Can cognitive exercise prevent the onset of dementia? Systematic review of randomized clinical trials with longitudinal follow-up

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CRD summary
This review concluded that cognitive exercise training in healthy older individuals produced strong and persistent protective effects on longitudinal neuropsychological performance. Given the poor quality of the included studies and numerous issues with the review process, which included no attempt to control for bias and error and double-counting, the reliability of this conclusion is unclear.

Authors’ objectives
To assess whether cognitive exercise can prevent the onset of dementia in healthy elderly individuals.

Searching
MEDLINE via PubMed was searched from 1950 to November 2007 without language restrictions; search terms were reported. Reference lists of relevant articles were searched manually to identify additional articles.

Study selection
Randomised controlled trials (RCTs) in healthy community-dwelling older adults aged over 50 that assessed a discrete cognitive exercise training regime (including any type of training using repetitive cognitive tasks on separate days for more than one week’s duration) were eligible for inclusion. Eligible studies also undertook a longitudinal (over three months) post-training neuropsychological follow-up. Studies in patients with clinical dementia, cognitive impairment or other neurological or psychiatric conditions were excluded. A range of interventions were used: computer-based training; reasoning training; paper and pencil training; self-generated strategy training; multifactorial training; information processing speed, memory and problem-solving training; and exercises for learning mnemonic skills. The frequency and duration of interventions varied; most lasted between five and 10 weeks. In most included studies interventions were compared with wait-and-see controls. The included studies used a variety of outcome measures for assessing longitudinal cognitive outcome. The main outcome comprised a primary neurophysiological outcome variable. All studies assessed healthy elders. Duration of follow-up ranged from three to 72 months.

Assessment of study quality
One reviewer assessed study quality using the CONSORT (Consolidated Standards of Reporting Trials) 22-item checklist.

Data extraction
All data were continuous. One reviewer extracted pre-change and post-change scores for a primary neurophysiological outcome between the training and control groups with 95% confidence intervals (CIs); Hedge’s d statistic was used for small samples where required. Lead authors were contacted for additional data where required.

Methods of synthesis
Change scores for training versus control groups were integrated using a random-effects (inverse variance weighted) mean difference (WMD) meta-analysis. Sensitivity analysis was undertaken to examine the effect of medium-term (less than two years) compared with long-term follow up (two years or more).

Results of the review
A total of seven RCTs were included in the review (n=3,194, range 30 to 2,832); three studies met more than 12 of the quality criteria. Not all included studies represented individual patient cohorts. Duration of follow-up ranged from three to 72 months.
Four of the seven studies showed statistically significant effects. Compared with wait-and-see control groups, cognitive exercise interventions yielded significantly improved neuropsychological performance (WMD 1.07, 95% CI 0.32 to 1.83; seven studies). Studies with long-term follow-up (WMD 1.02, 95% CI 0.14 to 1.89; five studies) did not differ from those with medium-term follow-up (WMD 1.16, 95% CI 0.37 to 1.96; two studies).

Authors' conclusions
Cognitive exercise training in healthy older individuals produced strong and persistent protective effects on longitudinal neuropsychological performance. Transfer of these effects to dementia-relevant domains such as general cognition and daily functioning had also been reported in some studies.

CRD commentary
The review question and inclusion criteria were clear, although there was limited information for participants. A limited literature search without language restrictions was restricted to one database. There was no specific search for unpublished studies, therefore, some studies may have been missed. The methods used for study selection were not reported and other parts of the review process appear to have been undertaken by a single reviewer; therefore, it appeared that methods to minimise error and bias were not applied. Appropriate criteria were used to assess the quality of the included studies, but the findings were only reported briefly and it was unclear which criteria the studies did not report; most studies appeared to have been of poor quality. The appropriateness of the meta-analysis is questionable given that the included RCTs did not represent individual patient cohorts; the two largest studies were based on the same study population. No assessment of heterogeneity was reported. The findings of the review were undermined by a lack of good-quality data and numerous issues with the review process, which included no attempt to control for bias, error and double-counting. In light of these shortcomings, the reliability of the authors’ conclusions is unclear.

Implications of the review for practice and research
Practice: The authors stated that older adults should maintain a robust level and range of mental activities, particularly following retirement.

Research: The authors stated that future clinical trials of cognitive exercise should pay careful attention to patient selection as well as the design of cognitive exercise and control conditions, together with improved quality of reporting.

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