Effect of exercise training on depressive symptoms among patients with a chronic illness: a systematic review and meta-analysis of randomized controlled trials

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CRD summary
The authors concluded that exercise training reduced depression in patients with chronic illness (other than depression). Potential biases of the review and limitations of the included evidence, such as the substantial variations across studies and use of self-reported outcomes, could impact on the reliability and generalisability of the pooled results. The conclusions should be treated with some caution.

Authors' objectives
To assess the effect of exercise training on depressive symptoms among patients with a chronic illness.

Searching
PubMed, PsycINFO, Web of Science and Physical Activity Guidelines for Americans Scientific Database and Google Scholar were searched up to June 2011 for publications in English. Search terms were reported. Reference lists of relevant studies were searched manually.

Study selection
Randomised controlled trials (RCTs) that compared the effects of exercise training versus no exercise in sedentary adults with chronic illness without a diagnosis of depression were eligible for inclusion. Eligible studies were required to report a depression outcome measurement at baseline and during and/or after intervention. Studies that assessed exercise as part of a multicomponent intervention, but did not include the additional component in a comparison condition, were excluded. Studies that compared exercise only with an active treatment were excluded.

The mean age of included patients was 51 years. Most patients (61%) were women. Most of the included studies were of patients with cardiovascular or cardiometabolic disease, fibromyalgia or chronic pain other than fibromyalgia. Depressive symptoms were a secondary outcome in most studies. Symptoms were measured mostly through self-report using the Beck Depression Inventory, Centre for Epidemiological Studies Depression Scale and Hospital Anxiety and Depression Scale. On average, exercise training (included aerobics and/or resistance training, yoga and Tai Chi) consisted of three 42 minute sessions per week for 17 weeks. Where reported, most exercise training programmes were classed as moderate intensity; some were classed as low or vigorous intensity. Exercise was undertaken individually or as a group, with some training included as part of a multi-component intervention (other components were not reported).

The authors did not state how many reviewers screened studies for inclusion.

Assessment of study quality
Study quality was assessed independently (the number of reviewers was not stated) using a modified version of the Detsky scale. Items assessed were randomisation, allocation concealment, attention-control use, depression measure quality, adherence, intention-to-treat (ITT) analyses and exercise training descriptions.

Data extraction
Mean change and standard deviations were extracted or estimated for intervention and control groups to calculate effect sizes (Hedge's d).

The authors did not state how many reviewers extracted data. Discrepancies were resolved by adjudication.

Methods of synthesis
A random-effects model was used to calculate pooled mean effect sizes, adjusted for small sample size bias (Hedges d and 95% confidence intervals (CIs)). Number needed to treat (NNT) was calculated. Statistical heterogeneity was assessed using Q and I².
Sensitivity analysis was performed to assess whether trials that reported depressive symptoms as the primary outcome had an effect on the findings. Meta-regression was used to assess the effects of multiple moderator variables (baseline depressive symptom scores, physical activity exposure, change in fitness, illness type, trial primary outcome change, blinded allocation, attention-control use and ITT analysis) on effect size. Publication bias was examined by visual inspection of a funnel plot and use of fail-safe N.

**Results of the review**

Ninety RCTs (10,534 participants, 168 effects) were included in the review. Seventy-nine of 168 effects reported blinding to allocation concealment and 53 reported ITT analysis. The mean exercise training adherence rate was 77%.

Exercise training statistically significantly reduced depression (mean effect size 0.30, 95% CI 0.25 to 0.36, NNT=6, I²=47%; 168 effects). Sensitivity analyses did not alter the findings significantly.

Meta-regression indicated that the largest reductions in depression were shown in patients with higher depression symptom scores at baseline and where the primary outcomes assessed in the trials showed significant improvements. A large number of other results on moderator variables were reported in the review.

There was no evidence of significant publication bias.

**Authors' conclusions**

Exercise training interventions reduced depression in patients who had developed depression during chronic illness. The largest effects were reported in patients with mild to moderate depression and in patients for whom exercise training improved function-related outcomes.

**CRD commentary**

The review question and supporting inclusion criteria were broadly defined. Several appropriate sources were searched for relevant articles. Language restrictions were applied and it appeared that no attempts were made to locate unpublished data, so potentially relevant data may have been missed. Formal assessment of publication bias found no evidence of bias. Although not explicitly stated, it seemed that study quality and data extraction were performed in duplicate. It was unclear whether this was true for study selection, so reviewer error and bias could not be ruled out completely. Appropriate criteria were used to assess study quality, but the complete results were not reported. The authors incorporated some quality assessment criteria within the statistical analyses. Many studies were included in the review, which was reflected in the clinical and methodological variability among studies. The authors went some way to investigate potential sources of heterogeneity.

Certain limitations should be borne in mind when interpreting the authors’ conclusions, these included the wide variability among studies, that most studies did not assess depressive symptoms as the primary outcome and that studies may not have been sufficiently powered to detect any changes. Most outcomes were self-reported. It was unclear whether several outcomes were measured in the same patients and, therefore, whether patients were double counted in the calculation of the overall effect sizes.

**Implications of the review for practice and research**

**Practice:** The authors stated that exercise training should be recommended to patients as a potential low risk additional treatment for depression that may develop during chronic illness.

**Research:** The authors stated a need for well-designed research to examine the effects of overall exercise dose to assess whether patients met recommended levels of physical activity. Future trials should use objective measures to assess the potential moderating effects of function-related improvements in patients with elevated depressive symptoms.

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**Bibliographic details**

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