to follow-up:** 0% for both groups **Outcome measurement:** Self-reported food diaries for diet; physical activity – single item question about number of days/week participated in activity	Compared with the control group, the intervention group showed improvement in diet and exercise after 12 weeks **Diet outcomes:** Intake of dairy, calcium rich fish, nuts, and vitamin D-rich foods such as fish oil and vegetables increased significantly in the intervention group The mean level of serum 25-OH-Vit.D showed significantly greater increases in the intervention group than in the control group at the study's completion. Serum levels of calcium changed little in both groups **Physical activity outcomes:** Regular weekly exercise was more frequent in the intervention group than at baseline or among control group participants

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Plawecki 2013	RCT	US	Mean age was 65.5 (9.6 years)	Older, community-dwelling people. 67% had no history of osteoporosis, almost all had previously had a bone scan (81%) **Gender:** 83% female **Ethnicity:** 90% white **SES:** 77% had some college eduction	**Intervention (N=35) :** Community intervention for improving bone health behaviours targeting those older than 50 years. An 8-week, bone-health community program addressed risks and lifestyle changes within the Health Belief Model and Theory of Reasoned Action frameworks Control (N=34): Delayed treatment control group	**Follow-up:** 8 weeks Lost to follow-up: Intervention 11.4%; Control 8.8% **Outcome measurement:** Calcium-Focused Food Frequency Questionnaire (CFFFQ) - includes both natural and fortified sources for usual calcium intake. 24 hour recalls for daily intake **Activity:** An activity log was used to record, number of steps using pedometers, the number of heel drops (to measure ground force activity), time devoted to balance activity (including minutes of resistance band use)	**Calcium intake:** At 8 weeks, there was no significant difference between intervention and control groups (p=0.70) in total calcium intake using the 24-hour recall or CFFFQ (p=0.072) There was a significant increase in total calcium from week 1 to week 8 (p=0.005 for 24-hour recall; p=0.027 for CFFFQ), with a significant increase for calcium from the fruit group (p=0.005) for the 24-hour recall and for calcium from grains for the CFFFQ (p=0.042) Those meeting or exceeding the Recommended Dietary Allowance (RDA) of calcium as measured by 24-hour recall were: 26% at week 1, 44% at week 4, and 35% at week 8 (p=0.039) **Vitamin D intake:** While dietary vitamin D significantly increased (p<0.015) at each time point during the intervention for the treatment group, no significant difference was found comparing control to treatment at week 8

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Resnick 2009 PRAISEDD intervention (People Reducing Risk and Improving Strength through Exercise, Diet and Drug Adher-ence)	Before and after study (feasibility study)	US	65+ Mean (SD) age was 76.4 (7.6)	Older adults on antihypertensive or lipid-lowering medications/ sedentary behaviour **Gender:** 64% female **Ethnicity:** 86% African American **SES:** Low income older adults; Mean 11.0 (4.7) years education	**Intervention:** Motivational, educational and exercise sessions with techniques known to strengthen self-efficacy and outcome for CVD prevention behaviors related to exercise, diet and medication 60-minute intervention sessions were held 3 times per week for 12 weeks. An interdisciplinary team implemented the intervention. During the first week,4 advanced practice nurses and a pharmacist were involved in delivering education. Further weekly sessions were implemented by a lay exercise trainer Intervention conducted at a senior housing site	**Follow-up:** 12 week intervention, follow-up to 4 months **Lost to follow-up:** 9% **Outcome measurement:** PA: Yale PA survey; cholesterol/sodium intake: Block Brief Food Questionnaire	There were significant decreases in systolic (P = .02) and diastolic blood pressure (P = .01) and a nonsignificant trend toward improvement in cholesterol intake (P = .09). There were no changes in time spent in moderate-level physical activity, sodium intake, medication adherence, or self-efficacy and outcome expectations across all 3 behaviors
Silva-Smith 2013 Promoting Older Adult-Wellness (POW)	RCT	US	60+ Mean: I 71.3 (7.43) C 67.76 (6.66)	Overweight/obese and sedentary older adults N=69 randomised **Gender:** 81.2% female in intervention group; 83.8% in control group **Ethnicity:** Intervention: 75% white; 12.5% African American; control: 64.9% white; 18.9% African American **SES:** Mean years education: Intervention 14.0 (2.7); control: 14.4 (3.0)	**Intervention (N=32):** Theory-based physical activity and healthy eating intervention aimed at reducing stroke risk factors. 8-week group motivational intervention **Control (N=37):** Biweekly newsletters by mail	**Follow-up:** 8 week intervention **Lost to follow-up:** 10% intervention group; 9% control **Outcome measurement:** Physical activity was measured using a 7-day pedometer and a 7-day PA self-report. Diet by 5-pass 24-hour diet recall method by a trained researcher	Statistically significant differences in the 7-day physical activity self-report were reported at post-test in the intervention group ($p<0.10$) but not for pedometer steps. The dietary measures were not statistically significant at post-test; however, the intervention group increased the quantity of vegetable servings

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Valente 2011	Secondary analysis of RCT	US	60-75 mean 66.6 (4.3)	Overweight and obese older adults. 77.7% were obese 25% were taking lipid-lowering and 14.8% were taking antihypertensive medication **Gender:** 59.2% female **Ethnicity:** 100% white **SES:** Not reported	Dietary education only: (DE) N=12 Dietary education plus resistance training (DERT) N=15: Resistance training and dietary education intervention	**Follow-up:** 10 weeks **Lost to follow-up:** None reported **Outcome measurement:** Self-reported FFQ	**Diet outcomes:** Significantly higher DASH diet index scores ($p<0.01$) post-intervention in DERT group compared to DE Note: However, DERT group had higher energy intake post-intervention and outcomes do not seem to have been adjusted for energy intake **Other outcomes:** The DERT subjects had significantly better triacylglycerol and apoB concentrations and DASH Diet Index scores than the DE subjects post-intervention. Improvements were seen within the DE group in energy intake, fat-free mass, and systolic blood pressure and within the DERT group in body weight, percentage of body fat, BMI, diastolic blood pressure, and oxidized low-density lipoprotein (all P , 0.05) **Conclusion:** DERT was more effective than DE alone in improving DASH Diet Index scores

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Vrdoljak 2014	RCT (cluster) (multi-centre, conducted in 59 general practices)	Croatia	65+ (Mean 72.3 (SD 5.2)	**Setting:** General practice **Population:** Croatian citizens aged 65+ years who visited their GP for any reason (those with life expectancy < 6 months, severe dementia, severe mental illness, communication disability excluded) **Gender:** 61% female **Ethnicity:** Not reported **SES:** 61.7% below average income; 21.0% average income and 17.3% above average income	Lifestyle intervention that targeted a range of health behaviours: PA, smoking, alcohol, diet **Intervention (N=371):** Intensified intervention delivered by GPs. Intervention participants were counselled and given a tailored life plan for adopting healthier behaviour. Each patient received educational leaflets for their detected CV risk factors and a specific appointment was given for the next follow-up visit **Comparator (N=367):** Usual care: GPs were not instructed to give any specific intervention	**Follow-up:** 18 months **Lost to follow-up:** Of those completing the baseline survey for completed the follow-up survey **Outcome measurement:** Self-reported, questionnaire	Outcomes reported separately for each health behaviour The only significant difference between the intervention and control group at the end of the study was for diet. More participants in the intervention group reported eating the Mediterranean diet, comparing to the control group (x2 = 5.81, df = 1, P = 0.02) No significant differences were found between the intervention and control groups for physical activity (chi-squared = 0.84, df = 1, p = 0.36), smoking (chi-squared = 0.85, df = 2, p = 0.65), alcohol consumption (chi-squared = 0.73, df = 1, p = 0.394)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Walker 2009, Walker 2010 Wellness for Women study	RCT (randomised by site)	US	50-69	Older rural women **Gender:** 100% female **Ethnicity:** Intervention: 99.1% white non-Hispanic; 0.9% Hispanic; Control: 89.1% white non-Hispanic; 6.4% Hispanic; 3.6% Native American or Alaskan **SES:** Intervention: 25.2% college graduate or higher; 45.2% some college; Control: 44.5% college graduate or higher; 33.6% some college	**Intervention (N=115):** Tailored PA and eating newsletters based on the Health Promotion model **Control (N-110):** Generic newsletter intervention	**Follow-up:** 12 month intervention with additional 12 month follow-up **Lost to follow-up:** Intervention 7.8%; control 0.9% (though all at baseline included in ITT analysis) **Outcome measurement:** Self-reported, PA (7 day activity record): Time engaged daily in moderate or greater intensity activity and associated energy expenditure were measured by the Modified 7-Day Activity Recall; Diet self-reported daily servings of fruits, vegetables, and whole grain products and daily intake of dietary fat (% calories from total fat and saturated fat) were measured by the web-based version of the 1998 Block Health Habits and History Questionnaire (HHHQ)	Both groups significantly increased stretching and strengthening exercise and fruit and vegetable servings and decreased % calories from fat, while only the tailored group increased ≥ moderate intensity activity and decreased % calories from saturated fat from baseline to 6 months

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Werkman 2010	RCT (cluster)	Netherlands	Mean age 59.5 years	Recent retirees N=413 cluster randomised **Gender:** Intervention: 83.2% male; Control: 87.2% male **Ethnicity:** Not reported **SES:** % reported as 'low educational level': Intervention: 25%; Control 23%	**Intervention (N=209):** Multifaceted computer tailored one-year energy balance programme **Control (N=204):** Received newsletters with general information about the study only	**Follow-up:** 12 months intervention with further 12 months follow-up **Lost to follow-up:** Intervention: 15.8%; Control: 16.2% **Outcome measurement:** Changes in the diet were assessed with a validated, semiquantitative food frequency questionnaire (FFQ). PA assessed with the Dutch version of the PA scale for the elderly (PASE)	**Diet and PA outcomes:** Physical activity and dietary behaviours improved in both the intervention and control group during the intervention period. Although these behaviours changed more favourably in the intervention group, these between-group-differences were not statistically significant **Other outcomes:** Waist circumference, body weight and blood pressure decreased significantly in men of the intervention and control group, but no significant between-group-differences were observed at 12 or at 24-months follow-up. A significant effect of the programme was only observed on waist circumference (-1.56 cm (95%CI: -2.91 to -0.21)) at 12 month follow up among men with low education (n = 85)

Table 6: Multicomponent – Quality assessment for interventions reporting on uptake/maintenance of behaviours

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Overall*	B1	B2	B3	*Overall*	C1	C2	C3	*Overall*	D1	D2	D3	D4	D5	*Overall*	
Andersen-Hanley 2012	Unclear	Unclear	Yes	*Unclear*	Yes	Unclear	Unclear	*Unclear*	Yes	No	No	*Unclear*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Anstey 2015	Yes	Yes	Yes	*Low*	Yes	Unclear	Yes	*Low*	Yes	Yes	N/A	*Low*	Unclear	Unclear	Yes	Yes	Yes	*Low*	**Low**
Barnes 2013	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Low**
Carlson 2008	Unclear	Unclear	Unclear	*Unclear*	No	Unclear	Unclear	*Unclear*	Unclear	Unclear	No	*Unclear*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Clare 2015	Yes	Unclear	Yes	*Unclear*	Yes	Unclear	No	*Unclear*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Clark 2012	Yes	Unclear	Yes	*Unclear*	No	Blind to design	Blind to design	*Unclear*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Cohen-Mansfield 2015	Unclear	Unclear	Unclear	*Unclear*	Yes	No	No	*Unclear*	Yes	Unclear	Unclear	*Unclear*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Dannhauser 2014	No	No	Yes	*High*	No	No	Unclear	*High*	Yes	N/A	Unclear	*Unclear*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**High**
Diamond 2015	Unclear	Yes	Yes	*Unclear*	No	No	Unclear	*Unclear*	Yes	Unclear	Unclear	*Unclear*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Fabre 2006	Unclear	Unclear	Yes	*Unclear*	No	Unclear	Unclear	*Unclear*	Unclear	Unclear	Unclear	*Unclear*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Gonzalez-Palau 2014	No	N/A	N/A	*High*	N/A	No	No	*High*	N/A	N/A	N/A	*N/A*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**High**
Hars 2013	Yes	Yes	Yes	*Low*	No	No	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Hughes 2014	Yes	Unclear	Yes	*Unclear*	Yes	Unclear	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Kamegaya 2014	Yes	Unclear	Yes	*Unclear*	No	Unclear	Unclear	*Unclear*	Yes	Unclear	Unclear	*Unclear*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Komulainen 2010	Yes	Yes	Yes	*Low*	Yes	No	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	Yes	Yes	*Low*	**Low**

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Overall*	B1	B2	B3	*Overall*	C1	C2	C3	*Overall*	D1	D2	D3	D4	D5	*Overall*	
Legault 2011	Unclear	Unclear	Yes	*Unclear*	Yes	Unclear	Unclear	*Unclear*	Yes	Yes	Unclear	*Unclear*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Linde 2014	Yes	Yes	Yes	*Low*	No	No	No	*High*	Yes	No	Yes	*Unclear*	Yes	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Maillot 2012	Unclear	Unclear	Yes	*Unclear*	No	No	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
McDaniel 2014	Unclear	Unclear	Unclear	*Unclear*	Yes	Unclear		*Unclear*	Yes	Yes	Yes	*Low*	Yes	No	No	Yes	Yes	*Unclear*	**Unclear**
Mendoza-Ruvalcaba 2015	Unclear	Unclear	Yes	*Unclear*	No	Unclear	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Miller 2012	Unclear	Unclear	Unclear	*Unclear*	No	Unclear	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Napoli 2014	Yes	Unclear	Yes	*Unclear*	Unclear	Unclear	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	Yes	Unclear	*Low*	**Unclear**
Ngandu 2015	Yes	Unclear	Yes	*Unclear*	Yes	Yes	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Oswald 2006	No	No	Yes	*High*	N/A	Unclear	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	Unclear	Unclear	*Unclear*	**High**
Pitkala 2011	Yes	Yes	Yes	*Low*	No	Unclear	Unclear	*Unclear*	Yes	Yes	No	*Unclear*	Yes	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Satoh 2014	No	Unclear	Yes	*High*	Yes	Unclear	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	Unclear	Unclear	*Unclear*	**High**
Shah 2014	No	No	Yes	*High*	No	No	No	*High*	Yes	No	No	*Unclear*	Unclear	Yes	Yes	No	No	*Unclear*	**High**
Shatil 2013	Unclear	Unclear	Yes	*Unclear*	No	Unclear	Unclear	*Unclear*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Singh 2014	Yes	Yes	Yes	*Low*	Yes	Unclear	Unclear	*Unclear*	Yes	No	Unclear	*Unclear*	Yes	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Small 2006	Unclear	Unclear	*Yes*	*Unclear*	No	Unclear	Unclear	*Unclear*	Yes	Unclear	Unclear	*Unclear*	Unclear	Yes	Yes	Unclear	Unclear	*Unclear*	**Unclear**
Smith 2010	Unclear	Unclear	Unclear	*Unclear*	No	Unclear	Unclear	*Unclear*	Yes	Unclear	Unclear	*Unclear*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Unclear**

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Over-all*	B1	B2	B3	*Over-all*	C1	C2	C3	*Over-all*	D1	D2	D3	D4	D5	*Over-all*	
Stine-Morrow 2007	Un-clear	Un-clear	Yes	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Un-clear	Un-clear	Un-clear	*Un-clear*	Un-clear	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Stine-Morrow 2008	Un-clear	Un-clear	Un-clear	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	No	No	*Un-clear*	Un-clear	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Stine-Morrow 2014	Un-clear	Un-clear	*Yes*	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Un-clear	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Tesky 2011	Un-clear	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Wiegand 2013	Yes	Un-clear	Yes	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Un-clear	No	No	Un-clear	Un-clear	*Un-clear*	**Unclear**
Yokoyama 2015	Yes	Yes	Yes	*Low*	Yes	Yes	No	*Low*	Yes	Yes	Yes	*Low*	Un-clear	Yes	Yes	No	No	*Un-clear*	**Unclear**
Zacharelli 2013	Un-clear	Un-clear	Un-clear	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**

Table 7: Multicomponent – Quality assessment for interventions reporting on cognitive outcomes

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Over-all*	B1	B2	B3	*Over-all*	C1	C2	C3	*Over-all*	D1	D2	D3	D4	D5	*Over-all*	
RCTs																			
Burke 2013, Pasalich 2013	Un-clear	Un-clear	Yes	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Yes	Yes	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Geller 2012	Un-clear	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	No	No	*Un-clear*	Un-clear	Un-clear	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Hageman 2014	Yes	Yes	Yes	*Low*	Yes	Un-clear	Un-clear	*Low*	Yes	Yes	Yes	*Low*	Yes	Un-clear	Yes	Yes	Yes	*Low*	**Low**
Harari 2008	Yes	Yes	Yes	*Low*	No	Un-clear	Un-clear	Un-clear	Yes	Yes	Yes	*Low*	Yes	Un-clear	Yes	Un-clear	Un-clear	*Uncle-ra*	**Unclear**
Jaacks 2014	Un-clear	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Kelley 2004	Yes	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	No	Yes	*Un-clear*	No	No	No	Un-clear	Un-clear	*High*	**Unclear**
Kimura 2013	Un-clear	Yes	Yes	*Un-clear*	No	No	No	Un-clear	Yes	Yes	Yes	*Low*	Yes	Un-clear	Un-clear	No	No	*Un-clear*	**Unclear**
Nahm 2010	Yes	Yes	Yes	*Low*	Yes	Yes	Un-clear	*Low*	Yes	Yes	Yes	*Low*	Yes	Un-clear	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Oh 2014	Yes	Yes	Yes	*Low*	No	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Yes	Un-clear	Yes (diet), no (PA)	Un-clear	Un-clear	*Un-clear*	**Unclear**
Plawecki 2013	Un-clear	Un-clear	Un-clear	*Un-clear*	No	No	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear (diet) Yes (PA)	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Silva-Smith 2013	Yes	Yes	Yes	*Low*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Yes	Un-clear	Yes	Yes	Yes	*Low*	**Low**
Valente 2011	Un-clear	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Yes	Un-clear	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Vrdoljak 2014	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	*Low*	Yes	Un-clear	Un-clear	Yes	Yes	*Un-clear*	**Unclear**

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	**A2**	**A3**	***Over-all***	**B1**	**B2**	**B3**	***Over-all***	**C1**	**C2**	**C3**	***Over-all***	**D1**	**D2**	**D3**	**D4**	**D5**	***Over-all***	
Walker 2009/10, Yates 2012	Un-clear	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Werkman 2010	Yes	Un-clear	Yes	*Un-clear*	No	No	No	*High*	Yes	Yes	Yes	*Low*	Yes	Un-clear	Yes	No	No	*Un-clear*	**Unclear**
Non-randomised studies																			
Resnick 2009	No	No	N/A	*High*	N/A	Un-clear	Un-clear	*Un-clear*	N/A	No	No	*Un-clear*	Yes	Un-clear	Yes	Un-clear	Un-clear	*Un-clear*	**High**

Table 8: Multicomponent – Quality assessment for studies reporting barriers and facilitators

	Theoretical Approach		Study Design	Data Collection	Validity		Analysis				Ethics		Overall
	1.1	1.2	2.1	3.1	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	
Clare 2015 NB: Mixed methods. This sections deals with qualitative methods only	Appropriate	Clear	Defensible	Appropriate	Clear	Not sure	Not reported fully in this paper	Reliable	Not sure	Not sure	Yes	Not sure	**Unclear – results to be fully reported in a separate paper**
Jackson 2008	Appropriate	Not sure	Not sure	Not sure – used validated questionnaires	Not sure	Not sure	Not reported	Not reported	Not reported	Not reported	Yes	Not sure	**Unclear – little about the qualitative analysis reported in this paper**

Table 9: Alcohol – Interventions to promote healthy drinking behaviours (RCTs)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Arean 2008 Oslin 2006 PRISM-E study	Multisite RCT in ten primary care clinics	US	65+ Mean age 72.0 (SD 5.3)	Older primary care patients with at-risk drinking (assessed by questionnaire), identified from people who had a primary care appointment for any reason N=560 randomised **Gender:** 92% male **Ethnicity:** 70% white; 23.8% black; 3.5% Hispanic or Latino; 0.7% Asian	**Intervention: Integrated care:** (N=280 randomised) Mental health services integrated into primary care clinic (services on site including psychotherapy, case management and a brief behavioural alcohol intervention based on harm reduction and MI) **Comparator: Enhanced referral:** (N=280 randomised) referred by primary care to a nurse or medical social worker model that linked patients to community-based services in a separate location (medication management, psychotherapy and alcoholics anonymous model treatment for heavy drinking)	**Follow-up:** 3 and 6 months (post-randomisation). **Lost to follow-up** (6 months): Integrated care: 18.1%; Enhanced referral: 14.6% **Outcome measurement:** Self-reported questionnaire	Drinking declined in both intervention groups between baseline and 6 months. However, there were no statistically significant between-group differences in drinking or binge episodes at 6 months Number of drinks per week declined from 18.1 (SD 10.6) at baseline in integrated care to 11.8 (SD 11.8) at 6 months and 17.5 (SD 11.3) at baseline in enhanced referral to 11.4 (SD 10.7) at 6 months; p for between-group treatment difference 0.913	Unclear

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Cucciare 2013	RCT	US	Mean age: 59 (SD15)	US Military veterans who screened positive for alcohol misuse (AUDIT-C) at a routine primary care visit. N=167 randomised **Gender:** 88% male **Ethnicity:** 58% white; 10% black; 7% Hispanic; 4% Asian Pacific Islander; 1% Native American	**Intervention:** (N=78) Brief web-delivered intervention using normative feedback comparing the participant's alcohol use with age and gender matched peers plus treatment as usual (TAU+BAI) **Comparator:** (N=89) Treatment as usual (TAU)	**Follow-up:** 3 and 6 months **Loss to follow-up:** Not reported, appears to be zero (outcome data based on all those randomised) **Outcome measurement:** Self-reported (30 day Timeline Follow Back (TLFB))	Both interventions led to a significant reduction in alcohol quantity and frequency and alcohol-related problems at 6-month follow-up. No differential treatment effects on outcomes were observed between the two treatment groups. BAIs using normative feedback may not have any additional benefit beyond usual treatment	Unclear
Ettner 2014 Project SHARE – Senior Health and Alcohol Risk Education	RCT (cluster randomised trial of 31 primary care providers and their patients at a community-based practice with seven clinics)	US	60+ Mean age 71 (SD 7.3 years)	At-risk older drinkers living in the community (identified by telephone and a baseline mailed survey) N=1186 randomised **Gender:** 65.7% male **Ethnicity:** 5.9% Latino; 94.1% non-Latino	**Intervention:** (N=546) Personalised reports, educational materials, drinking diaries, physician advice during office visits, and telephone counselling delivered by a health educator **Comparator:** (N=640) Usual care (specific details varied but could include alcohol counselling)	**Follow-up:** 3, 6, and 12 months after baseline **Loss to follow-up (12 months):** Intervention: 19.6% Control: 4.7% **Outcome measurement:** Self-reported, Comorbidity Alcohol Risk Evaluation Tool (CARET)	**At risk drinking:** At 6 and 12 months, there were significantly greater reductions in at-risk drinking in the intervention groups compared to control: 6 months: (60% vs. 72%; p </= 0.01); 12 months: (56% vs. 67%; p </= .01) **Usual drinks per week:** The effects of the intervention on usual number of drinks per week reported by patients were significant at both 6 and 12 months (-2.42 and -2.19, respectively, p </=0.01) **Costs:** Average variable costs per patient were $31 for screening and $79 for intervention	Unclear

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Fink 2005	RCT (randomised by site – 3 sites randomised to 3 groups)	US	65+ mean 76.6 (SD 6.2 years)	Older primary care patients who reported at least one alcoholic drink in the last 3 months At baseline, 21% were harmful drinkers, and 26% were hazardous drinkers N=711 randomised, N=665 completed. **Gender:** 54% female (completers) **Ethnicity:** 88% non-Hispanic white; 4% Hispanic; 7% Asian American; 1% African American (completers)	3 arms of trial - Combined report versus Patient report versus Usual care **Combined report Intervention:** N=6 physicians and N=212 patients received reports of patients' drinking classifications and patients also received education **Patient report intervention:** N=245 patients only received reports and education, but their five physicians did not receive reports **Comparator:** Usual care N=238: Neither the 12 participating physicians nor their patients received reports, and the patients did not receive any education during the study	**Follow-up:** 12 months **Loss to follow-up:** Usual care 6.7%; Patient report 6.1%; Combined report 6.6% **Outcome measurement:** Computerized Alcohol-Related Problems Survey (CARPS)	**Drinks/week:** In the combined report group compared to usual care, alcohol consumption decreased by 1.14 drinks per week ($p<0.05$). There was no statistically significant difference ($p<0.05$) between the patient report intervention and usual care in their changes in drinking from baseline to follow-up **Lower-risk drinking:** The patient report and combined report interventions were each associated with greater odds of lower-risk drinking at follow-up than usual care (OR 1.59 and 1.23, respectively, $P<0.05$ for each). Similar results were obtained when intention to treat analysis was used	Unclear

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Gordon 2003 (post hoc analysis by age of the Early Lifestyle Modification (ELM) programme, Maisto 2001)	RCT (N=45 randomised) From 12 primary care offices 13,438 patients were screened of whom 2702 were elderly (180 were hazardous drinkers)	US	65+ (76% were 66-75 years; 23% were 76-85 years and 2% over 85 years)	**Setting:** Primary care **Population:** Hazardous alcohol drinking elderly N=45; (analysis also compared with younger hazardous drinkers, N=256) **Gender:** 87% male (elderly); 67% male (non-elderly) **Ethnicity:** 69% white, 29% African-American, 2% other	Both intervention groups described as brief interventions. **ME Intervention:** Motivational Enhancement (N=18) **BA Intervention:** Brief advice (N=12) **Comparator:** Standard Care (N=12) The brief interventions (ME and BA) were delivered by extensively trained researchers. The ME intervention was more intense, longer and more frequent than the BA. Standard care may have included the usual range of services in primary care or no discussion of alcohol use problems	**Follow-up:** 1 year **Loss to follow up:** 0% (from baseline assessment to follow-up) **Outcome measurement:** Self-reported, Timeline Follow Back (TLFB) questionnaire	All 3 groups decreased the number of drinks per month, increased the number of days abstained, and reduced the number of days per month they drank. However, there were no significant differences between the intervention groups and standard care The ME group decreased drinks/month from 60.7 at baseline to 29.6 at 6 months to 34.4 at 12 months. The BA group decreased drinks/month from 126.9 at baseline to 66.9 at 6 months to 58.6 at 12 months. The standard care group decreased drinks/month from 61.9 at baseline to 50.1 at 6 months to 48.3 at 12 months. There were no significant differences between the elderly group and a younger group for all 3 interventions	High

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Hansen 2012	RCT	Denmark	Mean age 60 (men); 59 (women) Range 48-65	Heavy drinkers (identified from a population survey) 12,364 participants in a Danish health examination survey identified. 1026 heavy drinkers of whom N= 772 were included and randomised **Gender:** 49% men/51% women in BMI group; 54% men/46% women in control group **Ethnicity:** Not reported	**Intervention:** N=391. Brief Motivational Interview (mean duration 11 mins) followed up by telephone booster (5 mins), plus leaflets and information sheet about local alcohol treatment delivered by BMI trained research team **Comparator:** N=381. Control group received the same leaflets and information sheet as the intervention group	**Follow-up:** 6 (N=670) and 12 months (N=616) **Loss to follow-up:** (6 months): Intervention 12.5%; control 13.9% (12 months) Intervention 19.2%; control 21.3% **Outcome measurement:** Self-reported, internet-based questionnaire	Consumption among women decreased from a mean baseline level of 20.6 to 15.0 drinks/week for the control group (95% CI: 13.5–16.5) and 14.1 drinks/week for the BMI (95% CI: 12.9–15.2) after 6 months. Consumption among men decreased from a mean baseline level of 31.8 to 24.0 drinks/week for the control group and 23.1 drinks/wk for the BMI (95% CI: 21.1–25.1) after 6 months. (12 month data shown graphically in the paper but was similar to 6 month outcomes) The intervention effect of the BMI was −1.0 drinks/week, but there were no significant differences between groups (intention to treat analysis) (95% CI: −2.15 to 0.23) There were also no significant differences by gender	Unclear

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Kuerbis 2015 Co-morbidity Alcohol Risk Evaluation Study	RCT (Pilot)	US	50+ Mean age 64.7 (SD 8.4 years)	**Setting:** Primary care **Population:** Individuals aged 50 and older who were identified as at-risk drinkers according to the Comorbidity Alcohol Risk Evaluation Tool (CARET) N=86 randomised **Gender:** 66% male **Ethnicity:** 88% white (non-Hispanic); 9% Hispanic; 2% other	**Intervention:** (N=44) Brief mailed intervention with personalised mailed feedback outlining their specific risks associated with alcohol use, educational booklets about alcohol **Control group:** (N=42). No intervention, received $5 gift card	**Follow-up:** 3 months **Loss to follow-up:** Intervention 13.6%; Control: 2.4% **Outcome measurement:** Self-reported, Comorbidity Alcohol Risk Evaluation Tool (CARET)	Drinks per week decreased in the intervention group from 15.6 (8.8) to 12.1 (7.0); in the control group from 14.4 (7.0) to 13.5 (6.0). Between group difference was not significant. CARET risk score also declined in both groups. In the intervention group it declined from 2.6 (1.6) to 1.6 (1.7) and from 2.3 (1.3) to 2.1 (1.4) in the control group, but the intervention group had a statistically significantly greater decline than the control group ($p<0.01$). At 3 months, fewer intervention group participants than controls were at-risk drinkers (66% vs 88%; OR 0.32, p=0.05), binge drinking (45% vs 68%; OR 0.33, p=0.03), using alcohol with a medical or psychiatric condition (3% vs 17%; OR 0.28, p=0.12), or having symptoms of such a condition (29% vs 49%; OR 0.38, p=0.07)	Unclear

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Moore 2011 Addiction Healthy Living as you Age study (HLAYA)	RCT	US	55+ Mean age 68.4 (SD 6.9 years). Age range: 55-89	Older at-risk drinkers in primary care identified by the Comorbidity Alcohol Risk Evaluation Tool (CARET). N=631 randomised **Gender:** 71% male **Ethnicity:** 87% white (non-Hispanic); 8% Hispanic/Latino; 3% other	**Intervention:** (N=310) Received a personalised report, booklet on alcohol and aging, drinking diary, advice from the primary care provider and telephone counseling from a health educator at 2, 4 and 8 weeks **Control:** (N=321) Received a booklet on healthy behaviour during an office appointment	**Follow-up:** 3 and 12 months **Loss to follow-up:** (3 months) Intervention 21%; Control 4%; (6 months) Intervention 28%; Control 7% **Outcome measurement:** Self-reported, Comorbidity Alcohol Risk Evaluation Tool (CARET) and Timeline Follow Back (TLFB) questionnaire	The intervention group consumed fewer drinks (in the past 7 days) at 3 months (rate ratio 0.79 (0.70 to 0.90; p<0.001) and at 12 months (rate ratio 0.86 (0.76 to 0.98; p<0.05) There was a lower proportion of at-risk drinkers in the intervention group compared to the control group at 3 months: 49.6% vs 61.2%, odds ratio 0.45 (95% CI 0.28, 0.81; p<0.01). At 12 months the proportion of at-risk drinkers in the intervention group compared to control was 54.1% vs 59.9%, but the difference was not statistically significant. Odds ratio 0.75 (95% CI (0.42 to 1.36). Similarly, at 3 months, there was less heavy drinking in the intervention group: odds ratio 0.45 (0.21 to 0.96; p<0.05) but this was not significant at 12 months	Low

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Watson 2013 AESOPS trial	RCT (multi-centre)	UK (England and Scotland)	55+ Mean age 63.0 (SD 5.8 years)	Older hazardous alcohol users in primary care scoring >8 on the Alcohol Use Disorders Identification Test (10-item) (AUDIT) N=529 randomised **Gender:** 80.3% male **Ethnicity:** Not reported	Brief, minimal intervention vs stepped care. **Intervention:** (N=266) Those in the stepped care arm initially received a 20-minute session of behavioural change counselling, with referral to step 2 (motivational enhancement therapy) and step 3 (local specialist alcohol services) if indicated. Sessions were recorded and rated to ensure treatment fidelity **Comparator:** (N=263) The minimal intervention group received a 5-minute brief advice intervention with the practice or research nurse involving feedback of the screening results and discussion regarding the health consequences of continued hazardous alcohol consumption	**Follow-up:** 12 months **Minimal intervention:** 11% at 6 months; 11.8% at 12 months **Stepped care intervention:** 9.8% at 6 months; 13.2% at 12 months **Outcome measurement:** Self-reported, AUDIT-Consumption (AUDIT-C), DPI (Drinking Problems Index); Quality-adjusted life-years (QALYs) (for cost–utility analysis derived from European Quality of Life-5 Dimensions); and health and social care resource use	Both groups reduced alcohol consumption between baseline and 12 months. There were no significant differences in average drinks/day (ADD) between the groups at 12 months **Average drinks/day (ADD)** In the stepped care group drinks/d decreased from 3.38 (SD 2.14) at baseline to 2.45 (SD 1.83) at 6 months to 2.56 (SD 2.09) at 12 months. In the minimal intervention group drinks/d decreased from 3.41 (SD 2.19) at baseline to 2.81 (SD 2.03) at 6 months to 2.49 (SD 1.93) at 12 months. At 6 months the mean difference between the groups (drinks/d) was -0.073 (–0.156 to 0.011); p = 0.088 At 12 months the mean difference between the groups (drinks/d) was 0.025 (–0.062 to 0.112); p = 0.575 **Screening costs:** Mean screening cost for every participant recruited into the trial was £5.52 (2010 costs) **Intervention costs:** No statistically significant difference in costs between groups at 6 and 12 months. At 12 months, participants in the stepped care group incurred fewer costs, with a mean difference of –£194 (95% CI –£585 to £198), and had gained 0.0117 more QALYs (95% CI –0.0084 to 0.0318) than the control group	Unclear

Table 10: Alcohol – Interventions that targeted a range of health behaviours with seperate alcohol outcomes

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Harari 2008 This study referenced in Anderson et al. VINTAGE project	RCT	UK	65+ Mean age: 74	Functionally independent community-dwelling older adults **Gender:** 56.0 % female in intervention group and 52.9% female in control **Ethnicity:** Not reported	**Intervention:** Multi-domain health promotion study using the mailed HRA-O followed by computer-generated individualised written feedback to participants and GPs. Health behaviours addressed: PA, diet, smoking, alcohol, seat belts when driving. Preventive care: BP, cholesterol, blood glucose, faecal occult blood test, influenza or pneumococcal vaccinations, dental, vision, hearing, mammography checks **Comparator:** No intervention	**Follow-up:** 1 year **Loss to follow-up:** 0% (numbers analysed at baseline and follow-up the same) **Outcome measurement:** Self-reported, health risk appraisal for older persons (HRA-O) questionnaire	Over the range of health behaviours or preventative health care measures in older adults examined, there was minimal improvement in any health behaviour or uptake (except pneumococcal vaccination) At 1 year follow-up, there was no significant difference between groups in people reporting 'no or moderate' alcohol use - 80.2% of those in the intervention group and 79.7% of those in the control group (OR: 1.1 (95% CI 0.8, 1.3), p=0.63)	Unclear

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Schonfield 2010 Florida Brief Interven-tion and Treatment for Elders (BRITE) project	Non-ran-domised before and after inter-vention	US	Mean age: 75	**Setting:** Screening conducted at health fairs, retirement communities and senior housing sites. Interventions conducted at home, ageing services sites or medical settings **Population:** Older adults who screened positive for alcohol misuse (N=244 screened positive for alcohol and received intervention) **Gender:** 69.5% female Ethnicity: 76.2% white; 17.1% black; 5.7% multiracial; 0.3% Asian	**Intervention:** Brief intervention (1-5 1-hour sessions): future goals to improve quality of life, health habits (exercise and use of tobacco, alcohol, medications, and drugs), motivational interviewing, education about consequences of drinking and reasons to cut down The programme was delivered by trained counsellors including addictions specialists, nurses, social workers, and mental health counsellors with specific BRITE training	**Follow-up:** Time from baseline to intervention discharge not reported; then optional 30-day and 90-day follow-up **Loss to follow-up:** 53.3% of those who received intervention did not complete intervention discharge. **Outcome measurement:** self-reported, telephone or in-person interviews, including the 10-item Short Michigan Alcoholism Screening Test, Geriatric Version (SMAST-G)	Scores on the SMAST-G significantly decreased (t108=6.09; P<.001) from initial screen to discharge. The means between baseline and discharge were significantly different but the means from discharge to 30-day follow-up were not significantly different Among those who screened positive for alcohol problems on the baseline SMAST-G screen, only 18.9% were still positive at discharge and follow-up	High

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Follow-up and outcomes	Results	Risk of bias
Vrdoljak 2014	RCT multi-centre, conducted in 59 general practices	Croatia	65+ Mean age: 72.3 (SD 5.2 years)	**Setting:** General practice **Population:** Croatian citizens aged 65+ years who visited their GP for any reason (those with life expectancy <6 months, severe dementia, severe mental illness, communication disability excluded) **Gender:** 61% female **Ethnicity:** Not reported	Lifestyle intervention that targeted a range of health behaviours: PA, smoking, alcohol, diet **Intervention (N=371):** Intensified intervention delivered by GPs. Intervention participants were counselled and given a tailored life plan for adopting healthier behaviour. Each patient received educational leaflets for their detected CV risk factors and a specific appointment was given for the next follow-up visit **Comparator (N=367):** Usual care: GPs were not instructed to give any specific intervention	**Follow-up:** 18 months **Loss to follow-up:** Of those completing the baseline survey for alcohol (N=104), 97.1% completed the follow-up survey. However, only 29% of participants at baseline completed the alcohol questions **Outcome measurement:** Self-reported, questionnaire	Outcomes reported separately for each health behaviour, including alcohol There was no significant difference between groups for alcohol consumption (chi-squared = 0.73, df = 1, p = 0.394) at the end of intervention Note: it may not have been the same people who completed alcohol questions at baseline and follow-up. (Also no significant differences between the intervention and control groups for physical activity (chi-squared = 0.84, df = 1, p = 0.36), smoking (chi-squared = 0.85, df = 2, p = 0.65) at the end of the study)	High

Table 11: Alcohol – Included qualitative studies about barriers and facilitators

Study	Study design	Country	Age (years)	Population	Objective	Quality
Aira 2008 (Part of GeMS study: Geriatric Multidisciplinary Strategy for Good Care of the Elderly)	Qualitative (interviews) and quantitative assessment of alcohol use using AUDIT-questionnaire	Finland	75+ (83.4% aged 75-84; 16.6% aged 85+)	N=699 home-dwelling elderly living in the community **Gender:** 30.5% male; 69.5% female **SES:** 18.0% had >9 years education; 52.0% had 4-9 years education; 17.4% <4 years education **Alcohol consumption:** 48.5% had used alcohol in past year; 19.7% had used alcohol for medicinal purposes in past year. Similar in males and females	To describe alcohol use as self-medication by people aged over 75 years	-
Dare 2014	Qualitative study (in-depth interviews)	Australia	65-74 Mean age: 69.7 (SD 3.3 years)	N=20 men and N=22 women who were living in either private residences or (secular, resident-funded) retirement villages **Gender:** 47.6% male; 52.4% female **SES:** Participants from areas classified as having higher levels of socioeconomic advantage and >50% had a post-school qualification **Alcohol consumption:** Over 75% drinking alcohol over 4 days/wk. Average daily consumption of alcohol (standard drinks): Private home; men 1.89 (1.4); women 1.21 (0.8); Retirement village: men 3.13 (4.4); women 1.68 (1.1)	To identify relationships between social engagement, setting and alcohol use	++
Haarni 2010 (Too Much is Always Too Much - Alcohol and Ageing project)	Qualitative (interviews)	Finland	60-75	N=31 Urban older adults **Gender:** 48.4% male; 51.6% female **SES:** 14 had passed the matriculation examination, eight the middle school, and eight had at least the equivalent of elementary school studies **Alcohol consumption:** People who had abstained from alcohol all their life were excluded. Reports: 'the study included many kinds of alcohol consumers'	Life experience and alcohol: 60-75 year olds relationship to alcohol	-

Study	Study design	Country	Age (years)	Population	Objective	Quality
Johannessen 2015	Qualitative (interviews)	Norway	65+ Mean age: 81 Age range: 65-92	N=16 older adults that received in-home nursing service or home-help services (N=14 were widows or widowers) **Gender:** 37.5% male; 62.5% female **SES:** Not reported **Alcohol consumption:** 15 (of 16) had used alcohol	Older adults' experience with and reflections on use and misuse of alcohol and psychotropic drugs	++
Joseph 2012	Qualitative (in-depth formal interviews, observation, casual conversation, informal interviews)	Canada	44-74 Mean age: 61	Older male cricket players of Afro-Caribbean origin (friendly, non-league) and spectators (male and female). N=27 formal interviews conducted but data collected in a range of ways **Gender:** Predominantly male **SES:** Not reported **Alcohol consumption:** Most of the participants appeared to drink heavily but not specifically reported	Alcohol and older Caribbean-Canadian men	+
Kim 2009	Qualitative (focus group)	Canada	60+ Mean age 72 (SD 5.94 years) Age range: 62-83	N=19 elderly Korean immigrants residing in Canada (14 men, 5 women) **Gender:** 26.3% male; 73.7% female **SES:** Not reported **Alcohol consumption:** Drinking alcohol was a criterion for recruitment. 63.2% drank more than once a week	To explore drinking culture, alcohol and alcohol use in older Korean immigrants in Canada	+

Study	Study design	Country	Age (years)	Population	Objective	Quality
Millard 2008	Qualitative (focus groups)	UK (Scotland)	65+	N=90 staff and managers providing home, day and residential care to elderly clients **Gender:** Not reported for staff/managers or elderly clients **SES:** Not reported for staff/managers or elderly clients **Alcohol consumption:** Not reported for staff/managers or elderly clients	Alcohol and service gaps in homecare for older adults: including how client's alcohol problems were identified, role of home care provider, barriers to seeking help	-
Tolvanen 2005 Vitality 90+ project	Qualitative (interviews)	Finland	90+	N=181 participants who mainly lived in their own homes though some were in service housing or in nursing homes **Gender:** 33.5% male; 76.5% female (of interviews that discussed alcohol) **SES:** Not reported **Alcohol consumption:** 63% of men and 34% of women currently used alcohol; 23% of men and 6% of women had previously used alcohol earlier but no longer drank; and 13% of men and 24% of women did not drink at all (based on those who reported consumption in interviews)	Alcohol in life story interviews with Finnish people aged 90 or over	+
Ward 2011	Qualitative (N=21 interviews and N=3 focus groups with older adults)	UK	Range: mid 50s to late 80s	Aimed to include a diverse range of older adults. Included people living in their own homes, in sheltered housing and in hostels **Gender:** 61.9% male, 29.1% female (interviews) **SES:** Not reported **Alcohol consumption:** Not specifically reported but all participants appeared to consume alcohol	Older adultss perspectives on alcohol use in later life	+

Study	Study design	Country	Age (years)	Population	Objective	Quality
Wilson 2013	Qualitative Interviews (N=24) and 3 focus groups (N=27 people)	UK (North East England)	50+ Range: 50-95	Older adults recruited through Age UK and regional services for alcohol problems who had experience of drinking alcohol at any level of consumption Recruited a range of patterns of consumption, including occasional minimal drinkers, moderate and heavy drinkers, previously dependent drinkers and 2 currently dependent drinkers **Gender:** 50% male; 50% female (interviews); 22.2% male; 77.8% female. **SES:** Not reported **Alcohol consumption:** Those recruited had a range of patterns of consumption including occasional minimal drinkers, moderate and heavy drinkers, previously dependent drinkers and 2 currently dependent drinkers	To understand older adults reasoning about drinking in later life and how this interacted with health concerns	++

Table 12: Alcohol – Older adults' drinking habits in the context of ageing

	Aira	Dare	Haarni	Johannes-sen	Joseph	Kim	Millard	Tolvanen	Ward	Wilson
Social/Relaxation										
Alcohol as a social lubricant		X	X		X	X		X		X
Drinking for relaxation		X	X			X				
As a treat/something special		X	X							
Fun and enjoyment			X			X		X		
Quality of life										X
Part of social environment		X							X	
Access issues										
Cost and availability									X	
Health-related aspects										
Drinking for medicinal purposes	X		X			X		X		X
Drinking for relaxation		X	X			X				
In the context of ageing			X	X						
Ill health/drinking behaviour									X	X
Health risks	X	X		X				X	X	X
Driving		X								
Other										
Drinking to deal with negative issues		X	X	X					X	X
Positive versus negative alcohol identities			X			X		X	X	X
Self-regulating strategies	X	X	X							

Table 13: Alcohol – Quality assessment for interventions reporting on healthy drinking behaviours

	Population			Method of allocation to intervention (or comparison)										Outcomes						Analysis						Summa-ry		Over-all
	1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2	3.3	3.4	3.5	3.6	4.1	4.2	4.3	4.4	4.5	4.6	5.	5.2	
Arean 2008	+	+	+	++	+	-	-	+	++	NR	++	++	+	++	NA	++	++	++	++	++	++	NR	++	++	+	++	-	+
Cucciare 2013	+	+	+	++	++	-	+	++	-	-	++	++	++	++	NA	++	++	++	++	++	++	-	++	+	++	-	+	+
Ettner 2014	++	++	++	++	++	++	+	++	++	+	+	++	++	++	++	++	++	++	++	++	++	+	++	++	++	++	++	++
Fink 2005	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	NR	++	++	++	++	++	++	++
Gordon 2003	++	+	+	+	++	NR	-	++	NA	+	NR	++	NA	++	NA	++	++	++	++	++	-	-	++	+	-	+	-	-
Hansen 2012	++	++	+	++	++	++	-	++	NR	++	++	NA	+	++	NA	++	++	++	++	++	++	++	++	++	++	++	+	+
Harari 2008	++	+	+	++	++	++	-	+	+	NR	++	++	++	-	NA	+	+	++	++	++	++	NR	++	++	++	+	+	+
Kuerbis 2015	++	+	+	++	++	++	-	++	++	+	++	++	NA	++	NA	++	++	++	++	++	-	-	++	++	++	-	+	+
Moore 2011	++	++	++	++	++	++	+	++	++	+	++	++	NA	++	NA	++	++	++	++	++	++	+	++	++	++	++	++	++
Oslin 2006	+	+	-	+	+	-	-	+	NR	NR	++	++	+	+	NA	+	+	++	+	-	-	-	++	+	++	+	-	+
Schonfield 2010	+	-	+	-	+	NA	NA	+	NA	NA	-	+	+	++	NA	NA	++	NA	+	NA	NA	NA	NA	++	++	-	+	-
Vrdoljak 2014	++	+	+	+	+	NR	+	+	++	+	NR	++	++	+	NA	+	+	++	+	+	-	NR	+	-	-	-	+	-
Watson 2013	++	++	++	++	++	++	-	++	+	+	++	++	++	++	NA	++	++	++	++	++	++	++	++	++	++	++	++	++

Table 14: Alcohol – Quality assessment for interventions reporting barriers and facilitators

	Theoretical approach		Study	Data collection	Trustworthiness			Analysis						Ethics	Overall
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Aira 2008	Appropriate	Clear	Not sure	Appropriate	Unclear	Unclear	Not sure	Not reported	Poor	Not reported	Not sure	Partially relevant	Inadequate	Appropriate	-
Dare 2014	Appropriate	Clear	Defensible	Appropriate	Clear	Not sure	Reliable	Rigorous	Rich	Reliable	Convincing	Relevant	Adequate	Appropriate	++
Haarni 2010	Appropriate	Clear	Not sure	Inadequately reported	Not described	Unclear	Not sure	Not sure	Not sure	Not sure	Not sure	Partially relevant	Not sure	Not reported	-
Johanessen 2015	Appropriate	Clear	Defensible	Appropriate	Clear	Clear	Reliable	Rigorous	Rich	Reliable	Convincing	Relevant	Adequate	Appropriate	++
Joseph 2012	Appropriate	Unclear	Not sure	Appropriate	Clear	Clear	Not sure	Not sure	Rich	Not sure	Not sure	Partially relevant	Adequate	Not reported	+
Kim 2009	Appropriate	Clear	Defensible	Appropriate	Clear	Clear	Not sure	Rigorous	Rich	Reliable	Not sure	Partially relevant	Not sure	Not reported	+
Millard 2008	Appropriate	Mixed	Not sure	Inadequately reported	Not described	Unclear	Not sure	Not reported	Not reported	Not reported	Not sure	Relevant	Not sure	Not reported	-
Tolvanen 2005	Appropriate	Mixed	Defensible	Appropriate	Clear	Not sure	Not sure	Rigorous	Rich	Not sure	Convincing	Relevant	Adequate	Not reported	+
Ward 2011	Appropriate	Clear	Defensible	Appropriate	Clear	Clear	Not sure	Not reported	Not sure	Not reported	Convincing	Relevant	Adequate	Not reported	+
Wilson 2013	Appropriate	Clear	Defensible	Appropriate	Clear	Clear	Reliable	Rigorous	Rich	Reliable	Convincing	Relevant	Adequate	Appropriate	++

Table 15: Smoking - Interventions with smoking cessation and reduction outcomes (RCTs)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Follow-up and outcomes	Results	Risk of Bias
Hall 2009	RCT	US	50+ Mean age 56.7 (SD 5.9)	Smokers of >/= 10 cigarettes per day: Mean cigarettess/day: 20.5 (SD 8.7) Mean years of regular smoking: 37.8 (8.2) N=402 randomised **Gender:** 60% male **Ethnicity:** 76.9% Caucasian **SES:** 21.9% had a grad degree; 30.5% college graduates; 35.5% some college; 12.1% high school graduates or less	1. Participants completed a 12-week treatment that included group counselling, nicotine replacement therapy (NRT) and bupropion 2. Participants, independent of smoking status, were then randomised to follow-up conditions: (i) N=100 standard treatment (ST; no further treatment) (ii) N=99 extended NRT (E-NRT; 40 weeks of nicotine gum availability (iii) N=99 extended cognitive behavioural therapy (E-CBT; 11 cognitive behavioural sessions over a 40-week period) OR (iv) N=104 E-CBT plus E-NRT (E-combined; 11 cognitive behavioural sessions plus 40 weeks nicotine gum availability)	**Follow-up:** 6, 12, 18 and 24 months (post-randomisation). **Lost to follow-up:** wk 24 4.0%; wk 52 7.0%; wk 104 13.4% **Outcome measurement:** Primary outcome variable was 7-day point prevalence cigarette abstinence verified biochemically (2 assays) at weeks 24, 52, 64 and 104. Note: Participants were paid $25 for each assessment they completed	E-CBT had significantly higher cigarette abstinence rates than ST (no further treatment), odds ratio (OR) 1.27; 95% CI 1.52, 1.05, P = 0.01 and E-NRT (OR 1.22; 95% CI 1.45, 1.03, P = 0.02 over 2 years. There were no significant differences for E-NRT or E-combined compared to ST There was no significant difference between E-CBT and E-combined (OR 1.18; 95% CI 1.40, 0.99, P = 0.06) No differential effects by gender	Unclear

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Follow-up and outcomes	Results	Risk of Bias
Joyce 2008	Cluster RCT	US	65+	Older adults voluntarily enrolled on the Medicare Stop Smoking Programme Years smoking: 66-69% >50 years Heavy smokers: 27-30% smoked 25+ cigs/ day N=7354 randomised **Gender:** 39-42% male (depending on group) **Ethnicity:** White: 89-95%; black: 3-7%; other: 2-6%(depending on group) **SES:** Income: lowest: 18-21%; low: 19-21%; medium: 43-47%; higher: 13-18% (depending on group) Education: less than high school: 16-22%; high school: 36-39%; college: 41-47%	**Interventions:** Usual care: self-help educational materials (N=2230) Reimbursement for provider counselling (N=829) Reimbursement for provider counselling with pharmacotherapy (N= 2605) Telephone counselling Quitline with nicotine patch (N=1690)	**Follow-up:** 6 and 12 months post-baseline **Lost to follow-up:** 23.6% did not complete either 6 or 12 month assessments **Outcome measurement:** 7 day self-reported cessation	Telephone counselling Quitline with nicotine patch was most effective Quit rates at 12 months were:- Quitline +nicotine patch: 19.3% (95% CI 17.4-21.2) Provider counselling: 14.1 % (11.7-16.5) Provider counselling + pharmacotherapy: 15.8% (14.4-17.2) Usual care: 10.2% (9.0-11.5)	High

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Follow-up and outcomes	Results	Risk of Bias
Kim 2005	RCT	Korea	50+ Mean age: intervention 51.6 (SD 13.0); control: 53.1 (SD 13.5)	In younger and older smokers but conducts sub-group analysis by age (50+ versus <50 years) Currently smoking one cigarette a day or more. Participants were referred by physicians regardless of their willingness to quit N=401 randomised (66% of intervention group and 64% of control group willing to quit within 1 month) **Gender:** 94.5% male (intervention), 90.5% male (control) **Ethnicity:** Korean (no other ethnicity details reported) **SES:** 54% in intervention group and 51% of control group were high school graduates	Agency for Health Care Policy and Research guideline tailored for a Korean population **Intervention:** N=132 who were willing to quit within one month received part 2A of AHCPR guideline: including being helped to set a quit date, sign a stop-smoking contract, provided with self-help material. N=68 who were not willing to quit within one month received an intervention based on relevance, risks, rewards and repetition with phone follow-ups (also based on AHCPR) **Comparator:** N=201 were told to quit smoking by their own free will without any further assistance	**Follow-up:** 5 months **Lost to follow-up:** 1.7% overall **Outcome measurement:** Smoking cessation defined as absolutely no smoking since the last quit attempt, self-reported by telephone interview and verified by CO analyser (7ppm cut-off or less)	More effective for younger versus older smokers For the whole group: 14% of the intervention group and 9% of the control group had validated quits after 5 months: risk ratio (1.56, 95% CI 0.89-2.73) However, when only those aged >50 were included there was no difference between the groups: N=112 in intervention group and N=123 in the control group; 13.4% of the intervention group and 13.0% of the control group had validated quits: risk ratio (1.03, 95% CI 0.53-1.99)	Unclear

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Follow-up and outcomes	Results	Risk of Bias
Orleans 2000 Note: not clear if this study has been peer-reviewed	RCT	US	65+ Mean age 72	Older smokers who applied for a transdermal nicotine prescription Mean smoking duration >50 yrs Mean cigarettes/day: 22 N=470 **Gender:** predominantly female (specific data not reported) **Ethnicity:** predominantly white (no specific data reported) **SES:** majority had not completed high school (no specific data reported)	**Intervention:** Participants received a copy of a tailored self-help quitting guide for older smokers (Clear Horizons) and a series of seven personalised computer generated mailings (received over a period of 10 days to 6 months after baseline), and delivered through a state prescription plan **Comparator:** Usual care: a fact sheet on patch-assisted quitting	**Follow-up:** 6 and 12 months post-baseline **Lost to follow-up:** 14% (6 months) ; 22% (12 months) **Outcome measurement:** Self-reported (phone interviews)	At 6 months, those in the intervention group were more likely to report 7 day point prevalence abstinence than those in the comparator group. (40% vs 33%; $p<0.05$) However, at 12 months, the differences were not statistically significant (33% vs 31%)	High

Table 16: Smoking - Interventions with smoking cessation and reduction outcomes (non-RCTs)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Follow-up and outcomes	Results	Risk of Bias
Pothirat 2015	Non-randomised controlled trial	Thailand	60+ Mean age: Behavioural 67.2 (SD 6.7); Educational 66.9 (6.5)	Community-dwelling elderly smokers with smoking history of at least 10 pack years and who aimed to quit smoking within a month Mean smoking duration 51yrs (SD 13) Mean cigarettes/day: 12 (SD 0.8) All study participants smoked roll-your-own native unregulated cigarettes (crudely cut tobacco mixed with ground tamarind pod) N=224 **Gender:** Behavioural group therapy 40% male; Education 49% male **Ethnicity:** Not reported **SES (based on income):** 96% low SES; 4% moderate SES	Behavioural group therapy (n=120) versus educational programme (n=104). **Intervention: Behavioural group therapy** Same educational programme as the other group plus a total of 9 hours over 3 days of behavioural therapy including demonstrations of the health consequences of smoking, coping and social skills training, self-control, cognitive-behavioural interventions, reinforcement and relaxation **Comparator: Educational programme** 2hr education program that included a lecture on the health consequences of smoking.	**Follow-up:** 3, 6, 12 months **Lost to follow-up:** Intervention (behavioural): 3 months: 2.5%; 6 months 1.7%; 12 months 1.7%. **Outcome measurement:** self-reported and biochemical test (exhaled carbon monoxide < 10 ppm)	The continuous abstinence rate (CAR) of the behavioural therapy group at the end of the study (month 12) was significantly higher than the education group (40.1% vs 33.3%, p=0.034). Similar results were also found throughout all follow-up visits at month 3 (57.3% vs 27.0%, p<0.001) and month 6 (51.7% vs 25%, p<0.001)	High

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Follow-up and outcomes	Results	Risk of Bias
Tait 2006	Non-randomised controlled trial	Australia	68+	Community-dwelling older smokers (>/= 5 cigarettes/day equivalent) N=215 eligible Mean years of regular smoking: intervention: 53.9 (SD 8.0); control 57.9 (SD 6.2) **Gender:** 79.5% male Ethnicity: Not reported **SES:** Not reported	Participants in a larger study were interviewed: those considering quitting received intervention **Intervention (N=165):** Brief intervention, including individual counselling and education, including strategies to quit and avoid relapse, personalised package of written information, with follow-up telephone support and access to NRT **Comparator (N=50):** No intervention (those with no plans to quit smoking i.e. continuing smokers)	**Follow-up:** 6 months **Lost to follow-up (6 months):** Intervention: 3.6%; Comparator: 10% **Outcome measurement:** Smoking cessation self-reported and verified by exhaled carbon monoxide assessment (ECO), 8ppm threshold	At 6 months, 88.5% of the intervention group had made an attempt to quit, and 31% of the intervention group versus none from the control group reported not smoking for the past 30 days, however a confirmed ECO reading </= 8ppm was only available for 25.4% 20% reported sustained abstinence for the entire 6 months of follow-up	High

Table 17: Smoking - Interventions that targeted a range of behaviours with separate smoking outcomes

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Follow-up and outcomes	Results	Risk of Bias
Harari 2008	RCT	UK	65+ Mean age 74	Functionally independent community-dwelling older adults **Gender:** 56.0% female in intervention group and 52.9% female in control **Ethnicity:** Not reported	**Intervention:** Multi-domain health promotion study using the mailed HRA-O followed by computer-generated individualised written feedback to participants and GPs. Health behaviours addressed: PA, diet, smoking, alcohol, seat belts when driving. Preventive care: BP, cholesterol, blood glucose, faecal occult blood test, influenza or pneumococcal vaccinations, dental, vision, hearing, mammography checks. **Comparator:** No intervention	**Follow-up:** 1 year **Loss to follow-up:** 0% (numbers analysed at baseline and follow-up the same) **Outcome measurement:** Self-reported, health risk appraisal for older persons (HRA-O) questionnaire	Over the range of health behaviours or preventative health care measures in older adults examined, there was minimal improvement in any health behaviour or uptake (except pneumococcal vaccination) At 1 year follow-up, there was no significant difference between groups in people reporting 'no current tobacco use'- 90.9% of those in the intervention group and 89.6% of those in the control group (OR: 1.2 (95% CI 0.9, 1.6), p=0.36)	Unclear

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Follow-up and outcomes	Results	Risk of Bias
Vrdoljak 2014	RCT (multicentre conducted in 59 general practices)	Croatia	65+ Mean age 72.3 (SD 5.2)	**Setting:** General practice **Population:** Croatian citizens aged 65+ years who visited their GP for any reason (those with life expectancy <6 months, severe dementia, severe mental illness, communication disability excluded) At baseline, 69.6% were non-smokers, 23.5% former smokers and 6.8% were smokers **Gender:** 61% female (whole sample) **Ethnicity:** Not reported	Lifestyle intervention that targeted a range of health behaviours: PA, smoking, alcohol, diet. **Intervention (N=371):** Intensified intervention delivered by GPs. Intervention participants were counselled and given a tailored life plan for adopting healthier behaviour. Each patient received educational leaflets for their detected CV risk factors and a specific appointment was given for the next follow-up visit. **Comparator (N=367):** Usual care: GPs were not instructed to give any specific intervention.	**Follow-up:** 18 months **Loss to follow-up:** Of all respondents, N= (94%) completed the baseline survey for smoking and 59% completed the follow-up survey. **Outcome measurement:** Self-reported, questionnaire	Outcomes reported separately for each health behaviour, including smoking There was no significant difference between groups for smoking (chi-squared = 0.85, df = 2, p = 0.65) at the end of intervention Note: it may not have been the same people who completed alcohol questions at baseline and follow-up Also no significant differences between the intervention and control groups for physical activity (chi-squared = 0.84, df = 1, p = 0.36), alcohol (chi-squared = 0.73, df = 1, p = 0.394) at the end of the study)	High

Table 18: Smoking - Interventions targeted at training health professionals in smoking cessation services

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Follow-up and outcomes	Results	Risk of Bias
Kerr 2011 (Kerr 2007)	RCT	UK (Scotland)	Mean age: intervention 46/ control 44 (health professionals)	N=57 members of the primary care team who work with older adults (N=47 nurses and N=9 allied health professionals recruited from 7 community health and social care partnerships) **Gender:** Not reported **Ethnicity:** Not reported	**Intervention:** 1-day, brief, smoking cessation training aimed at providing the knowledge and skills aimed to deliver effective brief interventions. Training was tailored to overcome key barriers and delivered by a professional experienced in the delivery of smoking cessation training **Comparator:** No training	**Follow-up:** 1 week and 3 months after training **Loss to follow-up:** N=73 randomised, N=57 completed training; N=54 (94.7% of those trained) completed 1 week follow-up; N= 52 (91.2%) 3 month follow-up **Outcome measurement:** Self-reported, using a specifically developed and validated questionnaire. Qualitative data also collected from N=8	Statistically significant improvement in knowledge and attitudes of the intervention group. Practice also improved but differences were not significant	Unclear

Table 19: Smoking - Overview of qualitative studies reporting barriers and facilitators

Study	Study design	Country	Age (years)	Population	Objective	Quality
Huddlestone 2015 (Abstract only, but reports main results)	Qualitative (face to face semi-structured interviews)	UK (North-East England)	65+ Mean age 69	N=7 older smokers registered at a general practice in a large city **Gender:** Not reported **Ethnicity:** Not reported **SES:** Not reported	To explore issues around engagement of older smokers with smoking cessation support delivered in primary care	-
Kerr 2006	Qualitative (semi-structured interviews)	UK (Scotland)	65+	N=20 current (N=13) and former smokers (N=7) recruited through general practices and a forum for older smokers **Gender:** 46% male, 54% female **Ethnicity:** Not reported **SES:** Of the smokers, the majority were in the highest categories of deprivation (N=8 DEPCAT 6/7; N=3 DEPCAT 4/5; N=2 DEPCAT 3). Former smokers were less likely to be in the highest deprivation categories (N=1 DEPCAT 6/7; N=5 DEPCAT 4/4; N=1 DEPCAT 3) The scoring system ranges from DEPCAT 1 (the most affluent postcode sectors) to DEPCAT 7 (the most deprived)	Older current and former smokers' views on smoking, stopping smoking, and smoking cessation resources and services	++
Kerr 2007	Qualitative (semi-structured interviews)	UK	Range < 25 to 64	A sample of N=41 health visitors, district nurses, practice nurses and general practitioners working in primary care, with contact with older adults (>/= 65 years). Recruited through 33 general practices to ensure diversity in level of socio-economic deprivation and geographical location **Gender:** 32% male, 68% female **Ethnicity:** Not reported **SES:** Recruited from practices in a diverse range of socioeconomic areas	Exploration of the knowledge attitudes and practice of the primary care team in relation to smoking cessation to identify barriers to the effective provision of intervention to older adults	++

Study	Study design	Country	Age (years)	Population	Objective	Quality
Lundqvist 2006	Qualitative (interviews)	Sweden	Age range 47-70	N=9 middle-aged and elderly women. N=5 were smokers and N=4 ex-smokers. Aimed to recruit a wide range in terms of: social background, education, marital status and profession **Gender:** 100% female **Ethnicity:** Not reported **SES:** N=3 were blue collar workers, 2 were well-paid administrators, 2 had sickness pensions and 2 were retired	To identify attitudes and barriers to smoking cessation among middle-aged and elderly women	++
Medbo 2011	Qualitative (semi-structured interviews)	Norway	58+ (Range 58-80)	N=18 elderly smokers (N=5) and ex-smokers (N=13). N=11 had serious chronic diseases such as myocardial infarction, angina, stroke, COPD. Years smoking ranged from 10 to >60 **Gender:** 65% male, 35% female **Ethnicity:** Not reported **SES:** Not reported	Aim was to gain insights that may help general practitioners understand why people smoke, and why smokers quit and maintain quitting to inform interventions to stop smoking	++
Mohammadnezhad 2015 A/B (A: BMC Public Health, B: Int J Eviron Res Public Health)	Qualitative (semi-structured face-to-face interviews, with a Greek translator)	Australia	50+ Mean age 64.6 (SD 10.0)	N=20 older Greek-Australian smokers living in a metropolitan area (smoking defined as those who had smoked at least 100 cigarettes during his/her lifetime and were currently smoking). 65% were suffering from diseases such as cancer or heart disease The mean years of smoking were 45.5 years (SD = 10.8 years) **Gender:** 60% male, 40% female **Ethnicity:** All self-identified as Greek-Australians residing in Australia **SES:** 60% had completed high school level of education	To understand reasons for smoking and attitudes to quitting; and sociocultural factors that can influence smoking and smoking cessation behaviour	++

Table 20: Smoking - Barriers to smoking cessation in older adults

	Kerr 2007	Huddlestone	Lundqvist	Mohammadn-ezhad A	Mohammadn-ezhad B	Medbo
Health and quality of life						
Loss of enjoyment/pleasure	X			X		
Loss of perceived stress reduction/relaxation	X			X		
Loss of 'boredom relieving' qualities	X					
Potential weight gain	X		X			
Belief the damage has already been done	X					
Adverse life events					X	
Addiction to nicotine	X			X		
Low knowledge about related diseases and risks				X		
Sociocultural						
Difficulty in engaging longstanding smokers		X				
High acceptability in some cultural groups				X	X	
Social arrangements		X				
'Loss of special sense of group belonging'			X			
Integration into social activities				X		
Social networks/ influence of other people				X		X
Psychological						
Low self-efficacy	X			X		
Lack of motivation		X				
Lack of acknowledgement of health problems	X			X		
Fatalism			X			
Fear of craving						X
Smoking as a life-long habit	X					
Smoking as a personal choice		X				
Smoking cessation routes and services						
Potential health risks/side effects of NRT	X		X			

	Kerr 2007	Huddlestone	Lundqvist	Mohammadn-ezhad A	Mohammadn-ezhad B	Medbo
Belief NRT not compatible with other health problems	X					
Lack of confidence in NRT	X		X			X
Focus on disease within healthcare system			X			
Lack of confidence in available support			X			
Lack of follow-up from medical staff, pharmacists, etc. (e.g. NRT)			X			
Disease focus of hospital-based programmes			X			
Lack of support from some health professionals	X					

Table 21: Smoking - Facilitators to smoking cessation in older adults

	Kerr 2007	Huddlestone	Lundqvist	Mohammadn-ezhad A	Mohammadn-ezhad B	Medbo
Health and quality of life						
Improved health/prevention of ill health	X	X	X			X
Free from smell of smoking	X					
Sense of freedom after cessation			X			
Financial issues						
Saving money	X					
Sociocultural						
Increasing social unacceptability	X					X
Care, household and occupational responsibilities			X			
Family pressure/encouragement	X		X			
Social networks/ influence of other people				X		X
Psychological						
Will to stop smoking			X			
Smoking cessation routes and services						
Lack of knowledge about services	X					
Health promotion rather than focus on disease			X			
Key role of support from primary care team	X					
Input of health professionals	X	X				
Consistent advice from primary care physicians		X				
Support tailored to individual needs		X	X			
Choice of smoking cessation routes			X			
Tobacco as a ‘safety net’						X
Different diversion to help stop smoking	X					

Table 22: Smoking – Quality assessment for interventions reporting on smoking cessation and reduction outcomes

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Over-all*	B1	B2	B3	*Over-all*	C1	C2	C3	*Over-all*	D1	D2	D3	D4	D5	*Over-all*	
RCTs																			
Hall 2009	Y	Y	Y	*Low*	Y	Un-clear	Un-clear	*Un-clear*	Y	Y	Y	*Low*	Y	Y	Y	Un-clear	Un-clear	*Un-clear*	**Unclear**
Joyce 2008	Y	Un-clear	N	*Un-clear*	Y	Un-clear	Un-clear	*Un-clear*	Y	Un-clear	Un-clear	*Un-clear*	Y	N	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Kerr 2011	Un-clear	Un-clear	Un-clear	*Un-clear*	Y	N	N	*Un-clear*	Y	Un-clear	Un-clear	*Un-clear*	Y	N	Un-clear	N	Un-clear	*Un-clear*	**Unclear**
Kim 2005	Y	Y	Y	*Un-clear*	Un-clear	Un-clear	Un-clear	*Un-clear*	Y	Un-clear	Un-clear	*Un-clear*	Un-clear	Y	Y	N	Un-clear	*Un-clear*	**Unclear**
Orleans 2000	Un-clear	Un-clear	Un-clear	*Un-clear*	Un-clear	Un-clear	Un-clear	*Un-clear*	Un-clear	Un-clear	Un-clear	*Un-clear*	Y	Un-clear	Un-clear	Un-clear	Un-clear	*Un-clear*	**High**
Vrdoljak 2014	Y	Un-clear	Un-clear	*Un-clear*	Un-clear	Y	Y	*Un-clear*	Y	Un-clear	Un-clear	*Un-clear*	Y	N	N	Un-clear	Un-clear	*High*	**High**
Non-randomised studies																			
Pothirat 2015	N	N	N	*High*	Un-clear	Un-clear	Un-clear	*Un-clear*	Y	Un-clear	Un-clear	*Un-clear*	Y	Y	Y	Un-clear	Un-clear	*Un-clear*	**High**
Tait 2006	N	N	N	*High*	N	Y	Y	Un-clear	Y	N	N	*Un-clear*	Y	Y	Y	Un-clear	Un-clear	*Un-clear/ Low*	**High**

Table 23: Smoking – Quality assessment for studies reporting barriers and facilitators

	Theoretical approach		Study	Data collection	Trustworthiness			Analysis						Ethics	Overall
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Huddlestone 2015	Appropriate	Unclear	Not sure	Not sure/ inadequately reported	Not described	Unclear	Not sure	Not sure/not reported	Not sure/not reported	Not sure/not reported	Not sure	Relevant	Not sure	Not sure/not reported	-
Kerr 2006	Appropriate	Clear	Defensible	Appropriately	Clear	Clear	Not sure	Rigorous	Rich	Reliable	Convincing	Relevant	Adequate	Appropriate	++
Kerr 2007	Appropriate	Clear	Defensible	Appropriately	Appropriately	Clear	Reliable	Rigorous	Rich	Reliable	Convincing	Relevant	Adequate	Appropriate	++
Lundqvist 2006	Appropriate	Clear	Defensible	Appropriately	Unclear	Clear	Reliable	Rigorous	Rich	Reliable	Convincing	Relevant	Adequate	Appropriate	++
Medbo 2011	Appropriate	Clear	Defensible	Appropriately	Appropriately	Clear	Reliable	Rigorous	Rich	Reliable	Convincing	Relevant	Adequate	Appropriate	++
Mohammadnezhad 2015 A	Appropriate	Clear	Defensible	Appropriately	Clear	Clear	Reliable	Rigorous	Rich	Reliable	Convincing	Relevant	Adequate	Appropriate	++
Mohammadnezhad 2015 B	Appropriate	Clear	Defensible	Appropriately	Clear	Clear	Reliable	Rigorous	Rich	Reliable	Convincing	Relevant	Adequate	Appropriate	++

Table 24: Diet – Interventions to increase uptake/maintenance of healthy diet behaviours (RCTs)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Appleton 2013	RCT	N. Ireland, UK	65+	Community-dwelling older adults **Setting:** Community based church and social groups N=95 randomised **Gender:** 28-34% across groups **Ethnicity:** Not reported **SES:** Not reported	Fruit-tasting sessions involving familiar fruits and novel fruit products and dishes. The interventions were designed to be social, enjoyable activities to be undertaken in community-based groups, which could be implemented by non-health professionals **3 intervention groups:** (1) Single exposure (E1): fruit sampling on one occasion Only (n=39) (2) Repeated exposure (E5): fruit sampling on one occasion per week for 5 weeks (n=38) (3) Repeated exposure Plus (E5+): fruit sampling on one occasion per week for 5 weeks and provision of one portion of fruit per d to be consumed at home (n=18)	**Follow-up:** 5 weeks (to end of intervention) **Lost to follow-up:** 0% reported but data imputed from mean of 2 other timepoints for missing values **Outcome measurement:** Self-reported, 24 hr food recalls with additional prompts from researchers	For all participants (n=95), There were no significant differences in fruit or fruit and vegetable intake between groups In low consumers of fruit (one portion/day or less) (n=38) Fruit consumption was significantly higher in the repeated exposure groups compared to the single exposure group (groupxtime interaction: F(3,138)=3.36, p=0.02) Fruit intakes increased significantly in the repeated exposure groups (E5, E5+) (t(30) 5·79, P<0·01), but did not change in the E1 group (t(16) 0·29, P=0·78). No differences were found between E5 and E5+ groups (F(3,87) 1·22, P=0·31). Similar effects were also found for fruit and vegetable intakes

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Atienza 2008	RCT (pilot study)	US	50+ (mean age in control 58 y and int 63 y)	**Population:** N=27 randomised. **Setting:** Community N=36 randomised **Gender:** Intervention 69% female; control 70% female **Ethnicity:** Intervention: 88% white; control 90% white **SES:** Education (yrs): Intervention: 16.8 (2.2); control 16.7 (2.5)	Examined effect of using a hand-held computer for increasing vegetable and whole-grain intake over 8 weeks. **Intervention (n=20):** Instruction session and hand-held computer programmed to monitor their vegetable and whole-grain intake twice per day and to provide daily individualised feedback, goal-setting and support **Control (n=16):** Standard, age-appropriate written nutrition education materials	**Lost to follow-up:** Intervention: 16%; Control 31% **Outcomes:** Servings of vegetables/day; dietary fibre from grains (as a proxy for wholegrain intake) assessed by FFQ	(per 1000 kcal) in the intervention group compared to controls (from 1.5 at baseline to 2.5 servings/day; p=0.02). Control group remained constant at 1.9 servings/d (from graph) Dietary-fibre intake from grain sources per 1000 kcal was not statistically significant between groups

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Babatunde 2011	RCT	US	50+ (mean age 70.2; range 50 to 92)	**Population:** Community dwelling older, black adults. Male and female **Setting:** Churches and community-based organisations N=110 randomised **Gender:** 90% female **Ethnicity:** 100% black (of African descent) **SES:** Years of schooling ranged between 8 and 20 years (mean 13.1 yrs), and 73% had more than a high school diploma	**Intervention:** (n=59) Received 6-weekly osteoporosis education programme, developed with a theoretical background, with a focus on modifying health beliefs and self-efficacy with regard to osteoporosis prevention **Control:** (n=51) Wait-list control (received the intervention later)	**Follow-up:** 6 weeks (end of intervention) **Lost to follow-up:** 15.4 % **Outcomes:** Self-reported, Dietary calcium intake measured using the Random Assessment Method (RAM) calcium checklist, a type of food frequency questionnaire	The experimental group had a statistically significant improvement in calcium intake compared to those in the control (Wilks λ 0.47, F1,108 122.97, P < .001, η2 0.53). There was an average increase of 556 mg in dietary calcium intake from a mean score of 874 (SD324) at baseline to 1430 (SD331) mg/ day at the end of the program in the experimental group In the wait-list control group, calcium intake slightly decreased from a mean of 817.6 (SD326.7 to 778.2 (SD 369.3) mg/day
Barr 2000	RCT	US	55 to 85 years	People in good general health, 5 years or more post menopause for women, consuming 1.5 servings or fewer of dairy products daily and willing to consume 3 additional servings of fluid milk daily N=204 randomised	**Intervention:** The milk group were instructed to add 3 x 8oz servings of skim or 1% fluid milk to their usual consumption of dairy products and to follow their usual diet in other ways. No instruction to adjust for the added energy from milk was given **Control:** Instructed to maintain their usual diet including consumption of fewer than 1.5 servings/ day	**Follow-up:** 4 week baseline period and 12 week intervention **Lost to follow-up:** 3% in intervention group and 1% in control group **Outcome measurement:** self-reported 3-day food records checked by dietitians	Compared with controls, participants in the milk supplemented group significantly increased energy, protein, cholesterol, vitamins A, D and B12, riboflavin, pantothenate, calcium phosphorus, magnesium, zinc and potassium The milk group gained 0.6 kg more than the control group (p<0.01), however weight gain was less than predicted. Authors suggest likely there was some compensation for the added energy from milk

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Bernstein 2002	Parallel RCT (randomly assigned by gender and age in blocks of 4)	US	69+	**Population:** Community dwelling elderly N=70 randomised **Setting:** Home-based Gender: Intervention: 78.9% female; Control 81.2% female **Ethnicity:** Predominantly white 97.2%; 2.8% African American **SES:** Not reported but economically diverse participants were targeted for recruitment	**Intervention:** Personalised home-based nutrition education intervention (n=38) including behaviour modification techniques designed to increase fruit, vegetable and calcium-rich food consumption, delivered by home visits, telephone calls and monthly letters **Control:** Home-based exercise intervention (n=32)	**Follow-up:** 6 months intervention and follow-up **Lost to follow-up:** 0% (follow-up data obtained for all those at baseline) **Outcomes:** Self-reported FFQ and biochemical blood nutrient and carotenoid levels	Compared to the control group, the nutrition group increased their intake of fruits by 1.1 (SEM 0.2) servings/day - from 2.8 to 3.9, p<0.01; vegetables 1.1 (SEM 0.2) from 2.3 to 3.4 servings/d, p<0.001; milk/dairy by 0.9 (SEM 0.2) / day, from 3.0 to 3.9, p<0.001 No adverse effects reported At the end of the study, the nutrition group reported consuming 7.3 servings of fruit and vegetables and 3.9 servings of dairy products daily while to exercise control group reported 6.2 fruit/veg servings and 3.1 dairy servings/day (p<0.001) The nutrition group reported eating more citrus fruit, orange vegetables, tomatoes, other vegetables, cheese and milk compared to the control group (p<0.06) There was no significant change in intake from other food groups

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Carcaise-Edinboro 2008 The Rural Physician Cancer Prevention	RCT	US	18-72 years (reports separate outcomes for those aged 56+)	**Population:** Individuals from a rural and high minority population N=754 randomised (N=623 provided at least one follow-up measure) **Setting:** **Gender:** (of those that completed follow-up) 65.3% female **Ethnicity (%):** White 60.5, African American 36.8, Other 2.7 **SES:** 49% percent of participants had less than or equal to a high school education, 24% had a college degree	Low-intensity, physician-endorsed dietary education intervention versus no intervention **Intervention:** Designed to improve dietary behaviour; using tailored feedback and self-help dietary intervention. Participants received a mailed personalised statement of their dietary behaviour and theory-based, low-literacy nutrition information based on local advice about the target community in the form of 4 self-help booklets, and the intervention was endorsed by their physician **Comparator:** No intervention	**Follow-up:** 1, 6 and 12 months (post-intervention). **Lost to follow-up:** 18% **Outcome measurement:** self-reported, 5-item fruit and vegetable subscale of the fibre FFB and the Food Frequency Questionnaire (FFQ)	Fruit and vegetables (servings/d) in those aged 56+ yrs. Control (SD)/ Intervention(SD) Baseline: 2.76(1.40)/2.77(1.48) 1 month: 2.96(1.61)/3.78(1.93); p<0.001 between groups 6 months: 3.21(1.73)/3.72 (1.70); p<0.001 between groups 12 months: 3.17(1.69)/3.33 (1.69), p=0.13 between groups
Foldi 2005	Before and after study	US	65+	Elderly men **Setting:** Veteran's Affairs Medical Centre	**Intervention:** Video on osteoporosis prevention		67% of participants increased amount of calcium ingested and 10% began calcium supplementation. Significantly more met the RDA of calcium after watching the video

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Francis 2009	RCT (designed as an RCT but does not report results for between group differences so should really be interpreted as a before and after study)	US	Range 54-83	N=59 randomised **Gender:** 100% female **Ethnicity (%):** Not reported **SES:** Not reported (all were literate)	**Intervention (N=28):** Diet education program based on social marketing theory. The intervention group received two individual registered dietitian-led in-home education sessions **Control (N=30):** Received education material mailings as the main intervention group – the only difference between groups was the number of contacts with the dietitian	**Follow-up:** 90 days **Lost to follow-up:** 1.7% **Outcome measurement:** 3-day food records and Mini Nutritional assessment	Intervention and control Mini Nutritional Assessment scores improved (P=0.0001). Intervention group consumed more fiber than control (P=0.013) and reduced sodium intake (P=0.02). Controls reduced energy (P=0.01) and cholesterol intakes (P=0.029), likely because of the decreased food intake Notes: A: control group significantly lowered energy intake B: does not report between group differences, only within group differences
Greene 2008 SENIOR Project (Study of Exercise and Nutrition in Older Rhode Islanders) NB: Comparison is exercise versus nutrition	RCT	US	60+ Mean 74.7 (SD 6.4)	**Population:** Community-dwelling older adults **Setting:** Community **Gender:** 72.9% female **Ethnicity (%):** 79.5% White-Caucasian; 13.2% Hispanic-Portuguese **SES:** 19.5% had <12 yrs education; 38.5% were high school graduates; 19.9% were college graduates	**Intervention:** Received a behavior-specific fruit and vegetable manual based on the Transtheoretical model of behaviour change, newsletters, computer based expert system reports, and coaching calls from trained counsellors **Control:** Received either a manual about exercise or a fall-prevention manual, neither of which included information about nutrition	**Follow-up:** 12, 24 months **Lost to follow-up:** 34.7% (24.4% did not complete the study and 10.3% had one missing data point) **Outcome measurement:** Daily servings of fruit and vegetables assessed using brief food frequency instruments e.g. NCI Fruit and Vegetable Screener and the 5 A Day Program screener; and dietary recall telephone interviews in a subset of participants	Participants had a high intake of fruit and vegetables at baseline (5.2–7.4 servings), and this increased by 1.0–2.2 servings a day in the intervention group and by 0.7–1.4 servings a day in the control group Absolute values differed by assessment tool used Between-group differences were significant at the 12 and 24 month assessments (for all assessment measures used)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Kristal 2000 Puget Sound Eating Patterns Trial	RCT	US	18-69 recruited but reports separate outcomes for 55+	**Population:** Participants were enrollees of a consumer-owned health maintenance organisation N=1459 randomised overall; N=440 completed aged 55-69 **Setting:** Community (home-based) **Gender:** 50.9% male **Ethnicity (%):** 85.9% white; 4.5% black; 5.8% Asian; 3.0% Hispanic; 0.8% other **SES:** overall a range of household incomes	**Intervention (N=440):** tailored, multiple-component self-help intervention designed to lower fat intake and promote fruit and vegetable consumption. Consisted of a computer generated personalised letter, motivational phone-call, self-help manual, computer-generated behavioural feedback based on FFQ analysis, newsletters and supplementary materials) **Control:** No intervention	**Follow-up:** 3, 12 months **Lost to follow-up:** 13.5% completed both 3 and 12 month follow-ups **Outcome measurement:** Telephone based surveys. Change in fat intake measured with fat-related diet habits questionnaire; change in fruit and vegetable intake measured with 6 item FFQ	Reports outcomes separately for those age 55-69 Fruit and veg: increased by 0.61 servings/d (p<0.001) Fat-related diet habits: (summary score): decreased by 0.10 P<0.01) Note: not clear if the above are based on between group comparison For all participants (i.e age 18 to 69) Fruit and vegetables (svg/day): The intervention group (n=601) increased servings from 3.62 (SD 1.49) by 0.41 (SD 1.88) at 3 months and by 0.47 (SD 1.83) at 12 months The control group (n=604) increased servings from 3.47 (SD 1.41) by 0.08 (SD 1.63) at 3 months and by 0.14 (SD 1.80) at 12 months Between-group difference p<0.0001 Also reports cost analyses of the programme in 1998 costs (but not cost-effectiveness outcomes)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Lara 2015	RCT (pilot RCT)	UK	50-84 Mean 66 (SD 9)	Healthy men and women aged 50+ N=23 Mean BMI 27 at baseline **Setting:** Community **Gender:** Not reported **Ethnicity:** Not reported **SES:** Not reported	**Intervention:** Three-week brief MD intervention with two levels of dietary advice: **Group-1:** Attended a 2h educational group session on the MD **Group-2:** Attended a 2h group session and received additional support. Additional support was provided during telephone calls on days 3, 11 and 16 of the intervention, and providing participants with additional written materials including MD menus and recipes	**Follow-up:** 3 week intervention – assessed at end of intervention **Lost to follow-up:** 0%. **Outcome measurement:** Self-reported, 3 day food diaries	The intervention was rated as acceptable. No significant differences were observed between groups 1 and 2. Analysis of the combined sample showed significant increases from baseline in fish intake (P = 0.01) and MD score (P = 0.05) The cost of food intake during intervention was not significantly different from baseline

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Moynihan 2006 (Food Standards Agency N09015) Details based on summary report only – full report requested from FSA 22-3-2016. No pub-lished paper found.	RCT (cluster: 32 groups of 9 people)	UK	65-85 years Mean 76 (range 71-80)	Older adults living in sheltered housing in socially deprived areas Diet at baseline high in saturated fat, low in fibre and fruit and vegetables and low in vitamin D At baseline 76% of subjects were overweight or obese and only 0.5 % of subjects were underweight **Gender:** 14% male **Ethnicity (%):** Not reported **SES:** Not reported	**Intervention:** Peer-led community based food clubs (N=97) **Control:** Did not attend a food club	**Follow-up:** 1 year **Lost to follow-up:** N=201 at baseline; N=94 immediately after intervention and N=72 at one year after intervention **Outcome measurement:** questionnaire	Immediately following the intervention no significant changes in diet were observed After 1 year, percentage of energy from carbohydrate was significantly greater (2.4% more than people who had not attended a club) Changes in other dietary outcomes or blood nutrient levels were not significantly different between groups, though there were trends towards higher fruit and sugar intakes in the intervention group. At 1 year, significantly higher Vit D in the control group No significant changes in measurements of body fatness No effect on other aspects of diet, or on knowledge, attitudes or physical health Costs Training of one peer educator: £700; average cost of running a Food Club £130 per week. This cost could be reduced if peer educators did more than one Food Club: if each peer educator did 5 Food Clubs the average weekly cost per club would be approx £70 (2006 costs)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Taylor-Davis 2000	RCT	US	60-75 Mean 69.4 +/- 3.2	**Population:** Medicare recipients selected randomly from a Medical Centre patient database Note: self-rated interest in nutrition was significantly higher for participants than non-participants **Setting:** Home-based **Gender:** 57% male Ethnicity (%): 100% white **SES:** Approx half had at least a high school education; a third had received training or education beyond school	**Intervention 1:** Home-based educational intervention. Five mailed, biweekly nutrition newsletters based on the nutrition communication model and adult learning theory **Intervention 2:** Nutrition newsletters as intervention 1 with telephone follow-up **Control:** No intervention (completed pre and post-test surveys only)	**Follow-up:** Not clear (approx. 3 months) **Lost to follow-up:** 19.6% **Outcome measurement:** Self-reported, food behaviour scale: 81 item, 5-point Likert scale, with food behaviour subscales:modify meat; avoid fat; replace fat; substitute fat; increase fibre	The only significant difference between groups was one food behaviour subscale 'avoid fats' where those who received newsletters only (Intervention 1) performed significantly better ($p<0.05$) than controls There were no significant differences between any of the groups for all other food behaviour scales examined – 'replace fat', 'substitute fat' and 'increase fibre'

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Patterson 2004 (Women's Health Initiative Dietary Modification Trial)	RCT (40% randomised to int; 60% to control)	US	50-79	**Population:** Post-menopausal women enrolled from clinical centres with baseline fat intake >/=32% of energy consumption N=19542 randomised to intervention group and N=29294 to control group **Setting:** Clinic **Gender:** 100% female **Ethnicity (%):** 82.8% white; 9.9% African American; 3.3% Hispanic; 2.3% Asian/Pacific Islander; 0.4% American Indian/Alaskan Native SES: 21.7% <12 years education; 39.6 13-15 years; 10.7% 16 years; 28.0% >16 years	**Intervention:** Group dietary intervention targeted at reducing total dietary fat (to 20% of energy), reducing saturated fat (to 7% of energy) and increasing fruit and vegetable servings (to five or more daily) and grain servings (to six or more daily). Each group received 18 sessions in the first year to promote dietary and behaviour change and subsequent quarterly maintenance sessions **Control:** Usual diet	**Follow-up:** 5 years **Lost to follow-up:** 10% **Outcome measurement:** Food Frequency Questionnaire	Mean difference in total energy intake between the intervention and control women for total fat: was 10.9 % at Year 1, decreasing to 9.0 at Year 5; saturated fat 4.0 at Year 1 and 3.5% at Year 5. The difference in fruit and vegetable intake between intervention and controls was -1.2 servings per day at 1 Year and -1.3 servings per day at 5 years and for grains it was -0.8 and -0.5 servings/day at Year 1 and Year 5 All of these differences were statistically significant (P<0.001)

Table 25: Diet – Interventions to increase uptake/maintenance of healthy diet behaviours (non-RCTs)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Hermann 2000 Oklahoma 'Healthy Living' program	Before and after study	US	55+ Mean 69 (SD 8)	The project was marketed to the public via the media including television and radio public service announcements, news releases and flyers Volunteers were recruited to the programme N=67 completed pre and post dietary recalls	Eight session food and nutrition promotion programme. The programme was designed to provide clear information that participants could understand and apply to their daily lives. Used nutrition education theories including nutrition information, nutrition promotion and behaviour change strategies. Focus was on the total diet rather than individual foods	**Follow-up:** 8 weeks intervention, assessed at end of intervention **Lost to follow-up:** Not clear. N=76 completed programme but number recruited not reported. 88.1% completed post-test recalls **Outcome measurement:** self-reported, 24hr dietary recall questionnaire (analysed by registered dietitian)	Significant increases in the number of servings consumed from the Food Guide Pyramid food groups were achieved. Statistically significant increases were found for mean servings from the: bread, cereals, rice and pasta group increased from 3.8 to 4.9/d; vegetable group increased from 2.7 to 3.4/d; milk, yoghurt and cheese increased from 1.4 to 2.3/d Non-significant changes were seen in the fruit group – mean servings increased from 2.4 to 2.8/d and the meat, poultry, fish, dry beans, egg and nut group – increased from 1.9 to 2.0/d The mean servings/d from fats, oils and sweets significantly decreased from 2.7 to 1.8/d

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Keller 2006 (Evergreen Action Nutrition)	Before and after study (however, note: not same people assessed at baseline and follow-up)	Canada	Mean age: 72 .4 yrs at baseline and 74 +/- 7.4 yrs at follow-up)	Relatively healthy members of a seniors recreation centre **Setting:** Community recreation centre for older adults **Gender:** 69.1% female **Ethnicity (%):** Not reported **SES:** 45.8% had post-secondary education	**Intervention:** (Surveys completed by 247 at baseline and 251 at follow-up) Community health education programme developed involving researchers, nutrition educators and healthy older adults. Programme aimed at: improving fruit and vegetable consumption; promoting positive attitudes towards eating, nutrition and health; overcoming cooking difficulties and making cooking interesting; nutrition and food information in relation to disease. Emphasis was on activities that were social, relevant, and user-friendly	**Follow-up:** 3 years **Lost to follow-up:** N/A (different participants) **Outcome measurement:** SCREEN assessment, self-reported validated tool for overall nutritional risk and frequency of consumption of individual food items	Those at nutritional risk dropped from 56.7 to 38.5%; (chi-squared = 16.0 p<0.001); however, there was no difference in nutritional risk for those that did or did not participate in the programme 57.4% consumed few fruits and vegetables at baseline compared to 42.7% at follow-up (chi-squared = 12.2, p=0.001) Frequency of eating: at baseline 6.6% ate fewer than 3 times/day compared to 3.3% at follow-up (chi squared =3.2, p=0.05) Of those who participated in the programme, 37.3% compared to 53.7% who did not participate had low consumption of fruit and vegetables (chi-squared =4.0, p=0.045)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Rousset 2006	Non-ran-domised controlled study	France	65-75	Healthy elderly people living at home 47% of elderly people (53% of women and 40% of men) had a body mass index <24.5, and only two men and one woman were obese (body mass index >30) **Setting:** Community **Gender:** 54.9% female **Ethnicity (%):** Not reported **SES:** Not reported	**Intervention (N=35):** Nutrition information program targeting protein consumption in elderly people. Education messages about protein delivered by nutrition professionals (physician, registered dietitian and scientist) in a lecture and discussion. Participants were informed of their actual protein intake based on their baseline survey and the level of their nutrition and sensory knowledge; the role of proteins in muscle and bone maintenance and the immune system, and given protein details for different foods and menu ideas **Control (N=47):** No intervention but completed baseline questionnaires on food consumption and attitudes	**Follow-up:** 2 weeks after intervention **Lost to follow-up:** Attrition from intervention group: 27.6%; from control 2.0%. 96 randomised, 13 withdrew (12 from intervention (as did not want to or have time to participate in the lecture; 1 from control) **Outcome measurement:** 7 day food questionnaire, quantities self-assessed using photographs	For control group participants, protein consumption (by body mass unit) in the second survey was 6 g/day less than baseline (p=0.01 for women; p=0.10 for men) The control group consumed less protein from meat (P=0.03) and dairy products (P=0.006) than the participants in the intervention group However, protein intake in the intervention group was higher (P=0.02) at follow-up than baseline. Protein consumption by body mass unit increased significantly in women (P=0.02) and slightly but not significantly (P=0.35) in men. Fish consumption was higher in the second dietary survey (P=0.03). Less hard cheese (P=0.01) and more cottage cheese (P=0.06) were consumed

Table 26: Diet – Interventions to increase uptake/maintenance of healthy diet behaviours (secondary analyses)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Yates 2012 Secondary analysis of Wellness for Women trial (Hageman 2014 is main paper) (Initial study examined physical activity and healthy eating behaviours – only eating behaviours reported here)	RCT (randomi-sation by geographic area - two counties to intervention or control)	US	50-69 Mean 58 (SD 5.5)	Women from two rural counties in Nebraska, English speaking and able to use a computer to complete online surveys. Those in the maintenance stage for consumption of fat, fruits and vegetables, and grain intake as measured by the Stages of Healthy Eating Questionnaire **Setting:** Community **Gender:** 100% female **Ethnicity (%):** Not reported (check) **SES:** Not reported (check)	**Intervention:** Tailored newsletter. 18 mailed tailored or standard newsletters were sent to women every 2 weeks for the first 6 months and every 4 weeks for the next 6 months The content of the tailored newsletters was individualized in relation to: Personal goals, most current assessment of benefits, barriers, self-efficacy, and interpersonal support, and biomarker results regarding eating. The daily dietary components emphasized in the intervention were: 2 servings of fruit; 3 servings of vegetables (1 dark green or deep yellow); 6 servings of grains (3 whole grains); <30% of calories from fat; and <10% of calories from saturated fat **Control:** Standard newsletter. The standard newsletters contained general information about healthy eating that is currently available from organisations such as the American Heart Association and American Cancer Society	**Follow-up:** One year intervention with follow-up at 18 and 24 months **Lost to follow-up:** N=225 randomised	The tailored newsletter group was successful in improving their healthy eating behaviour compared to the standard newsletter group during the one-year intervention, at the end of the intervention, and during the follow-up phase. Family support at the end of the intervention was positively associated with healthy eating at the end of the intervention. Perceived barriers had the strongest impact on healthy eating behaviour at all time points. Compared to participants in the standard newsletter group, those in the tailored newsletter group perceived more family support and fewer barriers for healthy eating at the end of the intervention (mediation effects). Based on these findings, both family support and perceived barriers should be central components of interventions focused on healthy eating behaviour in rural midlife and older women

Table 27: Diet – Interventions to increase uptake/maintenance of healthy diet behaviours with cognitive outcomes

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Bayer-Carter 2011	RCT (randomised by dietary intervention)	US	Mean: intervention 67.6; control 69.3	N=49 older adults of which N=29 had amnestic mild cognitive impairment and N=20 were healthy controls **Setting:** Veterans Affairs Medical Center clinical research unit **Gender:** 53.1% female **Ethnicity:** Not reported **SES:** Mean educational level across groups: 13-15 years	**Intervention 1:** high–saturated fat/high–glycemic index diet (HIGH): (fat, 45% [saturated fat,_25%]; carbohydrates, 35%-40% [glycemic index,_70]; and protein, 15%-20%) **Intervention 2:** diet with a low– saturated fat/low–glycemic index diet (LOW) diet (fat, 25%; [saturated fat,_7%]; carbohydrates, 55%- 60% [glycemic index,_55]; and protein, 15%-20%) Both interventions were conducted in a group of participants with MCI and a group of healthy participants Note 1: all food was supplied by the research team and menus were designed by a research nutritionist Note 2: The difference between diets is not just in GI – it is also in fat and CHO content. Protein content was the same between diets. Energy content of diets was designed to maintain pre-study weights	**Follow-up:** 4 weeks intervention post-baseline **Lost to follow-up:** Not reported (appears to be 0%) **Outcome measurement:** Diet composition measured by self-reported 3-day food intake record	**Cognitive test outcomes** Delayed visual memory improved for both groups (healthy and aMCI) after completion of the LOW diet (p=0.04). In the HIGH group differences were not significant. No diet-related changes were observed for immediate memory, executive or motor speed domains **Biomarker outcomes (dementia-related)** CSF Aβ42: For the aMCI group, the LOW diet increased CSF Aβ42 concentrations (contrary to the pathologic pattern of lowered CSF Aβ42 typically observed in Alzheimer disease). Authors discuss a 'tipping point' process to explain the results. For healthy adults, the LOW diet decreased CSF Aβ42 whereas the HIGH diet increased CSF Aβ42 CSF apolipoprotein E (has a role in Aβ clearance) concentration was increased by the LOW diet and decreased by the HIGH diet for both groups F2-isoprostanes (quantitative bimarker of CNS free radical injury that are elevated in AD patients). Overall, the LOW diet reduced and the HIGH diet increased CSF F2-isoprostane concentrations. Both groups showed lowered F2-isoprostane concentrations with the LOW diet but only healthy adults showed increased concentrations with the HIGH diet (healthy control vs a MCI group change scores in the HIGH condition p=0.04) **Other dementia biomarkers** No differential effects were observed for CSF Aβ40, tau-protein or p-tau

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Martinez-Lapiscina 2013 J Nutr, Health, Aging Randomly selected subsample PREDIMED-NAVARRA study	RCT (conducted in a randomly selected sample from a cohort study)	Spain	55-80 Mean: MedDiet+EVOO: 67.2 (5.6); MedDiet+nuts: 67.3(6.0); 67.5 (5.7)	Older adults at high risk of cardiovascular disease (i.e. presence of type-2 diabetes,or at least 3 major risk factors such as hypertension, dyslipidemia, smoking and obesity) N=285 randomly selected of which N=271 agreed to participate **Setting:** Delivered in primary care but participants community-dwelling **Gender:** 44.8% male **Ethnicity:** Not reported **SES:** Mean years education: MedDiet+EVOO: 8.9 (2.0); MedDiet+nuts: 8.6 (2.8); 8.7 (3.3)	**Intervention 1:** MedDiet supplemented with extra virgin olive oil (EVOO) **Intervention 2:** Advice on Mediterranean diet and provision of mixed nuts **Control:** Advice on low-fat diet Participants in all groups received intensive education to increase adherence to their allocated intervention	**Follow-up:** 6.5 years intervention and follow-up **Lost to follow-up:** MedDiet+EVOO: 4.2% MedDiet+Nuts: 7.8% Low fat: 6.3% **Outcom measurement:** Global cognitive functioning using the Mini-Mental State Examination (MMSE) and a Spanish version of the Clock Drawing Test (CDT) Note: did not measure cognition at baseline (original trial was designed for CVD disease outcomes)	**Cognitive tests** After adjusting for multiple comparisons, there were no statistically significant differences between the groups ($p<0.05$) **MCI** Odds ratio for MCI was significantly lower in the MedDiet+EVOO group compared to control (0.34, 95% CI 0.12 to 0.97). OR for the MedDiet+Nuts compared to control was not significant **Dementia** Only 5 cases of dementia reported so difficult to make between group comparisons Note: Cognition not measured at baseline

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Martinez-Lapiscina 2013 J Neurol Neurosurg Psychiatry PREDIMED-NAVARRA study (different participants analysed)	RCT (randomisation done prior to agreement to participate)	Spain	55-80	As above N= 522 N=268 underwent comprehensive cognitive assessment to identify MCI or dementia	As above	**Follow-up:** 6.5 years intervention and follow-up **Lost to follow-up:** Not clear (randomisation done prior to agreement to participate) **Outcome measurement:** MMSE, clock drawing test (CDT). Incidence of dementia and MCI	**Cognitive tests** Mean MMSE and CDT scores were significantly higher for participants allocated to a MedDiet pattern supplemented with either EVOO or mixed nuts, compared with the control group MedDiet+EVOO vs control (adjusted) MMSE: +0.62 95% CI +0.18 to +1.05, p=0.005 CDT +0.33 (95% CI +0.003 to 0,67, p=0.048) MedDiet+Nuts vs control (adjusted) MMSE: +0.57 (95% CI 0.11 to 1.03), p=0.015 CDT: +0.33 (95% CI +0.003 to +0.67), p=0.048 Dementia incidence (cases from n=268) MedDiet+EVOO: 12 MedDiet+Nuts: 6 Low fat: 17 MCI incidence (cases from n=268 MedDiet+EVOO: 18 MedDiet+Nuts: 19 Low fat: 23

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Valls-Pedret 2015 JAMA Subcohort of the PREDIMED study Different sub-cohort of the above 2 studies which did include baseline cognitive test evaluation Much better study, reports full nutrient and energy intake analysis	RCT	Spain	55-80 Mean: MedDiet+EVOO: 67.9 (5.4); MedDiet+nuts: 66.7 (5.3); 65.5 (5.8)	Older adults at high risk of cardiovascular disease (i.e. presence of type-2 diabetes, or at least 3 major risk factors such as hypertension, dyslipidemia, smoking and obesity) N=447 randomised **Setting:** Delivered in primary care but participants community-dwelling **Gender:** 52.1% female **Ethnicity:** Not reported **SES:** Mean years education: MedDiet+EVOO: 6.8 (3.0); MedDiet+nuts: 7.6 (3.3); 7.1 (2.8)	**Intervention 1:** MedDiet supplemented with extra virgin olive oil (EVOO). Received quarterly education sessions and received supplemental foods at no cost **Intervention 2:** MedDiet supplemented with mixed nuts. Received quarterly education sessions and received supplemental foods at no cost **Control:** Advice to reduce dietary fat (personalised advice and group sessions at the same frequency as the MedDiet groups after 3 years but for the first 3 years just received a yearly visit and low fat advice leaflet)	**Follow-up:** 4.1 years (median) **Lost to follow-up:** MedDiet+EVOO:18.1% MedDiet+Nuts: 23.8% Control: 34.5% **Outcome measurement:** Validated FFQ collected during a face-to-face interview with a trained dietitian	In multivariate analyses adjusted for confounders, those in the MedDiet plus olive oil group scored significantly better on the RAVLT (p=0.049) and Color Trail Test part 2 (p=0.04), compared to control group No between-group differences for other cognitive tests were found (MMSE, Paired associates, verbal fluency, digit span forward, digit span backward, colour trail test part 1)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Diet Components							
Crews 2008	RCT (parallel design)	US	60+ Mean: intervention: 68.8 (8.6); control: 68.7 (8.0	Healthy, cognitively intact older adults (MMSE 24+) N=101 randomised Mean MMSE score at baseline: intervention: 28.5 (1.42); control 28.6 (1.4) **Gender:** 57.8% **Ethnicity:** NR **SES:** Mean years of education: intervention 15.5 (2.7); control 15.2 (2.8)	**Intervention:** Dark chocolate and cocoa (N=51). 37-g dark chocolate bar and 8 ounces (237 mL) of an artificially sweetened cocoa beverage **Control:** Placebo products (similar) (N=50)	**Follow-up:** 6 weeks **Lost to follow-up:** Intervention: 11.7%; control: 8.0% **Outcome measurement:** Selective Reminding Test Wechsler Memory Scale-III Wechsler Adult Intelligence Scale-III Digit symbol Trail Making Stroop Color-Word Test	**Cognitive tests** No significant group (dark chocolate and cocoa or placebo)-by-trial (baseline, midpoint, and end-of-treatment assessments) interactions were found **Other outcomes** Also no sig diff for other Haematological or blood pressure variables examined However, the midpoint and end-of-treatment mean pulse rate assessments in the dark chocolate and cocoa group were significantly higher than those at baseline and significantly higher than the midpoint and end-of treatment rates in the control group
Nadeem 2014	Data from 2 x RCTs combined (secondary analysis)	UK (Northern Ireland)	Trials recruited 40-65 and 65-85 years	Participants from the FAVRIT study were hypertensive (systolic blood pressure (BP) range 140–190 mmHg; diastolic BP range 90–110 mmHg), aged 40-65 In the ADIT (Ageing and Dietary Intervention Trial) older subjects (65–85 years)	**Intervention:** Both studies aimed to increase fruit and vegetable consumption In the FAVRIT (Fruit and Vegetable Randomised Intervention Trial) participants were randomised to receive a 1-, 3- or 6-portion F&V/d intervention for 8 weeks In the ADIT (Ageing and Dietary Intervention Trial older subjects (65–85 years) were randomised to receive a 2- or 5-portion F&V/d intervention for 16 weeks	**Follow-up:** 8 weeks (FAVRIT); 16 weeks (ADIT) **Lost to follow-up:** NR in this paper Outcome measurement: Determination of serum amyloid A concentrations. The concentrations of SAA in serum, HDL2 and HDL3 were determined using an ELISA procedure (KHA0011; Invitrogen Life Technologies	**Serum amyloid A (SAA)** Concentration of SAA in HDL3 decreased in the FAVRIT cohort (p=0·049) and those in HDL2 and HDL3 decreased in the ADIT cohort (P=0·035 and 0·032) **Other biomarkers** The concentrations of hsCRP, IL-6 and E-selectin were unaffected by increasing F&V intake in both studies (P.0·05 for all comparisons) The authors concluded that these results indicate that SAA responds to increased F&V intake, while other inflammatory markers remain unresponsive, and this leads to changes in HDL2 and HDL3, which may influence their antiatherogenic potential

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Drinks/juices delivering nutritional components which could be part of usual diet							
Bookheimer 2013	RCT	US	Mean: intervention: 63.1 (8.0); control 62.0 (7.8)	Non-demented, older right-handed subjects with self-reported age-related memory complaints. Mean MMSE in both groups at baseline: 28 (1.5). N=32 randomised **Gender:** Intervention: 73.3% female; control 76.9% female	**Intervention:** Pomegranate juice (N=15) and instruction in low polyphenol diet. (Restrict their intake of several fruits and vegetables, onions, tea, chocolate, and dried beans, for one week prior to the baseline visit andfor the duration for the study). **Control:** Placebo juice (N=13) and instruction in low polyphenol diet	**Follow-up:** 4 weeks **Lost to follow-up:**12.5% **Outcome measurement:** Buschke selective reminding test of verbal memory test; fMRI scans during cognitive tasks	After 4 weeks, only the pomegranate group showed a significant improvement in the Buschke selective reminding test of verbal memory (total items recalled and consistent longterm retrieval). Furthermore, compared to the placebo group, the pomegranate group had increased fMRI activity during verbal and visualmemory tasks; plasma metabolites of pomegranate juice biomarkers

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Desideri 2012 Cocoa, Cognition and Aging (CoCoA) Study (Funded by Mars)	RCT (parallel design)	Italy	High/ Int/Low: 71.2±4.9 65 – 80 71.3±4.5 65 - 82 71.0±4.5 64 – 81	Elderly people with MCI N=90 randomised **Setting:** Conducted via clinic but participants living in community. **Gender:** 52.2% **Ethnicity:** Not reported **SES:** Not reported	Cocoa flavonol consumption: a cocoa drink was consumed once daily for 8 weeks at 3 different levels: 990 mg (high flavanols), (N=30) 520 mg (intermediate flavanols), (N=30) 45 mg (low flavanols), (N=30) The dairy-based cocoa drinks used in this study were specially designed so that they were indistinguishable in taste and appearance, calorically balanced, and contained similar macronutrient, mineral, theobromine, and caffeine content, varying significantly only in the content of cocoa flavanols	**Follow-up:** 8 weeks **Lost to follow-up:** In low flavonols group, one person discontinued intervention; intermediate: 2 people discontinued; high: none discontinued. ITT analysis so all participants included **Outcome measurement:** Cognitive function was assessed by Mini Mental State Examination, Trail Making Test A and B, and verbal fluency test	**Cognitive tests:** **MMSE** At the end of the follow-up period, Mini Mental State Examination was similar in the 3 treatment groups (P=0.13) **Trail making test** The time required to complete Trail Making Test A and Trail Making Test B was significantly (P_0.05) lower in subjects assigned to high flavanols (38.10_10.94 and 104.10_28.73 seconds, respectively) and intermediate flavanols (40.20_11.35 and 115.97_28.35 seconds, respectively) in comparison with those assigned to low flavanols (52.60_17.97 and 139.23_43.02 seconds, respectively) **Verbal fluency test** Similarly, verbal fluency test score was significantly (P_0.05) better in subjects assigned to high flavanols in comparison with those assigned to low flavanols (27.50_6.75 versus 22.30_8.09 words per 60 seconds) **Other outcomes** Insulin resistance, blood pressure, and lipid peroxidation also decreased among subjects in the high-flavanol and intermediate-flavanol groups. Changes of insulin resistance explained _40% of composite z score variability through the study period

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Kean 2015	RCT	UK	67 yrs 60–81 y (mean 6 SD age: 66.7 6 5.3 y)	Healthy, older adults N=37	**Intervention** (N=37 crossover): Flavanol enriched orange juice (100% orange juice). High-flavanone (305 mg) 100% orange juice **Control** (N=37 crossover): An equicaloric low-flavanone (37 mg) orange-flavored cordial (500 mL) (Flavonone was naturally occurring in the drink)	**Follow-up:** 8 weeks **Lost to follow-up:** 2.7% (1 person from low flavonone arm) **Outcome measurement:** 8 weeks	Global cognitive function was significantly better after 8-wk consumption of flavanone-rich juice than after 8-wk consumption of the low-flavanone control. No significant effects on mood or blood pressure were observed
Krikorian 2010	Non-ran-domised controlled study (non-simul-taneous control)	US	Mean 76.2 (± 5.2)	Older adults with early memory changes N=9 randomised. **Gender:** 55.6% male. **Ethnicity:** NR **SES:** Mean (± SD) educational level was 15.6 (± 1.5) years	**Intervention N=9:** Wild blueberry juice **Control N=7:** Non-blueberry matched juice	**Follow-up:** 12 weeks intervention and follow-up **Lost to follow-up:** **Outcome measurement:**	Significantly improved paired associate learning (V-PAL) performance, $F(1,13) = 5.58$, $p = 0.03$, although improved recall on the CVLT for the blueberry juice subjects did not achieve statistical significance, $F(1,13) = 2.27$, $p = 0.12$

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Krikorian 2010 Br J Nutr	RCT	US	Mean: 78.2 (SD 5)	Older adults with memory decline but not dementia N=12 randomised (very small trial) **Gender:** 66.7% male **Ethnicity:** NR **SES:** Mean years education: 14·1 (2·9)	**Intervention N=5:** 100% Concord grape juice with daily consumption between 6 and 9 ml/kg **Control N=9:** Placebo beverage that contained no juice or natural polyphenol but was formulated to look and taste like grape juice and to have the same carbohydrate and energy composition	**Follow-up:** 12 weeks intervention and follow-up **Lost to follow-up:** None reported **Outcome measurement:** California Verbal Learning Test was administered to assess verbal learning and retention, and the Spatial Paired Associate Learning Test was used to evaluate non-verbal memory. Mood also measured as a potential covariate	**Item acquisition across learning trials:** (California Verbal Learning test) for subjects in the Concord grape juice group compared to those receiving placebo ($F(1, 8)=5{\cdot}55$; $P=0{\cdot}04$; Cohen'sf $=0{\cdot}28$) **Delayed verbal recall and spatial memory:** No statistically significant differences between grape juice subjects and control for delayed verbal recall ($P=0{\cdot}10$; Cohen's $f = 0{\cdot}33$) and spatial memory ($P=0{\cdot}12$; Cohen's $f=0{\cdot}67$) **Adverse effects:** Greater frequency of urination and aversion to the taste of juice or placebo that developed over time reported (no. of participants affected not reported)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Mastroiaco-vo 2015 Cocoa, Cognition and Aging (CoCoA) Study (Funded by Mars)	RCT	Italy		Elderly individuals without clinical evidence of cognitive dysfunction N=90 randomised **Setting:** Conducted via clinic but participants living in community **Gender:** 58.9% female **Ethnicity:** Not reported **SES:** Not reported	Cocoa flavonol consumption: a cocoa drink was consumed daily for 8 wk: Containing 993 mg [high flavanol (HF)] (N=30) 520 mg [intermediate flavanol (IF)] (N=30) 48 mg [low flavanol (LF)] (N=30)	**Follow-up:** 8 weeks L**ost to follow-up:** In low flavonols group, two people discontinued intervention; intermediate: 1 person discontinued; high: one person discontinued. ITT analysis so all participants included **Outcome measurement**: Cognitive function was assessed at baseline and after 8 wk by using the Mini-Mental State Examination (MMSE), the Trail Making Test (TMT) A and B, and the Verbal Fluency Test (VFT)	**MMSE** The changes were not different **Trail making test (TMT)** Mean changes (6SEs) in the time required to complete the TMT A and B after consumption of the HF (28.6 6 0.4 and 216.5 6 0.8 s, respectively) and IF (26.7 6 0.5 and 214.2 6 0.5 s, respectively) drinks significantly (P , 0.0001) differed from that after consumption of the LF drinks (20.8 6 1.6 and 21.1 6 0.7 s, respectively) **Verbal fluency test (VFT)** Similarly, VFT scores significantly improved among all treatment groups, but the magnitude of improvement in the VFT score was significantly (P ,0.0001) greater in the HF group (7.7 6 1.1 words/60 s) than in the IF (3.6 6 1.2 words/60 s) and LF (1.3 6 0.5 words/60 s) groups **Other outcomes** Significantly different improvements in insulin resistance (P , 0.0001), blood pressure (P , 0.0001), and lipid peroxidation (P = 0.001) were also observed for the HF and IF groups in comparison with the LF group. Changes in insulin resistance explained w17% of changes in composite z score (partial r2 = 0.1703, P , 0.0001)

Study	Study design	Country	Age (years)	Population	Intervention and comparator	Relevant outcomes and follow-up	Results
Ongoing trials – published protocols and registered clinical trials							
Feasibility and Efficacy of Dietary Interventions for Cognitive Impairment in Older Adults	RCT	US		Older adults with mild cognitive impairment (MCI) or early Alzheimer's disease (AD) living in the community Also to determine the role of apolipoprotein E (ApoE) genotype in participants' response to the MAD	Intervention: Ketogenic, modified Atkins diet (MAD). Control: Non-ketogenic control diet based on the National Institute on Aging's recommendations for senior nutrition.	Follow-up: 12 week trial Outcomes: Achieving a Healthy Eating Index (>=85) at 3 consecutive follow-up visits Efficacy for Cognition Composite Memory Score (mean z-score on delayed recall of HVLT-R and BVMT-R) Efficacy for Function Change in MDS-HC Instrumental Activities of Daily Living Score	Ongoing
Hawaii Dementia Prevention Trial (HADEPT)	RCT	US	65+	Older adults with MCI	Nutrition intervention to prevent cognitive decline	Nutrition intervention to prevent cognitive decline	Ongoing? – no further details found
Knight 2015. BMC Geriatrics MedLey study	RCT	Australia	65+	Healthy, older adults with normal cognitive function and proficient in English language N=166 randomised	**Intervention:** Mediterranean diet. Cretan MedDiet (i.e. vegetables, fruits, olive oil, legumes, fish, whole grain cereals, nuts and seeds and low consumption of processed foods, dairy products, red meat and vegetable oils) **Control:** Usual lifestyle and diet	**Follow-up:** 6 months intervention Outcomes: Cognitive function, psychological wellbeing	PROTOCOL ONLY – Results not yet published

Table 28: Diet – Included qualitative studies about barriers and facilitators

Study	Study design	Country	Age (years)	Population	Objective	Quality
Qualitative studies in older adults						
Drummond 2006	Qualitative (semi-structured interviews and focus groups)	Australia	Not reported	**N=50** Older community-dwelling World War II and Vietnam male war veterans living in both urban and rural areas **Gender:** 100% male **SES:** Not reported **Ethnicity:** Not reported	Ageing men's understanding of nutrition and implications for health	
McKie 2000	Individual semi-structured interviews and 24 hour dietary recall	UK (Scotland)	75+ (47% aged 75-79)	**N=152** Random sample of older adults from patient lists of GPs in 3 areas from rural and urban areas. 49% were widowed, 54% lived in lone households **Gender:** 68% female **SES:** 49% reported income below social security benefit rate (1997) **Ethnicity:** Not reported	To examine food consumption patterns and perceptions of dietary advice of older adults	
Pettigrew 2012	Individual interviews (N=20) and focus groups (N=12)	Australia	40+ but stratified by age group	**N=111** Mid-life and older adults in both metropolitan and regional areas **Gender:** Male and female included (ratio not reported) **SES:** Not reported **Ethnicity:** Not reported	To explore the diet-related beliefs and behaviours of midlife and older adults to inform future healthy eating interventions targeting this group	

Study	Study design	Country	Age (years)	Population	Objective	Quality
Qualitative studies conducted in participants of dietary interventions in older adults						
Hammarstrom 2014	Thematic structured interviews	Sweden	Mean 60, range 49 to 71 (for the total intervention group)	**N=12** Middle-aged and older women participating in dietary weight loss interventions (from both intervention groups including drop outs from the dietary interventions) **Gender:**100% female **SES:** Not reported other than overall 'quite highly educated' **Ethnicity:** Not reported other than 'all Swedish born'	To explore barriers and facilitators to weight loss in older adults participating in a diet intervention	
Hyland 2007 Peer Led Food Club Study	Individual semi-structured interviews and group discussions	UK (England)	Mean age for intervention participants was 76, range 71-86. Peer educators 60+, though age not reported other than 'slightly younger'	**N=20** **Gender:**18.2 % male **SES:** 'varied in background' **Ethnicity:** Not reported	Peer educators' perceptions of training and implementing a community-based nutrition intervention for older adults	
Moynihan 2006, 2007 Peer-led food club study	Focus groups and semi-structured in-depth interviews and questionnaire for dietary behaviour	UK (England)	Mean 76 (range 71-80)	**N=97** Community living older adults completed interviews **N=160** Completed dietary behaviour questionnaire **Gender:** 14% male **SES:** Not reported **Ethnicity:** Not reported	Attitudes towards eating more healthily and perceived barriers to healthy eating, attitudes towards participation in peer-led food club	

Study	Study design	Country	Age (years)	Population	Objective	Quality
Penn 2008 PA, diet	Individual semi-structured interviews	UK (England)	Mean age 64 (range 47 to 74)	**N=15** Participants in the European Diabetes Prevention Study (EDIPS) who maintained behaviour change over 3-5 years. **Gender:** 53.3% male **SES:** 5 (33.3%) were or previously employed in professional or related occupations; 1 (6.7%) administrative; 2 (13.4%) skilled trade; 6 (40%) process operatives or elementary occupations **Ethnicity:** Not reported	To understand the experience of those participants who maintained behaviour change in the European Diabetes Prevention Study, an RCT of diet and exercise interventions in people with impaired glucose tolerance	
Sandison 2008 Note: The primary RCT is not referenced so not clear which primary trial this is a sub-study of	Qualitative – questionnaire using open and some closed questions	UK (Scotland)	56-65, mean age 61	**N=61** Older women who were participants in the dietary arm of an RCT to increase fruit and vegetable intake. **Gender:** 100% female **SES:** Not reported **Ethnicity:** Not reported	To investigate the experiences of women who increased fruit and veg consumption as part of an RCT aiming to increase fruit and veg consumption for bone health	

Table 29: Diet – Quality assessment for interventions reporting on uptake/maintenance of healthy diet

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Over-all*	B1	B2	B3	*Over-all*	C1	C2	C3	*Over-all*	D1	D2	D3	D4	D5	*Over-all*	
RCTs																			
Appleton 2013	No	No	No	*High*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Un-clear	Yes	Un-clear	No	No	*Un-clear*	**High**
Atienza 2008	Yes	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Un-clear	Yes	Un-clear	No	Un-clear	*Un-clear*	**Unclear**
Babatunde 2011	Un-clear	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Un-clear	Yes	Un-clear	No	Un-clear	*Un-clear*	**Unclear**
Barr 2000	Un-clear	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Un-clear	Yes	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Bernstein 2002	Un-clear	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Un-clear	Yes	Yes	*Un-clear*	**Unclear**
Carcaise-Edinboro 2008	Un-clear	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Francis 2009	Un-clear	Un-clear	Un-clear	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Un-clear	Yes	Yes	*Un-clear*	**Unclear**
Greene 2008	Un-clear	Un-clear	Un-clear (by group)	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Kristal 2000	Yes	Un-clear	Un-clear (by group)	*Un-clear*	Un-clear	Un-clear	Un-clear	*Un-clear*	Un-clear	Un-clear (by group)	Un-clear (by group)	*Un-clear*	Yes	Yes	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Lara 2015	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	*Low*	Yes (brief int)	Yes	Un-clear	Un-clear	Un-clear	*Un-clear*	**Low**
Moynihan 2006	Yes	Un-clear (by clus-ter)	Yes	*Low*	Yes	No	No	*Un-clear*	Un-clear	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Un-clear	Yes	Yes	*Un-clear*	**Unclear**
Patterson 2004	Un-clear	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Over-all*	B1	B2	B3	*Over-all*	C1	C2	C3	*Over-all*	D1	D2	D3	D4	D5	*Over-all*	
Rousset 2006	Un-clear	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	No	No	*Un-clear*	Yes	Yes	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Taylor-Davis 2000	Un-clear	Un-clear	Yes	*Un-clear*	Yes	No	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Un-clear	No	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Non-randomised studies																			
Hermann 2000	N/A	N/A	N/A	*High*	N/A	N/A	N/A	*High*	N/A	N/A	N/A	*High*	Un-clear	Yes	Un-clear	No	N/A	*Un-clear*	**High**
Keller 2006	N/A	N/A	N/A	*High*	N/A	N/A	N/A	*High*	N/A	N/A	N/A	*High*	Yes	No	No	No	N/A	*Un-clear*	**High**

Table 30: Diet – Quality assessment for interventions reporting on diet with cognitive outcomes

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Overall*	B1	B2	B3	*Overall*	C1	C2	C3	*Overall*	D1	D2	D3	D4	D5	*Overall*	
Bayer-Carter 2011	Unclear	Unclear	Unclear	*Unclear*	Yes	Yes	Unclear	*Low*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Bookheimer 2013	Unclear	Unclear	No	*Unclear*	Yes	Yes	Unclear	*Low*	Yes	Unclear	Unclear	*Unclear*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Crews 2008	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	*Low*	Yes	Yes	Unclear	*Low*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Low**
Desideri 2012	Yes	Yes	Yes	*Low*	Yes	Yes	Unclear	*Low*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Low**
Kean 2015	Yes	Yes	Unclear (shown for cognition but not demog etc.)	*Low*	Yes	Yes	Yes	*Low*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Low**
Martinez-Lapiscina 2013 J Nutr, Health, Aging	Unclear (randonly selected from an RCT but method for 2nd nr)	Yes	Unclear (cognition not measured at baseline)	*Unclear*	Yes	No	Yes	*Unclear*	Yes	Unclear (only those who participated analysed)	Unclear	*Unclear*	Yes	Yes	Yes	Yes	Yes	*Low*	**Unclear**

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Overall*	B1	B2	B3	*Overall*	C1	C2	C3	*Overall*	D1	D2	D3	D4	D5	*Overall*	
Martinez-Lapiscina 2013 J Neurol Neurosurg Psychiatry	Unclear (randonly selected from an RCT but method for 2nd nr)	Yes	Unclear (cognition not measured at baseline)	*Unclear*	Yes	No	No	*Unclear*	Yes	Unclear (only those who participated analysed)	Unclear	*Unclear*	Yes	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Mastroiacovo 2015	Yes	Yes	Yes	*Low*	Yes	Yes	Unclear	*Low*	Yes	Yes	Yes	*Low*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Low**
Nadeem 2014	Yes	Unclear	Yes	*Unclear/ Low*	Yes	No	No	*Unclear*	Yes	No	Unclear	*Low*	Unclear	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Valls-Pedret 2015 JAMA	Yes	Unclear	Yes (small diffs in age and lipid values but unlikely to favour results)	*Unclear/ Low*	No	No	No	*High*	Yes (?) – slight differences in FU time	No	Unclear	*Unclear*	Yes	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Non-randomised studies																			
Krikorian 2010	N/A	N/A	Unclear	*High*	Yes	Yes	Unclear	*Low*	Yes	Unclear	Unclear	*Unclear*	Unclear	No	Unclear	Unclear	Unclear	*Unclear*	**High**

Table 31: Diet – Quality assessment for interventions reporting barriers and facilitators

	1. Theoretical approach		2. Study design	3. Data collection	4. Validity		5. Analysis				6. Ethics		Overall
	1.1	1.2	2.1	3.1	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	
Drummond 2006	Appropriate	Clear	Not sure	Appropriate	Un-clear	Not sure	Not sure	Not re-ported	Not sure	Adequate	Not re-ported	Not re-ported	-
Hammarstrom 2014	Appropriate	Clear	Defensible	Appropriate	Clear	Not sure	Rich	Relia-ble	Convincing	Adequate	Yes	Clear	++
Hyland 2007	Appropriate	Clear	Defensible	Appropriate	Clear	Relia-ble	Rich	Not sure	Convincing	Adequate	Yes	Clear	++
McKie 2000	Appropriate	Clear	Defensible	Appropriate	Clear	Not sure	Rich	Not re-ported	Convincing	Adequate	Not re-ported	Not re-ported	+
Moynihan 2006/2007	Appropriate	Clear	Defensible	Appropriate	Clear	Relia-ble	Rich	Not sure	Convincing	Adequate	Yes	Clear	++
Penn 2008	Appropriate	Clear	Defensible	Appropriate	Clear	Relia-ble	Rich	Not sure	Convincing	Adequate	Yes	Clear	++
Pettigrew 2012	Appropriate	Clear	Defensible	Appropriate	Clear	Relia-ble	Not sure	Relia-ble	Convincing	Adequate	Yes	Clear	++
Sandison 2008	Appropriate	Clear	Defensible	Not sure	Un-clear	Not sure	Not sure	Not re-ported	Convincing	Adequate	Yes	Not clear	+

Table 32: Physical Activity – Interventions to improve uptake/maintenance of physical activity

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Asikainen 2004	28 RCTs in total; RCTs with sufficient quality more than 25 participants and less than 35% of drop outs	NR	50-65	Postmenopausal women aged 50 to 65 years; 2632 women in total. Healthy, sedentary or had some leisure PA at entry into study; **Special Population:** Women with diseases or risk factors such as dyslipidaemia, hypertension, obesity or osteoporosis	Nine studies used walking; four studies used combined aerobic exercise (walking + flexibility + one of cycling, swimming, dance); Nine studies used combined resistance training and aerobics; two studies used resistance training with weight machines. Five other studies used other resistance training of five to nine exercises	Not reported	**PA uptake and Maintenance:** Mean drop out, mean attendance. **Other Physiological and QoL measures relevant to PA uptake (Short term):** Health-related fitness (bodyweight; proportion of body fat of total bodyweight (F%); bone mineral density (BMD); bone mineral content (BMC); various tests on muscle performance, flexibility, balance and coordination; maxi- mal oxygen consumption (VO2max); resting blood pressure (BP); total cholesterol (TC); high-density lipoprotein-cholesterol; low-density lipoprotein-cholesterol; triglycerides; blood glucose and insulin). **Adverse Outcome:** Injury Rates	**PA uptake / Maintenance / AE:** Walking (mean drop out was 13%, mean attendance in four studies was 84%. Mean injury rate reported in six studies was 3%). **Combined Aerobics** (Mean dropout rate was 12%; Attendance rate reported in one study was 77% in home based exercise and 53% in group based exercise; Incidence of injury in this study varied from 23% (high intensity exercise and 13% for low intensity exercise). **Combined aerobics and resistance training** (Mean dropout rate was 15% and mean attendance was 67%. Mean attendance was higher in exercise groups with more aerobic component compared with resistance training; Mean injury rate was 6%). **Resistance training with weights** (mean dropout rate was 16% and mean attendance was 90%; Injury rate was 33%). **High impact resistance training** (mean attendance rate was 68%, injury rate: 8%). **One single resistance, back extensor or jumping exercise** (mean attendance: 91%, injury rate: 2-3%

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Clegg 2012	6 RCTs in total	Interna-tional (3 in Western Europe, 2 in USA and 1 in New Zealand)	The medi-an age was 83 years (range 78-88)	Frail older adults; 987 participants. The majority of participants were female (median 79% female, range 50–88%). Three of the trials recruited less than 100 subjects; only two recruited more than 200 subjects. **Special Population:** Frail OAP; limited mobility requiring the use of a walking aid; sedentary; in receipt of home care and housebound but able to get out of chair and bed	Home based exercise. One intervention included a single component of progressive resistance exercise. Two combined progressive resistance exercises with one or more additional components of flexibility, balance, walking or range of motion exercises. Two interventions were complex interventions combining multiple exercise components with an occupational intervention. One study used an electronic device that counted the number of sit-to-standsstands	NR	**PA uptake and Maintenance:** Completion and adherence rates **Other Physiological and QoL measures relevant to PA uptake (Short term):** Measures of mobility (TUG), HRQoL (EQ-5D) and ADL (Barthel Index), muscle strength, balance, depression, bone strength	**PA uptake and Maintenance:** Median completion rate reported in six studies was 83% (65%-88%). Median adherence rate reported in three studies was 78% (66%-89%). **Other Physiological and QoL measures relevant to PA uptake (Short term):** One high-quality trial reported improved disability in those with moderate but not severe frailty. Meta-analysis of long-term care admission rates identified a trend towards reduced risk (pooled risk ratio, 0.89; 95% confidence interval, 0.55–1.45). Improved gait speed was reported in one trial, a trend towards improved gait speed was reported in one further trial, and gait speed did not improve in two. Improvements in ADL were reported in one trial; no improvements in ADL were reported in the other three trials. Three trials measured muscle strength using upper and lower body strength or grip strength. One trial reported improved lower body strength. There was no improvement in either upper or lower body strength in one trial. No improvement in grip strength was recorded in the study that measured this outcome. No improvement in general physical performance was reported in one trial. Improved balance was reported in one trial but there was no effect on balance in three trials. There was no effect on depression, bone density or flexibility

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Chase 2013	20 RCTs	Interna-tional	Study age ranges were from 66.30 to 81.70 years	Community-dwelling adult subjects aged 60 years or older. 3148. Sample size ranged from 33 to 966. Two studies had 100% female participants; one study had no female participants. Three studies did not report gender. In other studies female participants made up between 16.0% and 72.0% of the sample	Five studies employed behavioural interventions only; twelve studies combined cognitive and behavioural interventions	Controls or usual care control groups	**PA uptake and Maintenance:** PASE, pedometer and accelerometer, modified 7-day activity interview, activity diary, leisure-time PA questionnaire expressed in energy expenditure units, 7-day PA recall instrument, Baecke PA scale, Yale PA survey, Auckland Heart Study PA questionnaire, Modified CHAMPS, Flemish PA computerised questionnaire	**PA uptake and Maintenance:** Two cognitive-based interventions using Motivational Interviewing strategies demonstrated success in significantly improving PA behaviour among participants. All studies using 'supervised exercise sessions alone' demonstrated non-significant findings in differences in PA behaviour between treatment and control groups at outcome. Inconsistent success in increasing PA behaviour was observed among studies combining Cognitive-Behavioural Interventions; however most studies using combination cognitive-behavioural interventions reported successful long-term findings. One cognitive-behavioural–based intervention demonstrated long-term PA behaviour change results, with evidence of continued higher levels of PA from baseline up to 2 years beyond the end of a study. There were no significant changes in PA outcomes from post-test to follow-up period in three studies (Kelly, 2004, Talbot, 2003, Bird, 2011)

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Con 2003a	43 primary studies	NR	Mean participant ages in the primary studies ranged from 60 to 77.2 years	Community-dwelling individuals 60 years or older. 33,000 aging adults	Unspecified in paper	NR	**PA uptake and Maintenance:** Overall PA and episodic exercise behaviour	**PA uptake and Maintenance:** Interventions targeted to PA exclusively are more effective than those targeting multiple behaviours. Studies without health education were more effective than those reporting that they taught health benefits. MA findings strongly support the importance of some self-monitoring system to increase adults' PA. Meta-analysis revealed that the intensity of the intervention, in terms of contact time between the activity professionals and elders, is important. Intense direct contact with staff more than doubled the effect size of the interventions. In contrast, mailed or telephone interventions made no difference in outcomes. Although staff contact time is expensive, the profound effect on elders' physical activity behaviours makes this an important aspect of programming. Elders who exercised at centres as compared to home based activity, were much likely to continue PA. The most effective part of an activity prescription is making specific intensity recommendations. OAP were more likely to increase their PA when recommendation was for moderate intensity activity than when low intensity activity was suggested. Interventions delivered to groups were considerably more effective than that delivered to individuals. Interventions that recommend walking are probably more effective than programme without a walking suggestion. Walking is easily accessible and may be perceived as 'natural

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Con 2003b	17 RCTs	NR	Mean subject age of 65 and older	6,391 subjects	Walking. Also 6/17 studies looked at overall PA	NR	**PA uptake and Maintenance:** Overall PA and episodic exercise behaviour (<= 6 months post-test). Exercise maintenance (> 6 months post-test)	**PA uptake and Maintenance:** 7/10 studies with theory based intervention reported positive findings. 5/7 studies which used social cognitive framework reported positive results. 2/3 studies that used TTM reported positive outcomes. 4/5 that used combined models reported significant treatment effects. 3/5 studies with supervised centre based exercise reported positive treatment effect. 7/12 studies without supervised exercise reported greater exercise in treatment group than in the control group. Further, 4/6 studies with individualised interventions reported greater exercise in the treatment groups than the control groups. Interventions delivered to individuals were about equally likely to result in positive (6/11) and negative findings (5/11). Non-PA intervention used included motivational strategies and behavioural change techniques such as social support, stimulus control, self-regulation, health education etc. Self-monitoring and health education were most commonly used in studies. Mixed results on the association between these BCTs and PA uptake. 3/5 studies that delivered interventions in subjects' homes reported positive results. Each of the four studies that delivered interventions in aggregate community sites such as senior centres or churches reported more exercise by experimental subjects than control **Maintenance:** 5/17 studies with >=6 months follow-up reported significance maintenance of PA after end of intervention

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Cyarto 2004	8 intervention (5 RCTs, 2 quasi-experiments, 1 pre-post)	International (4 USA, 1 Australia, 2 UK, 1 Belgium)	The age of participants ranged from 40 to over 90 years, with approximately even representation of the 'young' old (mean age 50-60) the 'mid old' (mean age 60-70), and the 'older old' (mean age over 70)	Participants aged 60+. Sample sizes ranged from small studies with only 17 and 20 participants, to one with 719. Most studies had between 75 and 300 participants	Progressive Resistance Training (Walking, strength training, flexibility, balance and co-ordination)	NR	**PA uptake and Maintenance:** Questionnaires measuring PA, exercise logs. **Other Physiological and QoL measures relevant to PA uptake (Short term):** Accelerometers, heart rate monitors, measurement of CV-risk factors and direct observation of participants	**PA uptake and Maintenance:** All the general practice interventions produced some positive impact on PA levels. Study that used community mass media communication reported 23% increase in walking and proportion of those achieving 30 minutes of activity a day. Most of the studies reported positive results. **Maintenance:** CHAMPS II study reported maintenance of FU after 12 months. A notable feature of this study was the long-term involvement of the local community in the project through a local advisory committee
de Vries 2012	3/18 RCTs relevant to PA uptake & maintenance	NR	The age of the study population varied from 60 to 85 years	Community-dwelling older adults with impaired mobility, physical disability and/or multi-morbidity. **Special Population:** Frail and with mobility problems	Physical exercise therapy (Strength training, balance training, functional and task-related training, endurance and mobility training	No exercise, low-intensity exercise	**PA uptake and Maintenance:** PASE, self-reported PA, YPAS, FAI, number of walks. **Other Physiological and QoL measures relevant to PA uptake (Short term):** WS timed chair stands, SF-36, IADL, TUG, 6MWT, 400MWT	**PA uptake and Maintenance:** Three studies evaluated their intervention on the level of physical activity. Two of these studies were pooled in a meta-analyses, which showed no exercise on PA level (SMD: 0.08, 95% CI: -0.21, 0.31, I2: 0%) None of these studies found a significant effect. However, results show that physical exercise therapy has a positive effect on mobility

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Fairhall 2011	15 RCTs	Interna-tional	Aged 60+	3,616 participants	Exercise interventions that aimed to reduce falls in older adults (strength, balance, Tai Chi)	The effects of the intervention were compared with placebo, alternate therapy or usual care	**PA uptake and Maintenance:** Participation in life role measured by Scales with ICF components such as Adelaide Activity Profile, PASE, Older American's Resources and Services, Nottingham Extended ADL Index, Lawton's IADL Scale, Late Life Function and Disability Index, The Groningen Activity Restriction Scale, Frenchay Activities Index, Falls Handicap Inventory	**PA uptake and Maintenance:** The pooled estimate of the effect of interventions including exercise indicated a small improvement in participation (Hedges' g = 0.16, 95% confidence interval = 0.04–0.27, P = 0.006). Meta-regression showed multifactorial intervention with an exercise component had a larger effect than exercise intervention alone, but the difference was not statistically significant (effect on Hedges' g = 0.22, 95% CI = −0.05 to 0.50, P = 0.10)
French 2014	16/25 relevant intervention stud-ies (1 feasibility, 1 pre-post, 1 cluster RCT, 13 RCTs)	NR	The overall mean age of partici-pants was 69 years (study means ranged from 60 to 84 years)	Community-dwelling adults 60 years or over. The mean number of participants in the comparisons included in the self-efficacy analysis was 247 (range 5 to 1,011); the mean number included in the physical activity analysis was 349	Lifestyle PA (gardening, walking); Exercise (Aerobic class, gym, jogging), others	NR	**PA Uptake and Maintenance:** Change in Physical Activity measured in 'd' Cohen ES	**PA Uptake and Maintenance:** (Pooled ES) BCT Interventions had a small effect on PA (d=0.14, 95% CI 0.09, 0.2, p<0.001). Effect size ranged from d= -0.02 to 0.63. (Individual results) 3 BCTs were significantly associated with higher PA behaviour: 'barrier identification / problem solving', 'provide rewards contingent on successful behaviour', 'model / demonstrate behaviour'. 10 BCTs were associated with lower PA behaviour. The greatest difference in effect size occurred when the following BCTs were present: 'provide normative information about others' behaviour', 'provide information on where and when to perform behaviour' and 'plan social support / social change'

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Geraedts 2013	9/24 relevant studies (8 RCTs & 1 pre-post)	Interna-tional	55+	5,328 participants aged 55+	Remote feedback on home-based PA (Phone, Text)	Exercise or Non-Exercise	**PA Uptake and Maintenance:** Walking speed, strength, balance, peak VO2, 7- day PA recall, accelerometer, 6 MWT, TUG, adherence rate, compliance rate	**PA Uptake and Maintenance:** Results show that PA programs with frequent and non-frequent remote feedbacks are equally as effective in enhancing physical capacity measures as supervised exercise without remote feedback. **Maintenance:** Adherence to interventions using remote feedback was higher in the control groups in studies where intervention groups were compared to TAU. Adherence to interventions using remote feedback seems mostly acceptable-to-good, with rates in intervention groups varying between 32.1 and 91%.One study compared text messaging to a phone strategy and found that texting led to a significantly higher adherence than phone
Hobbs 2013	21 intervention studies (3 cluster RCTs, 2 pre-post and 16 RCTs)	Interna-tional (USA, Europe, NZ, Japan, Australia, Canada)	The mean age of participants was 60.7 years (SD = 4.4; range 55 to 67.6)	10,519 at risk adults aged 55 to 70 years. 'At risk' participants were reported as having at least one of the following disease risk factors: hypertension, impaired glucose tolerance, overweight/ obese, hyperlipidaemia, dyslipidaemia, family history, metabolic syndrome or osteopenia	The majority of interventions were multimodal and provided physical activity and lifestyle counselling	Received usual care; exercise alterative; some studies included information leaflet and newsletters	**PA Uptake and Maintenance:** Five trials used pedometers deriving step-count and one trial used an accelerometer deriving vector magnitude. Twenty trials estimated PA duration by self-report questionnaires reported as minutes of PA or energy expenditure. Four trials assessed PA using both objective and self-report methods	**PA Uptake and Maintenance:** Interventions to promote physical activity were effective at 12 months (standardized mean difference (SMD) = 1.08, 95% confidence interval (CI) = 0.16 to 1.99, pedometer step-count, approximating to an increase of 2,197 steps per day; SMD = 0.19, 95% CI = 0.10 to 0.28, self-reported physical activity duration outcome), but not at 24 months based on a small subset of trials. Further analysis by O'Brien (2015) shows that increasing the number of BCTs in PA promoting intervention does not enhance long term effectiveness. Interventions aiming to promote PA should consider using BCT feedback in order to enhance effects

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Muller 2014	16 interven-tion-studies (2 cluster RCTs, 2 quasi-experiments, 1 non-randomised CT & 11 RCTs)	Interna-tional (USA, Neth-erland, Aus-tralia, New Zealand	50+	Healthy, community-dwelling older adults (≥ 50 years)	Non-face to face PA	NR	**PA Uptake and Maintenance:** Self-reported questionnaires / instruments, accelerometer, weekly time spent in PA, weekly energy expenditure	**PA Uptake and Maintenance:** Of the 16 studies, 14 reported significant improvements in PA over the respective study periods (1 week to 24 months). Only one reported a non-significant decrease of PA in terms of daily calorie expenditure and time spent in moderate or greater PA over the previous week. **Maintenance:** PA levels were maintained after the intervention stimulus was removed in all but one study
Neidrick 2012	8/11 relevant RCTs	Interna-tional (USA, Australia, Canada, Europe, England)	50+	NR	Standardized intervention to promote PA	NR	**PA Uptake and Maintenance:** Self-reported questionnaires / instruments, PASE, Physical Activity Recall (PAR), Active Australia Physical Activity Questionnaire, Dutch Short Questionnaire to Assess Health Enhancing Physical Activity (SQUASH), Pedometer	**PA Uptake and Maintenance:** 7/10 studies found that PA promotion intervention was effective in increasing PA. 1/10 found that generalised health behaviour modification without PA component was not effective. 1/10 studies found that supplementing verbal advice with written advice did not show a significant effect on PA uptake. **Maintenance:** Limited evidence to show effect on long term adherence

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Nigg 2012	14/18 relevant RCTs	NR	55+	NR	Single Health Behaviour Change Interventions (SHBC) and Multiple Health Behaviour Change Interventions (MHBC)	NR	**PA Uptake and Maintenance:** Self-reported questionnaires / instruments, accelerometer, weekly time spent in PA, weekly energy expenditure	**PA Uptake and Maintenance:** Of the 12 SHBC studies evaluating PA or exercise, participants generally improved their level of activity at FU (6-12 months). MHBC showed mixed results; one study found that the combination of PA and fruit and vegetable consumption improved only nutritional outcomes but not PA behaviour at FU. The other showed improvement in both PA and weight loss behaviour
Stevens 2014	6 RCTs (5 RCTs & 1 Cluster RCT)	International (USA, NZ, Australia, Canada, UK)	Five of the studies reported the mean age of participants, which ranged from 65 to 74; four recruited a greater number of females	Adults aged 50 and above	Tailored PA (aerobic, strength and balance exercises)	NR	**PA Uptake and Maintenance:** PASE; time to reach target of >= 90 mins / week of MVPA; Auckland Heart Study Exercise Questionnaire; frequency and duration of walking and vigorous exercise	**PA Uptake and Maintenance:** 2/6 studies reported a statistically significant increase in physical activity levels. Two studies showed no significant increase in activity

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/ measures	Findings
Van der Bij 2002	2/6 studies reported a statistically significant increase in physical activity levels. Two studies showed no significant increase in activity	International (USA, Europe)	Mean age ranging from 51-88 years	Community-dwelling, healthy and inactive older adults. Large majority were white, well-educated and had moderate to high incomes	Home based PA, Group based PA and Educational PA	NR	**PA Uptake and Maintenance:** Participation rates	**PA Uptake and Maintenance:** Home based PA (Participation rate 86%-93%). Participation in longer term interventions was lower than in short-term Rx. 2 studies reported a decline in PA level after end of intervention. Group based PA (Mean participation in short term duration Rx (< 1 year) = 84%, 55-100%). Interventions in nursing or residential homes achieved high participation rates (mean= 87%). Participation rate in Rx > 1 year ranged between 63-84% mean=75%). All studies reported higher PA levels than baseline and that PA levels in intervention groups were significantly higher than control. 1/3 studies achieved higher PA level at 10 year follow-up. Education PA (35%-96%). Participation rate declined with increase in intervention sessions. All educational interventions showed significant increase in PA compared to control in short term (< 1 year). Overall high participation rates are achievable with short term PA interventions (< 1 year) but not found for long-term intervention. Possible explanation for inverse relationship between the participation rate and length of intervention are lack of interest, motivation, enjoyment, time or perceived benefit. It appears group-based and education interventions were effective in increasing PA in short-term. Long-term education was ineffective. Insufficient data to show long-term effectiveness of group based interventions. Home and group based interventions appear to be comparable

Table 33: Physical Activity – Interventions to improve uptake/maintenance of physical activity with cognitive outcomes

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/measures	Findings
Angevaren 2008	11 Randomised Controlled Trials (RCTs)	International	Age range (55-91)	Sedentary, frail participants with age-related illness	Cycling, walking, jogging, strengthening exercise, resistence, weight training, aerobics	No activities, stretching exercise	**Outcomes:** Cognitive speed, verbal memory function, visual memory function, working memory, executive functions, perception, face recognition, cognitive inhibition, auditory attention, motor function. **Outcome Measures:** Ross Information Processing Assessment, Wechsler Adult Intelligence Scale (WAIS), Randt memory test story recall	Overall, the effects of aerobic exercise on cognitive function compared with any other intervention were significant for speed (SMD random effects 0.26, 95% CI 0.04, 0.48, P=0.02), and visual attention speed (SMD random effects 0.26, 95% CI 0.02, 0.49, P=0.03). The effects of aerobic versus no intervention were positive for auditory attention (WMD random effects 0.52, 95% CI 0.13, 0.91, P<0.01) and motor function (WMD random effects 1.17, 95% CI 0.19, 2.15, P=0.02). Aerobic training appears effective in the short term for cognitive delay or prevention. Aerobic training was not superior to strength training
Balsamo 2013	8 RCTs	USA, Australia, Brazil, France	Average age = 74.8 years	Mixed population of normal cognitive older adults, AD and MCI, 1 only female study	Structured physical exercise, stretching, strength training, walking, daily living activities, strength training, cardiorespiratory training, music therapy	ADLs (bingo, patchwork, sewing), balance, stretching	Outcomes: (Cognitive function) Executive, short-term memory, attention, long term episodic memory. **Outcome Measures:** ADAS-Cog, MMSE, Wechsler Adult Intelligence Scale III, Wechsler Memory Scale-revised, Toulouse-Pieron's concentration attention Test, Rey Osterrieth Complex Figure	Although 5/8 studies showed higher cognitive response than controls, evidence was inconclusive due to lack of study power

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant outcomes/measures	Findings
Carvalho 2014	10/27 RCTs	Asia, USA, Europe	Older population of age ≥ 60 years	Mixed population (could not ascertain gender proportion of some studies); sedentary; independently ambulatory, living independently	PA (resistance training, aerobic, strength, balance and flexibility; combination	Flexi-tone (tri-weekly training of 10 mins warm-up, 25-30 mins of strength, flexibility and balance, 10 min cool down); No intervention; Education to improve lifestyle and PA; Balance and tone training: stretching, range of motion, balance exercises, and relaxation technique; Social Interaction; one weekly training session consisting of warm-up and stretching exercises, but no overload training	**Outcomes:** Cognitive status/ function, Brain Volume. **Outcome Measures:** Rivermead Behavioural Memory Test, Wechsler Adult Intelligence Scale, Direct and Indirect Digit Span, Memory Complaints Scale, Cambridge Cognitive Test, Wechsler Adult Intelligence Scale III, Wechsler Memory Scale-Revised, Toulouse-Pieron concentration attention test, Ray-Osterrieth complex figure, Freed and Cued Selective Reminding Test, Trail Making Test, and Stroop Test, MMSE, 3MS ADAS-Cog, Brain volume using MRI, Neuropsychological battery test, Reaction time tests including simple reaction time, 8-choice reaction time, 8-choice incompatible reaction time, and Go/ No-Go reaction	PA confers a protective effect on cognition in elderly subjects. 26/27 of all studies showed positive association between PA and cognition while 9/10 RCTs showed a positive association between PA and cognition

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant out-comes/measures	Findings
Chang 2012	10 RCTs	NR	OAP mean age ≥ 65	Healthy adults without cognitive impairment or specific disease, adults with an average age older than 65 years	Resistance Exercise (Otago, resistance training and balance, ST with aquatic exercise, callisthenic training with aquatic exercise, Aerobic exercise and diet	Health Education; Flexibility and Relaxation; balance and toning	**Outcomes:** Cognition. **Outcome measures:** WAIS-R, TMT-Word-list memory test, word-list recall test, verbal-fluency test, modified Boston naming test, constructional praxis & clock-drawing test B, Stroop CW, COWAT, WMS-R, Auditory oddball task, WAIS III, Toulouse-Pieron's concentration attention test, Mental arithmetic, computerized mirror drawing task, Rey-Osterrieth complex-figure test	Designs including loads from 60% to 80% 1RM, approximately seven movements in two sets with 2 minutes rest between sets at least twice per week for 2–12 months (usually 6 months), might positively affect cognition in older adults

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant out-comes/measures	Findings
Coelho 2013	5 RCTS and 1 non-randomised CT	NR	Mean age = 66.2 years	Older women (no-frail and pre-frail); mean age = 66.2 years; OP with MCI; elderly subjects with glucose toler-ance criteria for pre-diabetes or newly diagnosed; patients with major depression and healthy OP	Physical exercise (Resistance-training; Aerobic exercise (treadmill, stationary, bicycle, or elliptical trainer); Nordic walking; Gymnastics; Acute aerobic exercise (treadmill)	Stretching exercise; Unspecified; no control	**Outcomes:** Peripheral serum and plasma BDNF (brain-derived neu-rotrophic factor) concentrations; Cognitive function; depression. **Out-come Measures:** Blood analysis (Plasma/ELISA, Serum/ELISA). MMSE, GDS, Spatial memory paradigm, Episodic memory perfor-mance (auditory verbal learning test), Symbol-digit modalities, verbal fluency, stroop, trails B, task switching, story recall, and list learning, HAMD (Hamilton Rating Scale for Depression), and Dem Test	Aerobic exercise increases BDNF in older adults
Colcombe 2003	18 intervention studies (4 non-randomised CTs, 1 pre-post and 13 RCTs)	NR	Young old (55-65), middle-old (66-70) and old-old (71+)	Community-dwelling, “normal” older adult; Sedentary clinical populations of one kind or another, ranging from depressed persons to geriatric mental patients and individuals with cardiopulmonary obstructive disorder	Aerobic Fitness supervised aerobic training, combined aerobic training	Any	**Outcomes:** Cognitive Function (Speed, visuospatial, controlled-processes and executive-control processes). **Outcome Measure:** MA of ES	Significant difference in overall ES (Overall ES for Intervention group was 0.478 (SE=0.029, n=101, P<.01), and Overall ES for control group was 0.164 (SE=0.028, n=96. P<.05). Aerobic fitness training improved cognitive performance in the older adults and markedly in the executive processing of the brain. The mid-old and old-old reported to have benefited more from fitness training compared with the young-old participants

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant out-comes/measures	Findings
Gates 2013	14 RCTs	NR	65-95 years	Predominantly female, with cognitive impairment, frail elderly	Physical exercise (isolated moderate intensity aerobic exercise, low intensity walking, resisted training, combined training, Tai Chi, supervised aerobic training, and combined aerobic training. Aerobic training make up half of studies)	Any (social visits, no contact, education programs, normal and recreational activities, sham, active control)	**Outcomes:** Cognitive function (Executive function, memory and information processing). **Outcome Measures:** MMSE, ADASCog, CAMCOG, WAIS-R. **MA of ES was performed**	Overall, exercise training had minimal but positive effect on verbal fluency (ES=0.17; 95% CI= 0.04, 0.30). Aerobic training effective on global cognition in three studies [(ES=0.74; 95% CI: 0.43, 1.05), (ES=0.56; 95%CI: 0.19. 0.92), (ES=0.69; 95%CI: 0.03, 1. 32)]. Isolated resistance training produced significant effects on memory [(ES=3.37, 95%CI: 2.27, 4.74), (ES=0.54: 95%CI: 0.02, 1.08)]. Aerobic exercise training did not improve executive function compared with other reviews
Ohman 2014	8/22 relevant RCTs	NR	Age range: 50-86	60% female; mean MMSE score of 24	Physical exercise (aerobic exercise, strength training, balance, dual tasking, walking, hand and face exercises, Tai Chi, treadmill, stationary bicycle, elliptical trainer	Social visits or normal social activities; educational material; stretching; health education	**Outcomes:** Cognition; **Outcome Measures:** MMSE, ADAS-Cog, Symbol digit, verbal fluency, Stroop and task switching, delayed recall, CDR-SUB, Stroop Test, WMS-LM	There were some positive effects on one or several domains of cognition, global cognition, executive function or attention

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant out-comes/measures	Findings
Patterson 2010	12 intervention studies (6 non-randomised CTs and 6 RCTs)	Interna-tional included 1 non OECD studies	NR	NR	Physical activity (strengthening, aerobic training)	NR	**Outcome:** Cognitive function (speed, visual memory, visual reproduction, verbal memory, motor function, working memory, executive function, cognitive inhibition and auditory attention. **Outcome Measure:** Varied (simple reaction time, choice reaction time, Wechsler Memory Scales, Benton visual retention test, Randt memory test, Wechsler memory scale, finger tapping, digit span tests, face recognition, verbal fluency, problem solving, word comparison, Stroop test, letter search, visual search, Digit span forward	58% of intervention studies demonstrated small positive effects on at least one measure of cognitive function. These studies employed moderate intensity aerobic physical activity interventions; however, it is difficult to quantify the actual volume of exercise used in each intervention

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant out-comes/measures	Findings
Sherder 2014	8 RCTs (5 RCTs involving normal cognition, & 3 with cognitive impairment)	NR	Age ranges from 55-73 years for NC; 75-86 for participants with cognitive impairment	NR	Walking	Flexibility, balance, strengthening, toning, social visits, no treatment	**Outcomes:** Executive Function; **Outcome Measures:** Spatial Word Memory, spatial switching, Trial Making Test, Stroop test, Verbal Fluency test, Digit span	Studies suggest that walking improved executive functions in cognitively intact older persons who have lived a sedentary life
Tseng 2011	12 RCTs	NR	Mean age = 71.5 years	Older adult participants with and without cognitive impairment were 50%, respectively, and only 16.7% of the trials focused on female participants	Physical exercise (walking, treadmill running, extremity stretching exercise, weight bearing strength training, and swimming)	No treatment, stretching, normal daily activities, educational materials, social visits, vitamin B supplements	**Outcomes:** Cognitive Function; **Outcome Measures:** MMSE, WAIS III WMS-R, ADAS-Cog, CERAD, CDR, SCWT, WCST, AVLT, VFT, DSST	Trials showed a positive effect for exercise on cognition when the exercise regimen lasted for 6 weeks and occurred at least three times per week for 60 minutes

Study	Study design	Country	Age (years)	Population	Intervention	Control	Relevant out-comes/measures	Findings
Uffellen 2008	21 RCTs	NR	>=55 years	Age of the study populations ranged from 55 to 94 years in cognitively healthy populations and from 67 to 99 years in populations with cognitive decline. In both groups, the majority of participants were women	Physical exercise (Aerobic; Strength; Flexibility; Balance or a combination of the above	Yoga, Exercise (strengthening, balance, flexibility)	**Outcomes:** Cognition function. **Outcome Measures:** WAIS, WIAS-R, TMT, Verbal fluency test, Stroop colour Word Tests, Visual reproduction, digit span; visual reproduction, verbal memory, verbal pairs test (mental status test (Strub and Black), based on WMS	This review suggests that different kinds of exercise may benefit cognitive function irrespective of baseline cognitive status. Five out of the 15 studies in cognitively healthy subjects observed significant beneficial effects on some of the included measures for cognition. Significant effects were also observed in 5 out of the 8 studies in subjects with cognitive decline. In cognitively healthy adults, improvements were observed in memory (Corsis block-tapping test, Rey – Osterrieth figure, face recognition, digit span) information processing abilities (organization, auditory processing), and executive function (word fluency). Effective interventions in this group included aerobic exercise (n = 2); strength exercise alone or combined with balance exercise (n = 1); and all-round exercise including aerobic, strength, balance, and flexibility training (n = 1)

Table 34: Physical Activity – Included qualitative studies about barriers and facilitators

Study	Study design	Country	Age (years)	Population	PA type	Barriers	Facilitators	Limitations
Barnett 2012	5 qualitative studies	Interna-tional	NR	All participants had been retired for between six months and 5.6 years	Recreational PA	Lack of time for recreational PA; Low perceived value of recreational PA and preference for productive/meaningful PA	Lack of time for recreational PA; Low perceived value of recreational PA and preference for productive / meaningful PA. Health properties of PA motivate adoption/ increase of recreational PA but do not guarantee long-term maintenance; Lifelong PA habits influence recreational PA patterns after retirement; Recreational PA provides a new daily routine; Recreational PA offers new personal challenges; Recreational PA provides opportunities for social interactions	The qualitative evidence is limited by the small number of studies available and the limited socioeconomic diversity of study participants, who were mostly from relatively affluent backgrounds
Boehman 2013	5 qualitative studiess	USA	50+	Community dwelling – people living independently in their home and not an aged care facility	Population-based falls prevention exercise programs	**(Personal)** Health, Lack of motivation, fatigue, time factors, lack of knowledge about exercise, low self-efficacy, feelings and perception about exercise, previous exercise experience, body image, fear. **(Social)** Lack of social support, family and household commitments. **(Environmental)** Poor built environment, lack of access to programs and facilities, safety concerns, dogs, traffic, weather, lack of transportation, costs	**(Personal)** Health, enjoying the activity, self-motivation, body image, previous exercise experience, exercise, exercise knowledge. **(Social)** Social support, social contact, recommendation to exercise, role models. **(Environmental)** Accessible facilities and programs, available transport, conducive built environment, low/ reasonable costs	There were only five articles that focused on rural locations, all of which were from the United States, four focused on women only and the total population was 326 people

Study	Study design	Country	Age (years)	Population	PA type	Barriers	Facilitators	Limitations
Bunn 2008	24 studies (4 RCTs, 1 survey, 1 cross-sectional & 18 qualitative)	Interna-tional	55+	Older popu-lation	Falls prevention programme	**(General)** Fatalism/ attributing falls to external causes/lack of knowledge about effectiveness of falls prevention; Perception that physical deterio-ration inevitable with age; Lack of relevant information in appropri-ate formats/language; Provision of 'one size fits all ' advice. Advice seen as common sense/patronising; Low self-efficacy. Fear of loss of independence/ risk taking ability; No perception of need for help (no previous falls); Provoking fear of falling by using scare tactics; Social stigma: associa-tion with old age/frailty; Differing agenda of older adults and health professionals. **(Exer-cise)** No previous ex-ercise 'habit'; Physical discomfort/unpleasant sensations associated with exercise; Under-lying beliefs about personality type (e.g. too lazy, no willpower); Self-perception: too old to exercise. (Home modifications / as-sistive devices) Dislike of interventions seen as intrusive/didactic; Stigma of devices as-sociated with old age	**(General)** Information that falls can be preventable; Communicating life-enhancing aspects of strategies, e.g. maintaining independence and control; Accessible, appealing information format, from a variety of sources and in different languages; Choice of interventions for different people and lifestyles; High self-efficacy; Personalised modifications; Emphasis on social aspects of interventions. (**Exercise)** Previous exercise 'habit', Making exercise fun/enjoyable/ sociable, Good leadership/facilitation, Motivation/information about physical and psychological benefits of exercise, Programmes tailored to needs or lifestyle, Convenient scheduling/ reasonable pricing/ good access and transport. (Home modifications / assistive devices) Facilitate feeling of ownership of interventions, shared decision making, Referral from health-care professional	Potential for publication bias to affect results due to non-RCTs in review. Study quality not used to weight or exclude studies may also affect results

Study	Study design	Country	Age (years)	Population	PA type	Barriers	Facilitators	Limitations
Child 2012	12 qualitative studies	International	OA	Community-dwelling older adults	Falls prevention programme	**(Practical consideration)** Cost of accessing programme; ease of access to falls-prevention intervention i.e. ability to drive, availability and cost of transport, car parking facilities, cold weather; Time **(Adapting for community)** social and cultural acceptability of assistive devices, types of exercise, and fatalistic attitudes towards falling **(Psychosocial)** transforming identity (independence, confidence and QoL)		
Cunningham 2004	1 qualitative, 2 cross-sectional and 3 surveys	NR	Seniors	Community dwelling seniors	PA	Safety of footpaths, Access and convenience of facilities, proximity to services, heavy traffic, safety (dogs, crime), noise, adequate lighting, public transportation, litter		Inconsistent findings and mixed results in primary studies of the relationship between PA and environmental factors
Dunsky 2012	6/7 relevant surveys	International	45+	Adults and older adults	PA and sports	Injury		Main finding was that the information on rate of injuries in purposeful physical and sports activities in advanced age was too limited for reliable conclusions. While there is some information regarding the rate of injuries, it is not presented relative to the extent of activities, either in the number of active people or intensity of the activity

Study	Study design	Country	Age (years)	Population	PA type	Barriers	Facilitators	Limitations
Horne 2012	10 qualitative studies	Interna-tional	60+	OA from South Asian Community	PA	**(Communication)** Obtaining accurate information; Lack of information; Lack of support and encouragement; Language barriers. (**Relationship)** Overprotective family; Dependence on social support; Group norms. **(Beliefs)** Concepts of ageing; Lack of knowledge and understanding about the benefits of exercise and keeping active; Unfamiliarity of gym-based exercise; Role of fate and lack of personal control. **(Environment)** Migration; Not socialised to spend time outdoors or doing sport; Lack of culturally sensitive facilities; Lack of knowledge of geographical area and facilities; Obligations to others and contribution to community activities	**(Communication)** Who provides advice; Positive reinforcement; **(Relationship)** Facilitative relatives; Group, peer and community support; Instructor support. **(Beliefs)** Collectivist norms; **(Environment)** Engaging in community activities; Walking outdoors was a preferable form of PA	

Table 35: Physical Activity – Quality assessment for interventions reporting on uptake/maintenance of physical activity

AMSTAR (High= 8-11, Good= 5-7, Poor= <5)

Key: 1. 'a priori design; 2. duplicate study selection and data extraction; 3. comprehensive literature search; 4. Status of publication as an inclusion criterion; 5. List of studies (included and excluded provided)?; 6. Characteristics of the included studies provided 7. Scientific quality of the included studies assessed and documented; 8. Scientific quality of the included studies considered in formulating conclusions; 9. Appropriate method to combine findings; 10. Publication bias; 11. Conflict of interest

Author (Year)	1	2	3	4	5	6	7	8	9	10	11	Rank-ing
Asikainen 2004	Y	U	Y	N	Y	Y	Y	Y	Y	N	Y	High
Clegg 2012	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	High
Chase 2013	Y	N	Y	N	N	Y	N	N	Y	N	Y	Good
Conn 2003a	Y	Y	Y	Y	N	Y	N	N	Y	N	N	Good
Conn 2003b	Y	Y	Y	Y	N	Y	U	U	Y	N	N	Good
Cyarto 2004	Y	N	Y	N	N	N	N	U	Y	N	Y	Poor
de Vries 2012	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	High
Fairhall 2011	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
French 2014	Y	Y	Y	N	N	N	N	N	Y	N	Y	Good
Geraedts 2013	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	High
Hobbs 2013	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	High
Muller 2014	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	High
Neidrick 2012	Y	Y	Y	N	N	Y	N	N	Y	N	N	Good
Nigg 2012	Y	Y	Y	N	N	Y	U	U	Y	N	Y	Good
Stevens 2014	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	High
Van der Bij 2002	Y	Y	Y	N	N	Y	N	N	Y	N	Y	Good

Table 36: Physical Activity – Quality assessment for interventions reporting on physical activity with cognitive outcomes

AMSTAR (High= 8-11, Good= 5-7, Poor= <5)

Key: 1. 'a priori design; 2. duplicate study selection and data extraction; 3. comprehensive literature search; 4. Status of publication as an inclusion criterion; 5. List of studies (included and excluded provided)?; 6. Characteristics of the included studies provided? 7. Scientific quality of the included studies assessed and documented; 8. Scientific quality of the included studies considered in formulating conclusions; 9. Appropriate method to combine findings; 10. Publication bias; 11. Conflict of interest

Author (Year)	1	2	3	4	5	6	7	8	9	10	11	Rank-ing
Angevaren 2008	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	High
Balsamo 2013	N	N	Y	N	N	Y	N	N	N	N	Y	Poor
Carvalho 2014	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	High
Chang 2012	Y	U	Y	N	N	Y	U	Y	N	N	N	Poor
Coelho 2013	Y	N	Y	N	N	Y	N	Y	Y	Y	Y	Good
Colcombe 2003	Y	N	Y	Y	N	N	N	Y	Y	Y	Y	Good
Gates 2013	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	High
Ohman 2014	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y	High
Paterson 2010	Y	Y	Y	N	N	N	Y	Y	N	N	Y	Good
Scherder 2014	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	High
Tseng 2011	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	High
Van Uffellen 2008	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	High

Table 37: Cognitive Stimulation – Systematic reviews of cognitive training interventions with cognitive outcomes

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Gross 2012	N=35 intervention studies	International (limited to English language)	60+	Cognitively normal, community dwelling older adults	Memory training interventions (non-pharmacological)	Objective memory performance outcomes; intervention or participant characteristics that influence effectiveness Mean standardized difference in pre-post change between memory-trained and control groups was 0.31 standard deviations (SD; 95% confidence interval (CI): 0.22, 0.39) The pre-post training effect for memory-trained interventions was 0.43 SD (95% CI: 0.29, 0.57) and the practice effect for control groups was 0.06 SD (95% CI: -0.05, 0.16) 10 distinct memory training strategies were identified from studies. From meta-analyses, training multiple strategies was associated with larger training gains (p=0.04), although not statistically significant after adjusting for multiple comparisons. There was no difference in effect from training in any particular strategy, by age of participants, session length, or type of control condition

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Kelly 2014 Ag Res Rev A	N=31 RCTs	International	50+ (most included studies age >65)	Community dwelling older adults without known cognitive impairment	**Cognitive training:** 'specifically designed training programmes that provide guided practice on a standard set of cognitive tasks, aimed at improving performance in one or more cognitive domains' **General mental stimulation:** interventions that promote increased engagement in mentally stimulating activities. (e.g. reading, playing music or playing chess)	**Cognitive training** From meta-analysis Compared to active controls, cognitive training improved performance on measures of executive function (working memory, p = 0.04; processing speed, p < 0.0001) and composite measures of cognitive function (p = 0.001) Compared to no intervention, cognitive training improved performance on measures of memory (face-name recall, p = 0.02; immediate recall, p = 0.02; paired associates, p = 0.001) and subjective cognitive function (p = 0.01) Data were not available for face-name recall, paired associates, verbal fluency, reasoning, or everyday functioning. **Mental stimulation** Due to heterogeneity and lack of available data, meta-analysis not conducted for this outcome Mental stimulation had significantly larger effects compared to 'no intervention' controls on four out of eight memory measures; nine out of 17 measures of executive function; and one out of three composite measures of cognitive function

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Kelly 2014 Ag Res Rev A *(continued)*						In individual trials, one found no significant differences between mental stimulation and active control groups on four measures of memory, four measures of executive function, one composite measure of cognitive function and one measure of subjective cognitive performance. One study found that acting class participants significantly outperformed singing class controls in two measures of memory and two measures of executive function. The authors concluded that 'more research is required to determine if general mental stimulation can benefit cognitive and everyday functioning. Transfer and maintenance of intervention effects are most commonly reported when training is adaptive, with at least ten intervention sessions and a long-term follow-up. Memory and subjective cognitive performance might be improved by training in group versus individual settings.' 'The impact of cognitive training on everyday functioning is largely under investigated'. Transfer of training effects were reported in nine out of ten trials: five reported transfer to untrained tasks within the same domain

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Li	N=20 intervention studies of which N=17 were included in meta-analysis	International	NR for the SR but in all studies, mean age is 55+	People with MCI (no age specified)	Cognitive interventions	People with MCI benefited significantly more from the cognitive intervention than MCI control group in overall cognition (Q= 16.21, p < .001), overall self-ratings (Q= 6.92, p = .009), episodic memory (Q= 13.96, p < .001), executive function/WM (Q= 5.40, p = 0.02). The effect sizes of separated domains in MCI intervention group were all larger than the MCI control group, although the differences did not reach significance, MMSE (Q= 2.47, p = 0.12), semantic memory (Q= 1.18, p = 0.28), attention/processing speed (Q= 2.27, p = 0.13), visuo-spatial ability (Q= 1.26, p = 0.26), language (Q= 0.49, p = 0.49), self-rated memory (Q= 3.08, p = 0.08), depression (Q= 0.08, p = 0.78), anxiety (Q= 0.02, p = 0.88), ADL (Q= 0.23, p = 0.63)
Martin 2011 (Cochrane review)	RCTs (N=36) of which 24 studies relating to memory training were pooled in meta-analysis	International (limited to English or German language)	60+	Healthy older adults and older adults with MCI. Eligible studies were from any setting	Cognitive training interventions targeting specific domains of cognitive functioning such as memory, attention, or speed Note: most of the included studies included focused on memory training interventions, and very few on speed improvements or training of executive functioning	No studies reported dementia outcomes (though only looked for in MCI studies) No studies provided adverse effects information **From meta-analyses** For healthy older adults, immediate and delayed verbal recall improved significantly (p<0.05) through training compared to a no treatment control condition For individuals with mild cognitive impairment significant training gains were obtained for treatment compared to no contact control in immediate (p=0.04) recall and delayed recall (p=0.05)

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Reijnders 2013	N=35 intervention studies. (27 RCTS and 8 clinical studies) published between 2007 and 2012. N=6 studies were in people with MCI, the rest were in healthy older adults	International (limited to English language)	NR	Healthy older adults and people with MCI	Cognitive training interventions	Evidence that cognitive training can be effective in improving various aspects of objective cognitive functioning; memory performance, executive functioning, processing speed, attention, fluid intelligence, and subjective cognitive performance
Tardif 2011	N=14 cognitive intervention programme studies with a control group (9 RCTs, 1 controlled study, 2 quasiexperimental, 2 used a within subject crossover design)	International (limited to English or French)	NR for review but all included studies >55	Healthy elderly participants - 13/14 studies recruited in the community, 2 recruited from retirement homes (1 of these recruited from both)	Cognitive intervention programmes	Nine out of 14 studies targeted memory as the principal cognitive function to train or stimulate. Face-name associations, mental imagery, paired associations, and the method of loci were the main techniques taught to participants. Improvements were observed on at least one outcome measure in each study included
Teixeira 2012	N=7 intervention studies	International	60+	Community-dwelling older adults with MCI	Non-pharmacological interventions including cognitive interventions (N=6) and 1 PA intervention	Cognitive function, including aspects of memory or executive function All 6 included studies reported at least one significantly improved measure of cognitive function. All 6 reported improved episodic memory and one study also reported improved executive function The authors noted 'contradictions and divergences' in the available studies, so it was not possible to establish a systematic protocol for effective cognitive training interventions

Table 38: Cognitive Stimulation – Systematic reviews of cognitive training compared to physical activity

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Hindin 2012	N=42 intervention studies (25 reported extended cognitive practice interventions and 17 aerobic interventions) Extended practice cognitive training is completing many trials of basic tasks such as phoneme span or choice response time with or without strategy instruction (hundreds to thousands). Only strategies likely to generalise to other untrained outcomes were included	International (restricted to English language)	55+ (mean 69.2 y)	Healthy community living older adults (included interventions which took place in a range of settings including laboratories, gymnasiums, in the home and outdoors	Cognitive tasks *or* aerobic exercise	Untrained cognitive outcomes including choice reaction time, memory, executive function. Both extended cognitive practice and aerobic interventions produced significant effects but they did not differ in magnitude. Better study quality was associated with larger effect sizes Extended practice effect size (ES) =0.33, 95% CI 0.13 , 0.52; Aerobic intervention ES = 0.33, 95% CI 0.10 , 0.55)
Karr 2014	N=46 intervention studies (23 PA, 21 cognitive training (CT) and 2 both PA and CT)	International (limited to English language studies)	65+ (mean age 74 (5.7) for PA studies and 73.3 (4.3) for CT	Healthy people, people with dementia or MCI Studies of PA had mean MMSE 27.1 (2.2) and CT studies had mean MMSE 26.0 (3.9) Gender: PA: 30.4% male; CT: 40.9% male	Compares cognitive training versus PA	Executive function, participant and intervention characteristics that produce the best outcomes Both PA and cognitive training significantly improved executive functions but no significant difference in effect size between the two interventions Note: some evidence of publication bias – for CT more recent publications produced lower effect sizes

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Law 2014	N=8 RCT or non-randomised trials (5 in people with cognitive impairment and 3 in cognitively healthy people). Of the 3 in cognitively healthy people, 1 was an RCT and 2 were non-RCT interventions	International (but limited to English language publications)	60+	Older adults with and without cognitive impairment (included studies in people with dementia but reported outcomes separately for cognitively healthy participants so only those outcomes are reported)	Combined cognitive and exercise interventions	**Cognitive outcomes** Overall, the results of the reviewed studies in both populations with and without cognitive impairment were conflicting. Among the three studies with cognitively healthy participants, one study found no effects while two studies revealed significant effects. Fabre et al. (2002) reported a significant effect on memory performance (d = 1.29). Oswald et al. (2006) found significant effects, with within-group effect sizes reported, on general cognitive functions (d+ = 1.14), subjective rating of cognitive impairment (d+ = 0.59) and functional status (d+ = 0.27), which were sustained at 5-years follow-up

Table 39: Cognitive Stimulation – Systematic reviews of computerised cognitive training interventions

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Bleakley 2013	N=12 interventions (5 RCTs, 2 controlled trials and 5 other studies (observational)	International (only English language studies)	65+	Older adults	Interactive computer games (involving a physical component e.g. aerobic, strength, balance, or flexibility components)	Cognitive function (or physical outcomes). Secondary outcomes: compliance, enjoyment and adverse effects Only 2 studies reported cognitive outcomes, the rest reported physical outcomes. Both studies were non-controlled (before and after studies, Rosenberg 2010, Studenski 2010) Both studies found positive but non-significant effects on cognitive function
Kueider 2012	N=38 intervention studies (RCTs, non-randomised and pre-post design studies)	International (limited to English language)	55+	Participants without AD or MCI	Computer-based cognitive training computerised interactive gaming, video games, virtual reality. (N=21 classic cognitive based tasks; N=9 neuropsychological software; N=8 video games)	Cognitive domain-specific programs Reported pre-post training effect sizes for intervention groups ranged from 0.06 to 6.32 for classic cognitive training interventions, 0.19 to 7.14 for neuropsychological software interventions, and 0.09 to 1.70 for video game interventions. Most studies reported older adults did not need to be technologically savvy in order to successfully complete or benefit from training. The authors reported that 'findings are comparable or better than those from reviews of more traditional, paper-and-pencil cognitive training approaches suggesting that computerized training is an effective, less labour intensive alternative'

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Lampit 2014	N= 52 RCTs	International (no language limits)	60+	Cognitively healthy older adults (without dementia or cognitive impairment)	Computerised cognitive training Studies had to report >/= 4h of computerised cognitive training to be included; compared to active or passive control condition	The overall effect size (Hedges' g, random effects model) for computerised cognitive training versus control was small and statistically significant, g = 0.22 (95% CI 0.15 to 0.29). Small to moderate effect sizes were found for nonverbal memory, g = 0.24 (95% CI 0.09 to 0.38); verbal memory, g = 0.08 (95% CI 0.01 to 0.15); working memory (WM), g = 0.22 (95% CI 0.09 to 0.35); processing speed, g = 0.31 (95% CI 0.11 to 0.50); and visuospatial skills, g = 0.30 (95% CI 0.07 to 0.54). No significant effects were found for executive functions and attention. Analyses of effective design factors showed that home-based administration was ineffective compared to group-based training, and that more than three training sessions per week was ineffective versus three or fewer. There was no evidence for the effectiveness of working memory training, and only weak evidence for sessions less than 30 min

Table 40: Cognitive Stimulation – other systematic reviews

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Huckans 2013	N=14 RCTs	International (limited to English language)	NR	Community-dwelling older adults with MCI	Cognitive rehabilitation therapies defined as any systematic behavioural therapy specifically designed to improve cognitive performance	Short-term (<1 month) and long-term (>/= 1 month) impact on objective cognitive performance, including attention/information processing, memory, executive function and global cognition
Jean 2010	N=15 intervention studies (5 were RCTs, 8 quasiexperimental studies, 3 pre-test-post-test between group controlled trials, 2 between group pre-test-post-test, 3 pre-test post-test trials with only one group and 2 were single case studies. Number of participants in studies was from 1 to 193 but Most included studies had small sample sizes (n<30)	NR	NR	People with mild amnestic cognitive impairment (A-MCI)	Cognitive training Some programs focused only on memory, whereas other programs used multifaceted approaches targeting two or more cognitive functions. Eight were offered in groups, and seven took place on an individual basis	Objective or subjective measures of memory No meta-analysis conducted 44% of objective measures of memory significantly improved, when compared with 12% of objective measures of cognition other than memory 49% of subjective measures of memory, quality of life, or mood significantly improved after training

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Metternich 2008	N=14 RCTs included of which 13 were included in meta-analyses and 10 were included in meta-analysis of the primary outcome measure: subjective memory. Studies were only included if they included a measure of objective memory	International (limited to English, Dutch, German or French)	Mean age 53+ for include studies	People with subjective memory complaints or desire to improve their memory performance. Studies exclusively investigating groups of patients with objective memory deficits e.g. MCI, AAMI were excluded	Non-pharmacological interventions (The categories of intervention were: conventional memory training (MT; n = 8), expectancy change (EC: cognitive restructuring, psychoeducation, etc.; n = 5), combined interventions (n = 5), physical training (n = 1), and physical and mental training combined (n = 2)	Subjective memory and objective memory. EC followed by combined interventions, was most effective for subjective memory. MT or physical and mental training combined were not efficient. On objective memory, MT was the only efficient intervention **Objective memory** No significant effects for EC versus WL, P, CT or MT. Significant effects for MT versus WL and P, as well as MT versus CT; No significant effects for MT versus PT or CPT, for CT versus WL/P and for PT versus WL or combined physical and mental training versus WL/P **Subjective memory** The meta-analyses show significant effects for EC training over WL and P conditions, and no significant effects for EC versus CT or MT. There were no significant effects for MT versus WL and P. A significant effect for CT over WL (p = 0,047), but not versus P, was observed. There was a weak trend towards significance for CT over MT (p = 0.098). There was no significant effect for combined physical and mental training versus WL. There were no data for comparisons regarding PT CT = combination of conventional memory training and expectancy change; PT = physically oriented training; CPT = combination of conventional memory training and physically oriented training; MT = conventional memory training; P = placebo; WL = waitlist

Study	Included studies and design	Country	Age (for inclusion)	Population	Intervention or exposure	Relevant outcomes
Papp 2009	RCTs (N=10)	International (limited to English language)	NR for review inclusion but all studies mean age >>55+	Community-dwelling healthy elderly (people with MCI, Alzheimer's disease or dementia were excluded)	Cognitive training	Cognitive outcomes. From meta-analysis: The weighted mean effect size (Cohen's d) of cognitive intervention across all outcome measures after training was 0.16 (95% confidence interval, 0.138 to 0.186) The authors reported a lack of consensus on what constitutes the most effective type of cognitive training, insufficient follow-up times, a lack of matched active controls, and few outcome measures showing changes in daily functioning, global cognitive skills, or progression to early AD
Valenzuela 2009 Am J Geriatr Soc	N=7 RCTs	International (no language restrictions)	50+	Healthy older adults. People with dementia or cognitive impairment were excluded	Cognitive exercise training	Neuropsychological performance
Zehnder 2009	N=24 intervention studies	International (limited to English or German)	60+	Older adults – healthy and with MCI	Memory training	Cognitive outcome measures

Table 41: Cognitive Stimulation – Quality assessment of systematic reviews of cognitive stimulation interventions

AMSTAR (High= 8-11, Moderate= 5-7, Low= <5)

Key: 1. 'a priori design; 2. duplicate study selection and data extraction; 3. comprehensive literature search; 4. Status of publication as an inclusion criterion; 5. List of studies (included and excluded provided)?; 6. Characteristics of the included studies provided? 7. Scientific quality of the included studies assessed and documented; 8. Scientific quality of the included studies considered in formulating conclusions; 9. Appropriate method to combine findings; 10. Publication bias; 11. Conflict of interest

Author (Year)	1	2	3	4	5	6	7	8	9	10	11	Ranking
Bleakley 2013	Not reported	Y	Y	Y	Y for included studies; N for excluded	Y	Y	Y	Y	N	Y	**High**
Gross 2012	Not reported	Y	Y	Y	Included studies shown in meta-analysis; excluded not reported	N	N	N	Y	Y	Y for the SR; N for individual studies	**Moderate**
Hindin 2012	Not reported	Not reported	Y	Y	Y for included studies (Appendix S1), N for excluded	N (only refs in S1)	Y	Y	Y	Y	Y	**Moderate**
Karr 2014	Y - reports prior inclusion criteria	Y for data extraction; not reported for study inclusion	Y	Y	Y	Y	Y	Y	Y	Y	Y	**High**
Kelly 2014 (Ag Res Rev 15, 28-43)	Not reported	Y	Y	Y	Y	Y	Y	N	Y	Y	Y for the SR; N for individual studies	**High**

Author (Year)	1	2	3	4	5	6	7	8	9	10	11	Ranking
Kueider 2012	N	Not reported	Y	Y	Y for included studies; N for excluded	Y	N	N	Y	Y	Y	**Moderate**
Lampit 2014	Y	Y	Y	Y	Y for included studies; N for excluded	Y	Y	N	Y	Y	Y	**High**
Li 2011	Not reported	Y	Y	Not reported	Y for included studies; some excluded referenced	Y	N	N	Y	Y	Y for review; N for individual studies	**Moderate**
Martin 2011	Y	Y for study inclusion, unclear for data extraction	Y	Y	Y	Y	Y	N	Y	Y	Y for SR; N for individual studies	**High**
Reijnders 2013	Not reported	Y for data extraction; unclear for study inclusion	Y	Y	Y for included studies; N for excluded	Y	Y	Y	Y	Y	Y for SR; N for individual studies	**High**
Stott 2011	Y - specifies a priori inclusion criteria	Not reported	Y	Y	Y for included studies; N for excluded	Y	Y	Y	Y	N	Y	**High**
Tardif 2011	Not reported	Not reported	Y (but very limited search terms)	Y	Y for included studies; N for excluded	Y	N	Y	Y	N	N	**Low**
Teixeira 2012	Not reported	Not reported	Limited search terms	Unclear	Y for included studies; some excluded referenced	Y	N	N	N/A	N	Y for SR; N for individual studies	**Low**

Table 42: Social – Systematic reviews or exposures for social participation interventions

Study	Included study and design	Country	Age (years)	Population	Intervention or exposure	Relevant outcomes
Bickerdike 2014 University of York Evidence briefing (York CRD)	N=7 systematic reviews examining interventions for loneliness and social isolation N=7 systematic reviews examining interventions for loneliness and social isolation	International (limited to English language)	Not reported	People who are, or were at risk of loneliness and social isolation	Overview of SRs of interventions for loneliness and social isolation	Loneliness, social isolation and related outcomes (incl. measures of health services utilisation and associated costs)
Berger 2013	N=13 intervention studies (9 RCTs, 1 non randomised controlled trial, 3 other intervention studies)	International	NR	Older adults with low vision	Occupational therapy interventions	Social and leisure participation
Cattan 2005	N=30 intervention studies included. 16 RCTs. 10 non-randomised and 4 other intervention studies	International - but included studies conducted in USA (N=17) Canada and Europe	'Older adults' as defined in individual reviews	Older adults 'regardless of race, gender, physical disability or ability'	Health promotion interventions to prevent social isolation and loneliness among older adults	Social isolation and/or loneliness
Choi 2012 Healthcare Info	N= 6 controlled intervention studies included of which 4 were RCTs. 5 studies reported loneliness as an outcome	International (Limited to studies in English or Korean)	NR (mean age of all included studies 65+)	Older adults	Computer mediated social support for managing loneliness	Loneliness outcomes generally measured on a loneliness scale (and depression)
Dickens 2011	N=32 (16 RCTs and 16 quasi-experimental studies)	International (limited to English language studies)	NR	Most studies were conducted in community dwelling older. Also included studies were in people with existing disease	Interventions designed to alleviate social isolation and loneliness	Social isolation and loneliness
Findlay 2003	N=17 included intervention studies (N=6 RCTs)	International (English language). Included studies conducted in the US (8), Australia (3), Canada (2), The Netherlands (2), Italy (1), Sweden (1).	NR	Older adults – inclusion criteria not specified. Generally studies are in people living in the community with and without support	Interventions to reduce social isolation	Loneliness, social isolation, measures of personal contact, and a range of other outcomes such as mortality etc

Study	Included study and design	Country	Age (years)	Population	Intervention or exposure	Relevant outcomes
Forsman 2011	N=69 intervention studies: n=56 RCTS and n=13 non-randomised controlled studies	N=17 trials from Europe, N=52 non-European (majority from US)	65+ Mea of included studies	Older adults who did not meet diagnostic criteria for any mental disorder (e.g. dementia) In N=32 trials, participants lived independently, in senior communities or received home health services; n=15 trials, participants lived in nursing homes or other institutions; n=22 studies the participants' living status was not clear	Psychosocial interventions for the promotion of mental health or prevention of depression	Primary outcomes related to mental health, although social capital, social network or social support were also included as outcomes
Hagan 2014	N=17 intervention studies (9 controlled trials; 3 before and after studies; 2 pilot studies and 3 evaluations)	International (limited to English language)	NR	Older adults N=9 studies were conducted in people living in the community; N=7 studies in supported living communities or nursing care and N=1 was in an unspecified setting	Social therapeutic interventions primarily aimed at reducing loneliness or social isolation	Loneliness, social isolation, social networks, social support Ten of the 17 studies measured loneliness using discrete validated scales. The rest used broader non-explicit measures
Heaven 2013	14 articles, reporting 11 separate studies that evaluated 7 different interventions (Only studies with a control or comparison group were included, only 3 were RCTs)	Studies from highly developed nations only included (Interventions: US n=5; Japan n=1; The Netherlands (n=1)	55-70	Older adults in the retirement transition	Interventions to extend or support social roles for older adults	Participants' perception of social roles (or to aspects of their health or well-being). Minimum follow-up period of 3 months
Morris 2014	N= 18 intervention studies (N=12 RCTs, 3 non-randomised controlled studies, 3 before and after studies)	International (limited to English language)	45+	Older adults living at home. Varying participant characteristics	Smart technologies	Social connectedness

Table 43: Social – Systematic reviews relevant to barriers/facilitators to social participation

Study	Included study and design	Country	Age (years)	Population	Intervention or exposure	Relevant outcomes
Nef 2013	N=18 interventions and qualitative studies	International (limited to English language)	55+	Older adults	Social networking sites	Use of SNS and B/F in relation to maintenance of social networks

Table 44: Social – Interventions to improve uptake/maintenance of social participation with cognitive outcomes

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Carballo-García 2013	Non-randomised controlled trial	Spain	65-85 Mean 77 (6)	Elderly people with or without cognitive impairment who applied to participate in social or cultural activities provided free by municipal senior centres in central Madrid (N=240 with normal ageing and N=77 with cognitive impairment) **Setting:** Community **Gender:** 86.1% female **Ethnicity:** Not reported **SES:** Educational level: Without cognitive impairment:28.3% functionally illiterate; 41.7% primary studies; 12.5% secondary studies; 17.5% university education With cognitive impairment: 71.4% functionally illiterate; 20.8% primary studies; 2.6% secondary studies; 5.2% university	**Intervention:** 'Non-pharmacological therapy' delivered 1 hour a day/2 days a week in groups of no more than 20, for 9 months. Consisted of: Cognitive stimulation exercises according to group abilities. Exercises covered a wide range of cognitive processes: attention, perception, memory, language, inhibition, planning, reasoning, arithmetic, drawing, etc. Group dynamics tasks designed to strengthen social skills, the expression of positive feelings, and interaction between participants General topics such as depression, anxiety, etc. Art therapy conducted in partnership with a museum, and team-building workshops were also used to increase social participation and prevent isolation **Control group:** Other leisure, social or cultural activities	**Follow-up:** 9 months **Lost to follow-up:** Outcome assessment: Cognitive outcomes: The Miniexamen Cognoscitivo (MEC) and the adapted and validated Spanish-language version of the Short Portable Mental Status Questionnaire (SPMSQ) **Other outcomes:** Also: General mental state, emotional well-being, quality of life, and daily life activities	Results reported separately for those with and without cognitive impairment. **Normal ageing group (no cognitive impairment) (N=240 total)** **Intervention (N=217)** Mean (SD) MEC cognition Pre 31.49 (2.533) Post 32.10 (2.298), Improvement SPMSQ cognition Pre 1.16 (1.226) Post 0.56 (0.907) Improvement **Control (N=23)** Mean (SD) MEC cognition Pre 30.52 (2.556) Post 28.43 (3.396) Decline SPMSQ cognition Pre 1.26 (1.453) Post 2.09 (1.379) Decline Effect of intervention vs control MEC cognition F=9.091 P< .001 N2p = 0.134 SPMSQ cognition F= 8.366 P< .001 N2p = 0.125 Significant effect by age (F =2.583, P < .05), younger participants benefitted the most

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Carballo-García 2013 *(continued)*							**Cognitive impairment group (N=77 total)** Intervention (N=63) MEC cognition Pre 27.19 (3.868) Post 26.43 (4.578) Decline SPMSQ cognition Pre 2.52 (1.804) Post 2.14 (1.983) Decline Control (N=14) MEC cognition Pre 27.21 (4.710 Post 22.21 (5.041) Decline SPMSQ cognition Pre 2.93 (2.336) Post 5.29 (2.091) Decline Intervention Vs control MEC cognition F = 7.451, P < .001. N2p = 0.293 SPMSQ cognition F = 6.754, P < .001. N2p = 0.273

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Carlson 2008 Experience Corps	RCT (pilot) (cluster randomised by school)	US	Mean: Intervention: 70.1 (6.42) Control : 68.4 (5.15)	Older adults N=149 randomised [N=21 dropped out immediately following randomization] Baseline MMSE: Intervention: 24.96 (3.45); Control: 25.3 (2.60) **Setting:** Community **Female:** Intervention: 83%; Control 93% **Ethnicity:** Intervention: 94% black; Control: 95% black **SES:** Mean years education: Intervention: 11.9 (2.54) ; Control: 11.2 (2.66); 38% had less than high school education	Experience Corps® places older volunteers in public elementary schools in roles designed to meet schools' needs and increase the social, physical, and cognitive activity of the volunteers Community-based program designed to increase cognitive and physical activity in a social, real-world setting **Intervention (N=70):** Participants randomized to EC trained in teams to help elementary school children with reading achievement, library support, and classroom behaviour for 15 hr/week **Control (N=58):** Wait-list control	**Follow-up:** 4 to 8 months **Lost to follow-up:** Intervention: 11.4%; control: 17.2% **Outcome measurement:** Cognitive outcomes: Memory, executive function (EF), and psychomotor Speed: Trail Making Test: Parts A and B Word list memory: Immediate recall Delayed recall Rey-Osterrieth: Copy score Delayed recall	**Cognitive outcomes:** (age and education adjusted) **Trail-making test** Part A: No significant difference between groups Part B: Significant difference between intervention and control groups at follow-up ($p<0.05$). Intervention group improved by 1.3 secs from baseline; control group declined 21.7 secs from baseline **Word list memory** No significant difference between groups for immediate or delayed recall **Rey-Osterrieth CFT** Copy score: No sig diff between groups. Delayed recall: Significant difference between intervention and control groups at follow-up ($p<0.05$). Intervention group improved by 1.0 points and control group declined by 1.1 points

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Cohen-Mansfield 2015	RCT Note: Interventions were not conducted simultaneously	Israel	65+ Mean 73.5 (SD 5.2)	Older adults with memory complaints MMSE 24+ for inclusion (Mean MMSE at baseline 28) N=44 randomised **Setting:** Community **Gender:** 72.7% female **Ethnicity:** Not reported **SES:** Mean years education: 14.82 (3.77); range 5-22	**Health promotion (N=15):** structured format course including lectures, discussions, exercises, handouts and homework; covering health behaviours; dementia and delirium; communication; cognitive activities to keep the mind fit; relationships, depression, and coping; home and travel safety; recreation and leisure; medications and health care providers; physical activity; and lifelong learning **Cognitive training (N=15):** Memory training based on the previous ACTIVE trial with a focus on verbal episodic memory exercises **Participation-centred course (N=14):** Book club was used as a focus to deliver memory, cognitive and organisational strategies and using cognitive-behavioural principles. The course used external strategies (e.g. reading aid and daily planner), internal strategies (e.g. linking meaning to new information), and social interaction strategies (e.g., asking for help and sharing memory difficulties) **Control:** Wait-list control (N=28? but unclear, changing numbers)	**Follow-up:** 10 weeks intervention and follow-up **Lost to follow-up:** Health promotion: 20%; cognitive training: 20%; participation: 28.6%. Only completers were analysed for results **Outcome measurement:** Global Cognitive Score assessed using the MindStreams mild cognitive impairment assessment, a computerized cognitive assessment. The Mini-Mental State Examination and the self-report of memory difficulties were also utilized. To assess well-being, the UCLA Loneliness Scale-8 was used. Health was evaluated by self-report instruments	**Cognitive outcomes** No significant differences ($p<0.05$) between intervention groups (health promotion; cognitive training; participation) for any cognitive outcome except for self-reported memory which was higher in the group receiving cognitive training **Loneliness** No significant differences ($p<0.05$) between intervention groups (health promotion; cognitive training; participation) for loneliness as an outcome There was a significant difference in change in loneliness for the cognitive training group compared to the wait-list control

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Hughes 2014	RCT	US	Mean: Intervention: 78.5 (7.1); control: 76.2 (4.3)	Older adults with MCI recruited from a population cohort study Mean MMSE at baseline Intervention: 27.2 (1.9) Control: 27.1 (1.8) N=20 randomised **Setting:** Community **Gender:** Intervention: 80% female; control: 60% female **Ethnicity:** Intervention: 70% white; control: 90% white **SES:** Mean years education: Intervention 13.8 (2.4); control 13.1 (1.9)	**Intervention (N=10):** Group-based interactive video gaming using Nintendo Wii; 90 mins week for 24 weeks The Wii Sports games, including bowling, golf, tennis, and baseball were the core of the sessions. From week 7, participants were introduced to new games for 15-30 mins of the session. In weeks 10 and 20 participants competed in Wii tournaments to encourage enhanced effort and social interaction **Control (N=10):** Health education designed to provide a source of passive cognitive stimulation in a socially matched setting ; 90 mins week for 24 weeks	**Follow-up:** 24 weeks (post-intervention) & at 1 year **Lost to follow-up:** 10% (1 died by 1-year follow-up, 1 did not complete post-intervention assessment) **Outcome measurement:** Cognitive function: Computerized Assessment of Mild Cognitive Impairment (CAMCI) Subjective cognitive ability: Cognitive Self-Report Questionnaire-25 Social functioning: Cognitive Self-Report Questionnaire-25 Other outcomes; mood, IADL, gait speed	**Adherence:** The Wii group attended an average of 23.1 (SD 1.1, range 21–24) sessions compared with 21.8 (SD 3.3, range 14–24) in the control group; 18 participants attended at least 20/24 sessions; and 9 attended all sessions **Cognitive function:** No significant differences between intervention and control groups No significant differences for any other outcomes measured

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Park 2014 Synapse Project	RCT	US	60 to 90 Mean 71.7	Older adults without cognitive impairment MMSE at baseline 26+ **Setting:** Community **Gender:** 73.9% female **Ethnicity:** 14.2% 'minority' (not described) participants **SES:** Only those with 10th grade + education were included	**6 lifestyle conditions:** comparing productive engagement with receptive engagement (did not actively acquire new skills) which involve different cognitive function Participated in all conditions for an average of 16.51 hr a week for 3 months (except for no treatment control) **Productive engagement:** Photo (N=29): novice participants learned digital-photography and computer skills using photo-editing software **Quilting (N=35):** novice participants learned how to design and sew quilts **Dual condition (N=42):** participants spent half of the 3 months doing quilting and the other half on photography **Receptive engagement:** Social condition (N=36): participants engaged in on-site, facilitator-led social interactions, field trips, and entertainment. **Placebo condition (N=39):** Tasks off site that appeared to be beneficial to cognition but had no substantiated link to cognitive improvement (e.g., listening to classical music, completing word-meaning puzzles). **No treatment control (N=40)**	**Follow-up:** 3 months intervention and follow-up **Lost to follow-up:** **Outcome measurement:** Processing speed, assessed using digit-comparison tasks with three, six, and nine items Mental control, assessed using Flanker Center Letter, Flanker Center Arrow, and Flanker Center Symbol tasks and the Cogstate Identification Task Episodic memory, assessed using the immediate recall section of the modified Hopkins Verbal Learning Task, the Cambridge Neuropsychological Test Automated Battery (CANTAB) Verbal Recognition Memory Task and the long-delay section of the modified Hopkins Verbal Learning Task. Visuospatial processing, assessed using the CANTAB Spatial Memory Task, the CANTAB Stockings of Cambridge Task, and a modified version of Raven's Progressive Matrices	Episodic memory: sig diffs between photo group and placebo (p=0.01) and for dual condition and placebo (p=0.05). No significant effects were found for other conditions (quilt or social) compared to placebo No significant difference between the two receptive-engagement conditions (p = 0.59), and the three productive-engagement conditions did not differ from one another (p = 0.19. Productive engagement (the quilt, photo, and dual conditions) caused a significant increase in episodic memory compared with receptive engagement (the social and placebo conditions) The three productive-engagement groups were superior in episodic memory when compared with the social group alone In summary, the evidence suggests that sustained effort to acquire a demanding new skill improves episodic memory; no evidence suggesting that socializing, information exchange, and novelty alone facilitate cognitive function. Participants in the photo and dual conditions exhibited a significant improvement in episodic memory, whereas the effect was not significant for those in the quilt condition (p = 0.11) but was in the direction of facilitation

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Pitkala 2011	RCT	Finland	75+ Mean: 80 (3.6	**Population:** Older adults with subjective feelings of loneliness 80.2% of intervention group and 78.8% of control group lived alone. Mean MMSE at baseline: Intervention: 26.9 (2.4); control (26.6) (2.6). N=235 randomised **Setting:** Day care centres **Gender:** Female Intervention: 74.4%; control: 72.9% **Ethnicity:** Not reported **SES:** % with economic status good or moderate: Intervention 97.2; control: 96.2	**Intervention (N=117):** Socially stimulating group intervention aimed at enhancing interaction and friendships between participants and to stimulate them socially. Groups were facilitated by trained professionals. Participants were divided into 3 groups depending on their interests: therapeutic writing (N=48); group exercises (N=92); or art experiences (N=95) and then randomised to intervention or control within those groups. Intervention was once per week and usually lasted for 6 hours and was provided free of charge **Control (N=118):** Continued in normal community care. They could participate in their normal hobbies and activities but no intervention was arranged for them	**Follow-up:** 3, 6 months for cognitive outcomes **Lost to follow-up:** Intervention: 6.0%; control: 17.8% **Outcome measurement:** Cognition by Alzheimer's disease assessment scale (ADAS-cog) and mental function by 15D measure and psychological wellbeing and HRQoL at 12 months	**ADAS-Cog scale (3 months)** Mean changes (all participants) I: -2.6points (95% CI -3.4 to -1.8) C: -1.6 points (95% CI -2.2 to -1.0 (p=0.023; F1,167.8 = 5.23) Art group I: -2.4 points (95% CI -3.5 to -1.3) C: -1.8 points (95% CI -2.9 to -0.8) (p=0.17; F1,47.2 = 1.88) Exercise group I: -3.2 points (95% CI -4.7 to -1.7) C: -1.6 points (95% CI 2.6 to –0.5 (p=0.60; F1,72.7 = 0.28) Writing group I: -1.7 points (95% CI -2.7 to -0.7) C: -1.2 points (95% CI -2.7 to 0.3) (p=0.033; F1,33.6 = 4.49) 15D index dimension of mental function) over 12 months I: +0.048 (95%CI: +0.013 to +0.085) C: -0.027 (95%CI: -0.063 to +0.010) (p=0.004; t = 2.89, df=187) Note: Cognitive outcomes also measured at 6 months but not reported here.

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Stine-Morrow 2007 Senior Odyssey programme	Quasi-RCT (field experiment) Assigned those from retirement villages to the exper-imental group because of effort put in to build relation-ships. So not properly randomised	US	Range 55-93 Mean: I: 73.6, range 60–93 C: 70.2, range 58–85	Older adults living in the community or retirement villages N=81 [initially 85] randomised **Setting:** Community programme **Gender:** Not reported **Ethnicity:** Not reported **SES:** Mean years education: intervention: 16.1 (0.4); control: 15.4 (0.7)	**Intervention (N=61):** Engaged lifestyle programme. Team-based, competitive programme of creative problem solving involving repeated opportunities for engagement with ill-defined problems with multiple solutions. (The programme was developed from a well-established programme for children and young adults) **Control (N=24):** Wait-list control	**Follow-up:** 20 week intervention (Note: pre- and post cognitive tests up to 9 months apart). **Lost to follow-up:** Intervention: 18% (20 wks); control: 12% **Outcome measurement:** Cognitive outcomes 1. Processing speed: Letter and Pattern Comparison tasks and Finding As and Identical Pictures 2. Working memory: Letter–Number Sequencing 3. Inductive reasoning: Letter Sets and Figure Classification and Everyday Problem Solving 4. Visual-spatial processing: Card Rotation and Hidden Patterns 5. Divergent thinking (fluency): Word Association, Ornamentation, and Opposites, FAS and Alternate Uses Dispositions reflective of cognitive engagement: Mindfulness, need for cognition, memory self-efficacy, activity	Mean participation: 17.3 weeks out of 20 (86.5%) Only processing speed showed differential positive change in the experimental group relative to the control group; differential change in divergent thinking reached a marginal level of significance. **Predisposition toward cognitive engagement** Change (from pre-to-post intervention SD) **Intervention** Mindfulness -0.02 Need for cognition 0.11 Metamemory in adulthood (MIA) self-efficacy -0.06 Perceived activity level -0.11 Processing speed 0.09 Working memory 0.12 Inductive reasoning 0.22 Visuospatial processing 0.33 Divergent thinking 0.29 **Control** Mindfulness -0.40 Need for cognition -0.28 MIA self-efficacy -0.09 Perceived activity level 0.15 Processing speed 0.70 Working memory -0.06 Inductive reasoning -0.29 Visuospatial processing 0.01 Divergent thinking 0.11 **Between group difference (p value)** Mindfulness 2.03 (0.02) Need for cognition 1.85 (0.03) MIA self-efficacy 0.18(>0.20) Perceived activity level -1.80 (0.08) Processing speed 1.76 (0.04) Working memory 0.85 (0.20) Inductive reasoning 1.17 (0.12) Visuospatial processing 1.03 (0.15) Divergent thinking 1.32 (0.10)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Stine-Morrow 2007 Senior Odyssey programme *(cont...)*							**Correlations Between Measures of Perceived Cognitive Engagement and Cognitive Components (p value)** **Mindfulness** Processing speed 0.12 (ns) Working memory 0.12 (ns) Inductive reasoning 0.20 (ns) Visuospatial processing 0.14 (ns) Divergent thinking 0.26 (p<0.05) **Need for cognition** Processing speed 0.11 (ns) Working memory 0.20 (ns) Inductive reasoning 0.26 (p<0.05) Visuospatial processing 0.30 (p<0.01) Divergent thinking 0.19 (ns) **MIA self-efficacy** Processing speed 0.21 Working memory 0.26 (p<0.05) Inductive reasoning 0.39 (p<0.01) Visuospatial processing 0.28 (p<0.01) Divergent thinking .11 **Perceived activity level** Processing speed 0.30 (p<0.01) Working memory 0.25 (p<0.05) Inductive reasoning 0.44 (p<0.01) Visuospatial processing 0.39 (p<0.01) Divergent thinking 0.38 (p<0.01)

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Stine-Morrow 2008 Senior Odyssey programme (appears to be a different study from Stine-Morrow 2007 above) Note: recruitment was conducted over 2 years/ seasons so data reported in Stine-Morrow 2007 may be first wave of data that may also be reported in this trial	Quasi-RCT (field experiment) Assigned those from retirement villages to the experimental group because of effort put in to build relationships. So not properly randomised	US	Intervention: 73.0, range: 59–93 Control: 72.0, range: 58–91	Older adults from the community and local retirement communities N=181 randomised **Setting:** Community **Gender:** Not reported **Ethnicity:** Not reported **SES:** Years of education (mean): Intervention 16.3 (SE 4), Control 16.0 (SE 3)	**Intervention (N=107):** Engaged lifestyle programme. Team-based, competitive program of creative problem solving involving repeated opportunities for engagement with ill-defined problems with multiple solutions. (The programme was developed from a well-established programme for children and young adults). **Control (N=74):** Wait-list control	**Follow-up:** 20 week intervention **Lost to follow-up:** Intervention: 19%; control: 15% did not completed post-test Those who returned for follow-up scored higher for speed of processing at pretest than those who did not return **Outcome measurement:** Cognitive ability: composite measure of fluid ability Measures of dispositions reflective of habitual cognitive engagement: Mindfulness, need for cognition, memory self-efficacy	Adherence to the programme: Attendance at weekly meetings was variable (6-20 session; mean 15.5 (SE4) **Cognitive tests (one-tailed tests)** Different in change significant for speed t(146)=1.81, p=0.036 Inductive reasoning t(146)=1.83, p=0.034 Divergent thinking t(147)=1.88, p=0.031 Not significant for Working memory t(146)=1.01, p=0.136 Visual-spatial processing t(144)=.60, p=0.275. Overall showed differential positive change among those who participated in the cognitive intervention, t(149)=3.11, p=0.001 Control group vs. experimental group Self-efficacy, t(133) = −1.59 Mindfulness, t(128)=0.81 Need for cognition, t(130)=0.68

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Stine-Morrow 2014 Senior Odyssey programme versus cognitive training programme	Quasi-RCT Some participants not randomly allocated to meet project deadlines	US	60 to 94 Mean: 72.6	Healthy older adults from the community and local retirement communities N=461 randomised **Setting:** Community **Gender:** Engagement intervention: 71% female; Cognitive training intervention 77% female; Waiting list control: 76% female **Ethnicity:** Not reported **SES:** Years of education (mean): Engagement intervention 15.7 (2.6); Cognitive training intervention 15.2 (2.7); Control 15.4 (2.5)	**Engagement programme (Senior Odyssey) (N=188):** A team-based competitive program in creative problem solving (no explicit instruction) As above **Cognitive training (N=130):** Home-based inductive reasoning training program (instruction and practice explicit) **Wait-list control (N=143):** No intervention but participated in testing as a control for re-test effects	**Follow-up:** 16 weeks intervention but pre- and post-test were 30 to 32 weeks apart **Lost to follow-up:** Engagement: 16 %; Cognitive training: 12 %; Wait-list: 12% **Outcome measurement:** Cognitive Outcomes: Processing Speed: Letter and Pattern Comparison tasks and the Finding A's task Reasoning: Letter Sets, Number Series, Letter Series, and Word Series tasks and the Everyday Problem-Solving (EPS) task Visual-spatial processing (VSP): Card Rotation and Hidden Patterns Divergent Thinking: Alternate Uses task and the Opposites task Verbal Episodic Memory: Was measured using two indicators derived from performance on the Hopkins Verbal Learning Test; total number of words remembered over three trials (HVLT-Tot) and the delayed recall score (HVLT-DR) and proportion of correct propositions recalled in an immediate sentence free-recall task	**Adherence to the programmes:** Engagement participants attended an average of 11.0 out of 16 session (SD 4.8) and Training participants completed an average of 12.9 modules out of 16 (SD -5.2); this difference in adherence was significant, $F(1, 317)$ 11.42, $p < 0.001$ **Pre-to-post change effect sizes:** Results presented graphically **Key results:** Those in the training condition showed selective improvement in inductive reasoning. Training participants showed more change than both Engagement and Waitlist participants and Engagement and Waitlist participants did not change from each other. Those in the engagement condition showed selective improvement in divergent thinking. Neither the Waitlist or Training group had significant re-test effects **Correlations between baseline characteristics and latent training improvements** **Divergent Thinking:** Engagement: Statistically significant ($p<0.05$) differences for age, Montreal Cognitive Assessment (MoCA), verbal, openness, need for cognition, social network index **Inductive Reasoning:** Training: Statistically significant differences for MoCA, Verbal

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Tesky 2011 AKTIVA study	RCT	Germany	50+ Median: 72 (7)	Older adults without dementia or cognitive impairment N=307 randomised **Setting:** Community **Gender:** 72.3% female [73.1% of analysed sample (N=152)] **Ethnicity:** German & Turkish ethnicity in initial sample; only German ethnicity in analysed sample **SES:** 'Most participants had attended school for about 10 years, and only a few participants had completed an academic university education'	AKTIVA intervention (n = 126): Group programme of cognitively stimulating leisure activities (8 weekly sessions and two booster sessions after a break of 4 months) AKTIVA intervention plus nutrition and exercise counseling (n = 84): Control group (n = 97): No intervention	**Follow-up:** 8 week intervention and post-test conducted 1 week after (week 9); 2 booster sessions conducted at 27 to 28 weeks and then follow-up tests conducted 29 weeks after start of intervention **Lost to follow-up:** N=67 (21.8%) withdrew from the study. Those with impaired cognition (N=28) and N=4 Turkish participants excluded from analysis after the programme. **Outcome measurement:** Cognitive outcomes: Mini-Mental Status Test ADAS-Cog: the cognitive part of the Alzheimer's Disease Assessment Scale Part A and B of the Trail-Making Test Clinical Dementia Rating (CDR) Self-report questionnaires	**Cognitive outcomes** Older persons (≥75 years) showed enhanced speed of information processing (by TMT Version A) ($F = 4.17^*$, $p < 0.05$); younger participants (< 75 years) showed an improvement in subjective memory decline (by MAC-Q) ($F = 2.55^*$, $p < 0.05$). **Frequency of leisure activities** Additionally, AKTIVA enhanced the frequency of activities for leisure activities for subassembly groups

Table 45: Social – Included studies about barriers and facilitators

Study	Study design	Country	Age (years)	Population	Objective	Quality
Qualitative studies						
Goll 2015	Qualitative (semi-structured interviews)	UK	60+ Range 62-100; mean 79 (12)	Older adults (N=15) identified by voluntary organisations in urban and multicultural areas of London, identified by staff as accessing none/few social opportunities or experiencing loneliness/social isolation All participants lived alone, except one who lived with her husband who had severe dementia **Gender:** 66.7 % female **Ethnicity:** 73.3% (N=11) white British; 13.3% (N=2) Black Caribbean; 6.7% (N=1) Central Asian; 6.7% (N=1) South-East European **SES:** Standard Occupational Classification (SOC): 1 (management, N=2); 2 (professional, N=4); 3 (technical, N=1); 4 (administrative, N=2); 5 (skilled trades, N=2); 8 (operative, N=2); 9 (elementary, N=2)	Barriers to social participation among lonely older adults	++
Barriers and facilitators to a specific intervention						
Cattan 2011	Qualitative (interviews)	UK	Range mid-50s to early-90s	N=40 in total. Older service recipients (N=27) of a national telephone befriending scheme for isolated and/or lonely older adults from 8 project sites across the UK; and service volunteers (N=6); combined recipients and service volunteers (N=7)	Qualitative evaluation of a national telephone befriending scheme	++
People who work with older adults						
Anderson 2009 J Appl Ger	Qualitative (survey with open-ended questions). Also descriptive stats & frequencies	US	Of stylists: 18-30y 12.5% 31-45y 25.0% 45-60y 50.0% 61y and above, 12.5%	N=40 hairstylists from 31 randomly selected salons **Gender:** 85% female **Ethnicity:** 80.0% white, 17.5% African American, 2.5 % other **SES:** High school or GED 32.5%; some college 52.5%; associates degree 12.5%	To understand relationships and informal social support from hairdressers with older adult clients	-

Table 46: Social – Quality assessment of systematic reviews of social participation interventions

AMSTAR (High= 8-11, Good= 5-7, Poor= <5)

Key: 1. 'a priori design; 2. duplicate study selection and data extraction; 3. comprehensive literature search; 4. Status of publication as an inclusion criterion; 5. List of studies (included and excluded provided)?; 6. Characteristics of the included studies provided? 7. Scientific quality of the included studies assessed and documented; 8. Scientific quality of the included studies considered in formulating conclusions; 9. Appropriate method to combine findings; 10. Publication bias; 11. Conflict of interest

Author (Year)	1	2	3	4	5	6	7	8	9	10	11	Rank-ing
Berger 2013 (Arbesman 2013 methods)	N	N	Y	Y	Y for included studies; N for exclud-ed	N	N	N	N/A	N	N	**Low**
Bickerdike 2014	Over-view of the above SRs – no assess-ment tool											**Unclear**
Cattan 2005	N	Y for study, unclear for abstract screen-ing/data extrac-tion	YN	Y	Y for included studies; broken link for exclud-ed	Y	Y	Y	N/A	N	Partly for SR; N for included studies	**High**
Choi 2012 Healthcare Info	N	N (not report-ed)	Y	Y	Y	Y	Y	Y	Y	Y	N	**High**
Dickens 2011	Y Protocol not re-ferred to in main text	Y	Y	Y	Y for included studies; N for ex-cluded	Y	Y	Y	Y	N	Y	**High**

Author (Year)	1	2	3	4	5	6	7	8	9	10	11	Ranking
Findlay 2003	N	N (not reported)	Y	Y	Y for included studies; N for excluded	Y	N	N	N/A	N	N	**Low**
Forsman 2011	N	Y	Y	Y	Y for included studies; N for excluded	Partly (some data in meta-analysis)	N (not reported for individual studies)	Y	Y	N	Y	**Moderate**
Hagan 2014	N	N	Y	Y	Y for included studies; N for excluded	Y	N	N	N/A	N	N	**Low**
Heaven 2013	N	Y	Y	Y	Y for included studies; N for excluded	Y	Y	Y	N/A	N	Y	**High**
Morris 2014	N	Y	Y	Y	Y for included studies; N for excluded	Y	Y	Y	N/A	N	Y (for SR), N for included studies	**High**
Nef 2013	Y (author's roles refer to protocol but not in Methods)	Y			Y for included studies; N for excluded	Y	N	N	N/A	N	Y	**Moderate**

Table 47: Social – Quality assessment of intervention studies for social participation

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Over-all*	B1	B2	B3	*Over-all*	C1	C2	C3	*Over-all*	D1	D2	D3	D4	D5	*Over-all*	
RCTs																			
Carballo-García 2013	N/A	N/A	N/A	*High*	N/A	No	N/A	*N/A*	N/A	N/A	N/A	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**High**
Carlson 2008 (Fried 2004)	Un-clear	Un-clear	Un-clear	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Cohen-Mansfield 2015	Un-clear	Un-clear	Un-clear	*Un-clear*	Yes	No	No	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Un-clear	Yes	Yes	Yes	Yes	*Low*	**Unclear**
Hughes 2014	Yes	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Park 2014	Un-clear	Un-clear	Yes	*Un-clear*	Yes	No	No	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Pitkala 2011	Yes	Yes	Yes	*Low*	No	Un-clear	Un-clear	*Un-clear*	Yes	Yes	No	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Stine-Morrow 2007	Un-clear	Un-clear	Yes	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Un-clear	Un-clear	Un-clear	*Un-clear*	Un-clear	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Stine-Morrow 2008	Un-clear	Un-clear	Un-clear	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	No	No	*Un-clear*	Un-clear	Yes	Yes	Un-clear	Un-clear	*Uncle-aer*	**Unclear**
Stine-Morrow 2014	Un-clear	Un-clear	Yes	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	*Low*	Un-clear	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Tesky 2011	Un-clear	Un-clear	Yes	*Yes*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**

Table 48: Social – Quality assessment of qualitative studies for social participation

	1. Theoretical approach		2. Study design	3. Data collection	4. Validity		5. Analysis				6. Ethics		Overall
	1.1	1.2	2.1	3.1	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	
Anderson 2009	Appropriate	Clear	Not sure	Inadequately reported	Clear	Not sure	Poor	Not sure	Not sure	Not sure	Not re-ported	Not clear	**Low**
Cattan 2011	Appropriate	Clear	Defensible	Not clear (unclear who conducted interviews)	Un-clear	Relia-ble	Not sure	Relia-ble	Not sure	Adequate	Yes	Clear	**Moderate**
Goll 2015	Appropriate	Clear	Defensible	Appropriate	Clear	Relia-ble	Rich	Relia-ble	Convincing	Adequate	Yes	Clear	**High**

Table 49: Leisure – Interventions to improve uptake/maintenance of leisure activities

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Matsuka 2003 Designing a Life of Wellness Program	Before and after study	US	70-92	Older adults living in senior apartment complexes. N=65 **Setting:** Community **Gender:** 95% female **Ethnicity:** Not reported **SES:** 'target population was middle to upper class older adults'	**Intervention:** Program focused on the importance of participation in meaningful social and community occupations for better quality of life and strategies to remove personal and environmental barriers. Comprised 6 months of weekly 1 1/2 hour educational classes taught by occupational therapists	**Follow-up:** 6 months **Lost to follow-up:** 40% (65 participated but complete pre- and post test data was only available for 39) **Outcome measurement:** Self-reported, SF36 Health Survey Scale: results reported by specific domains, including social functioning outcomes **Frequency of socialisation and community participation:** Self-reported, 5-point Likert scale questionnaire	**Social functioning:** Scores on the SF-36 Health Survey were significantly higher in social functioning following participation in the program: pre: 69.55 (30.32); post: 77.24 (24.81); p</=0.01) **Frequency of socialisation and community participation:** Mean number of participants who communicated with family, friends, or support persons at least 3 times per week increased from 47% to 56%. Mean number of participants who participated in social or community activities increased from 56% to 66% **Other outcomes:** Scores on the SF-36 Health Survey were significantly higher for vitality, and the mental health summary scores after the programme

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Zingmark 2014	RCT (pilot)	Sweden	Range 77-82 Mean: 79	Generally well older adults, without apparent cognitive or communication prob-lems and without major activity restrictions; who lived alone, without home care in an urban area At baseline, participants performed a mean of 8 leisure activities N=177 randomised **Setting:** Community **Gender:** 82% women **Ethnicity:** Not reported **SES:** Post high school education: CG: 26.7%; IG: 31.7%; AG: 30.6%; DG: 42.1%	Interventions to increase occupational engagement (participation in a wide range of activities e.g. physical, social and leisure activities). All interventions were based on concepts of healthy eating and health promotion and were delivered by occupational therapists. All interventions involved discussion of meaningful activities and coping with age-related activity restrictions to improve or maintain engagement in valued activities **Individual intervention (IG) (N=41):** using a client-centred, goal orientated approach. Also involved engagement in activities when identified **Activity group (AG) (N=49):** OT-led group format and included engagement in activities such as walking with a pedometer, cooking, visiting a coffee shop **Discussion group (DG) (N=41):** participated in one lecture and discussion group about engagement and healthy ageing. OT led group format **Control group (CG) (N=46):** No intervention	**Follow-up:** 3, 12 months **Lost to follow-up: I**G: 7.3%; AG: 6.1%; DG: 17.1%; Control: 15.2% All participants included in ITT analysis. **Outcome measurement:** Leisure engagement measured using Modified NPS interest checklist (MNPS); This covers 20 checklists and leisure engagement was a composite of self-report of whether they performed the activity, wanted to perform the activity and importance for wellbeing ratings **Activities of daily living (ADL) ability**	**Leisure engagement outcomes** All groups showed a decline in leisure engagement between baseline and 3 and 12 months At 3 months, all intervention groups showed less decline in leisure engagement than the control group but significance of between group differences not reported Effect sizes were small. Statistical significance of difference between groups was not reported At 12 months, the Individual intervention and the Discussion group maintained less decline in leisure engagement than the control group but significance of between-group differences not reported **ADL** All the intervention groups and control showed decline from baseline to T3 Statistical significance of difference between groups was not reported

Table 50: Leisure – Interventions to improve uptake/maintenance of leisure activities with cognitive outcomes

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Volunteering							
Carlson 2008, Fried 2004 (no cog outcomes) Experience Corps	RCT (pilot) (cluster randomised by school)	US	Mean: Intervention: 70.1 (6.42) Control : 68.4 (5.15)	Older adults N=149 randomised Baseline MMSE: Intervention: 24.96 (3.45); Control: 25.3 (2.60) **Setting:** Community **Gender:** Intervention: 83% female; Control 93% female **Ethnicity:** Intervention: 94% black; Control: 95% black **SES:** Mean years education: Intervention: 11.9 (2.54); Control: 11.2 (2.66); 38% had less than high school education	Experience Corps places older volunteers in public elementary schools in roles designed to meet schools' needs and increase the social, physical, and cognitive activity of the volunteers Community-based program designed to increase cognitive and physical activity in a social, real-world setting **Intervention (N=70):** Participants randomized to EC trained in teams to help elementary school children with reading achievement, library support, and classroom behaviour for 15 hr/week **Control (N=58):** Wait-list control	**Follow-up:** 4 to 8 months **Lost to follow-up:** Intervention: 11.4%; control: 17.2%. **Outcome measurement:** memory, executive function (EF), and psychomotor Speed: Trail Making Test: Parts A and B Word list memory: Immediate recall Delayed recall Rey-Osterrieth: Copy score Delayed recall	**Cognitive outcomes:** (age and education adjusted) Trail-making test Part A: No nificant difference between groups Part B: Significant difference between intervention and control groups at follow-up ($p<0.05$). Intervention group improved by 1.3 secs from baseline; control group declined 21.7 secs from baseline Word list memory No significant difference between groups for immediate or delayed recall Rey-Osterrieth CFT Copy score: No significant difference between groups Delayed recall: Significant difference between intervention and control groups at follow-up ($p<0.05$). Intervention group improved by 1.0 points and control group declined by 0.7 points

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Learning new leisure skills e.g. digital photography, quilting, music education and playing an instrument							
Bugos 2007	RCT	US	60-85	Musically inexperienced community-dwelling older adults N=31 randomised Setting: Community Gender: Intervention: 81.0% female; control: 77.8% female Ethnicity: Not reported SES: Mean years education: Intervention: 16.5; control 16.3	Intervention (N=16): Piano instruction: A broad-based music education program, including instruction with progressive difficulty in musical performance, technical motor/dexterity exercises, and music theory. Lessons were half an hour each week plus independent practice for a minimum of 3 hours a week Control (N=15): No intervention	Follow-up: 6 months (end intervention) and 3 months later (9 months from baseline) Lost to follow-up: Intervention 23.8%; control 16.7% Outcome measurement: Digit Symbol, Digit Span, Block Design, Letter Number Sequencing, and Trail Making	The experimental group significantly improved performance on the Trail Making Test and Digit Symbol measures as compared to healthy controls, but not other cognitive measures

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Park 2014 Synapse Project	RCT	US	60 to 90 Mean 71	Older adults without cognitive impairment MMSE at baseline 26+ **Setting:** Community **Gender:** 73.9% female **Ethnicity:** 14.2% 'minority' (not described) participants **SES:** Only those with 10th grade + education were included	**6 lifestyle conditions:** comparing productive engagement with receptive engagement (did not actively acquire new skills) which involve different cognitive function Participated in all conditions for an average of 16.51 hr a week for 3 months (except for no treatment control) **Productive engagement:** **Photo (N=29):** novice participants learned digital-photography and computer skills using photo-editing software **Quilting (N=35):** novice participants learned how to design and sew quilts **Dual condition (N=42):** participants spent half of the 3-months doing quilting and the other half on photography **Receptive engagement:** **Social condition (N=36):** participants engaged in on-site, facilitator-led social interactions, field trips, and entertainment **Placebo condition (N=39):** Tasks at home that appeared to be beneficial to cognition but had no substantiated link to cognitive improvement (e.g., listening to classical music, completing word-meaning puzzles) **No treatment control (N=40)**	**Follow-up:** 3 months intervention and follow-up **Lost to follow-up:** **Outcome measurement:** Processing speed, assessed using digit-comparison tasks with three, six, and nine items Mental control, assessed using Flanker Center Letter, Flanker Center Arrow, and Flanker Center Symbol tasks and the Cogstate Identification Task Episodic memory, assessed using the immediate recall section of the modified Hopkins Verbal Learning Task, the Cambridge Neuropsychological Test Automated Battery (CANTAB), Verbal Recognition Memory Task and the long-delay section of the modified Hopkins Verbal Learning Task Visuospatial processing, assessed using the CANTAB Spatial Memory Task, the CANTAB Stockings of Cambridge Task, and a modified version of Raven's Progressive Matrices	**Episodic memory:** significant differences between photo group and placebo (p=0.01) and for dual condition and placebo (p=0.05). No significant effects were found for other conditions (quilt or social) compared to placebo But this doesn't look right from graph?

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Leisure activities in general							
Tesky 2011 AKTIVA study	RCT	Germany	50+ Mean: 72 (7)	Older adults without dementia or cognitive impairment N=307 randomised **Setting:** Community **Gender:** 72.3% female **Ethnicity:** 'German ethnicity' reported for those included in analysis **SES:** 'Most participants had attended school for about 10 years, and only a few participants had completed an academic university education'	**AKTIVA intervention (n = 126):** Group programme of cognitively stimulating leisure activities (8 weekly sessions and two booster sessions after a break of 4 months). Sessions included information and education about dementia and risk factors and the importance of a healthy, active lifestyle, awareness and motivational factors. Participants were instructed and motivated to perform more cognitively stimulating leisure activities such as reading, playing games or playing music as part of their daily routine **AKTIVA intervention plus nutrition and exercise counselling (n = 84):** in addition to the cognitively stimulating leisure activities, participants could engage in e.g. walking, yoga, gymnastics and healthy eating sessions **Control group (n = 97):** No intervention	**Follow-up:** 8 week intervention and post-test conducted 1 week after (week 9); 2 booster sessions conducted at 27 to 28 weeks and then follow-up tests conducted 29 weeks after start of intervention **Lost to follow-up:** N=67 (21.8%) withdrew from the study. Those with impaired cognition (N=28) and N=15 Turkish participants excluded from analysis after the programme. N=208 analysed **Outcome measurement:** Cognitive outcomes: Mini-Mental Status Test ADAS-Cog: the cognitive part of the Alzheimer's Disease Assessment Scale Part A and B of the Trail-Making Test Clinical Dementia Rating (CDR)	Participation in the group program resulted in positive effects on cognitive function and attitude toward aging. Older adults (≥75 years) showed enhanced speed of information processing (by TMT Version A) ($F = 4.17^*$, $p < 0.05$); younger participants (< 75 years) showed an improvement in subjective memory decline (by MAC-Q) ($F = 2.55^*$, $p < 0.05$) Additionally, AKTIVA enhanced the frequency of activities for leisure activities

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Crosswords							
Murphy 2014	RCT	Ireland	57-90 Mean: 71.5 (SD = 8.3)	Community-dwelling older adults with normal cognition N=37 randomised **Setting:** Community **Gender:** 73.0% female **Ethnicity:** Not reported **SES:** No difference in education between groups but level not reported	**Intervention:** Crossword group (N=19): asked to attempt one crossword daily for 4 weeks. A mixture of simple and cryptic crosswords from a national newspaper was used **Control (N=18):** asked to keep a diary in which they daily recorded three things for which they felt grateful Note: no measures were taken to ensure compliance by either the crossword or gratitude group	**Follow-up:** 4 week intervention and follow-up **Lost to follow-up:** Not reported **Outcome measurement:** Phonemic verbal fluency (PVF): measured using Controlled Oral Word Association Test (COWAT)	After 4 weeks, the crossword group had significantly higher Phonemic Verbal Fluency (PVF) scores and for the cluster size component [F (1, 35) = 3.17, p = 0.042, partial eta squared = 0.083] with a moderate effect size
Interactive gaming (Note this only includes interactive games – solely video games will probably be under cognitive training)							
Hughes 2014	RCT	US	Mean: Intervention: 78.5 (7.1); control: 76.2 (4.3)	Older adults with MCI recruited from a population cohort study Mean MMSE at baseline 27.1 (1.8) N=20 randomised **Setting:** Community **Gender:** Intervention: 80% female; control: 60% female **Ethnicity:** Intervention: 70% white; control: 90% whit. **SES:** Mean years education: Intervention 13.8 (2.4); control 13.1 (1.9)	**Intervention (N=10):** Group-based interactive video gaming using Nintendo Wii; 90 mins/week for 24 weeks The Wii Sports games, including bowling, golf, tennis, and baseball were the core of the sessions. From week 7, participants were introduced to new games for 15-20 mins of the session. In weeks 10 and 20 participants competed in Wii tournaments to encourage enhanced effort and social activation **Control (N=10):** Health education designed to provide a source of passive cognitive stimulation in a socially matched setting; 90 mins/week for 24 weeks	**Follow-up:** 24 weeks **Lost to follow-up:** 10% (1 died, 1 did not complete follow-up assessment) **Outcome measurement:** Cognitive function: Computerized Assessment of Mild Cognitive Impairment (CAMCI) Subjective cognitive ability: Cognitive Self-Report Questionnaire-25 Social functioning: Cognitive Self-Report Questionnaire-25 Other outcomes; mood, IADL, gait speed	**Adherence:** The Wii group attended an average of 23.1 (SD 1.1, range 21–24) sessions compared with 21.8 (SD 3.3, range 14–24) in the control group; 18 participants attended at least 20/24 sessions; and 9 attended all sessions **Cognitive function:** No significant differences between intervention and control groups No significant differences for any other outcomes measured

Study	Study design	Country	Age (years)	Population and setting	Intervention and comparator	Relevant outcomes and follow-up	Key results
Meditation							
Gard 2014	Systematic review	Interna-tional	Not reported	Review aimed to examine the effects of meditation on cognitive decline Studies in any population included. Included studies were in people with healthy cognitive function, poor cognitive function and dementia caregivers (normal function) Setting, gender, ethnicity and SES not generally reported for relevant intervention studies	Studies covering a range of meditation techniques were included: including mantra-based meditations such as TM, Kirtan Kriya yogic meditation (KKYM), and meditations that involve focusing on a visual object,to Buddhist-based mindfulness practices, including Shamata-Vipassana,81 Zen, and other forms. Two studies did not clearly describe the meditation techniques	Range of outcomes relevant to ageing included	N=12 studies included, of which 6 were RCTs. Preliminary positive effects on attention, memory, executive function, processing speed, and general cognition were reported across studies. However, most studies had a high risk of bias and small sample sizes

Table 51: Leisure – Quality assessment of leisure activity intervention studies

	Selection bias				Performance bias				Attrition bias				Detection bias						Summary Risk of Bias
	A1	A2	A3	*Over-all*	B1	B2	B3	*Over-all*	C1	C2	C3	*Over-all*	D1	D2	D3	D4	D5	*Over-all*	
RCTs																			
Bugos 2007	Un-clear	Un-clear	Yes	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Carlson 2008 (Fried 2004)	Un-clear	Un-clear	Un-clear	*Un-clear*	No	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Hughes 2014	Yes	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Murphy 2014	Un-clear	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Un-clear	Un-clear	Un-clear	Un-clear	Un-clear	*Un-clear*	**Unclear**
Park 2014	Un-clear	Un-clear	Yes	*Un-clear*	Yes	No	No	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Tesky 2011	Un-clear	Un-clear	Yes	*Yes*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Un-clear	Un-clear	*Un-clear*	Yes	Yes	Yes	Un-clear	Un-clear	*Un-clear*	**Unclear**
Zingmark 2014	Yes	Un-clear	Yes	*Un-clear*	Yes	No	No	*Un-clear*	Yes	Un-clear	Yes	*Un-clear*	Yes	Un-clear	Yes	Yes	Yes	*Un-clear*	**Unclear**
Non-randomised studies																			
Matsuka 2003	N/A	N/A	N/A	*High*	N/A	Un-clear	Un-clear	*Un-clear*	N/A	No	No	*Un-clear*	Yes	Un-clear	Yes	Un-clear	Un-clear	*Un-clear*	**High**

Table 52: Leisure – Quality assessment of systematic reviews of leisure activity interventions

AMSTAR (High= 8-11, Good= 5-7, Poor= <5)

Key: 1. 'a priori design; 2. duplicate study selection and data extraction; 3. comprehensive literature search; 4. Status of publication as an inclusion criterion; 5. List of studies (included and excluded provided)?; 6. Characteristics of the included studies provided? 7. Scientific quality of the included studies assessed and documented; 8. Scientific quality of the included studies considered in formulating conclusions; 9. Appropriate method to combine findings; 10. Publication bias; 11. Conflict of interest

Author (Year)	1	2	3	4	5	6	7	8	9	10	11	Rank-ing
Gard 2014	N	Y	Y	Y	Y	Y	Y	Y	N/A	N/A	Y	+