CRD summary
This review looked at the effects of exercise training on people with heart failure. The authors found that exercise programmes may reduce adverse events (temporary or permanent termination of the exercise programme, or death), but more evidence is needed to assess the effect on mortality alone. Given there were several methodological problems with the review, the evidence may be insufficient to support the conclusion.

Authors' objectives
To determine the effects of exercise training in people with heart failure.

Searching
MEDLINE (from 1966 to August 2003), Medscape (from 1979 to August 2003) and the Cochrane Controlled Trials Register (from 1979 to August 2003) were searched; the search terms were given. The latest editions of relevant journals and the reference lists of identified articles were also checked. Authors were contacted for additional information where necessary.

Study selection
Study designs of evaluations included in the review
No inclusion criteria for study design were given. The included studies were randomised controlled trials (RCTs), non-randomised controlled studies and observational cohort studies.

Specific interventions included in the review
The intervention of interest was exercise training programmes. Studies of single exercise sessions were excluded. The control groups received no exercise training. In the included studies, the exercise programmes varied in duration from 15 to 120 minutes and in frequency from one to 7 sessions per week; the duration of the programmes ranged from 1 to 104 weeks. The nature of the exercise included intermittent or continuous aerobic exercise and strength training. Exercise intensity ranged from 40 to 85\% of maximum oxygen consumption, or from 45 to 95\% of maximum heart rate.

Participants included in the review
Studies assessing people with heart failure were eligible for inclusion. The inclusion criteria for clinical trials included a baseline ejection fraction of less than 40\%. The participants in the included studies were on stable medical regimes including beta-blockers and angiotensin-converting enzyme inhibitors. The mean age of the participants was 59 years, and 79\% were men. The mean ejection fraction was 27 (standard deviation, SD=7), and 61\% had ischaemia.

Outcomes assessed in the review
The outcomes of interest were adverse events, mortality, and the relationship between exercise training and changes in functional capacity, as measured by peak oxygen consumption in mL/kg per minute. Adverse events were defined as any incident causing temporary or permanent withdrawal from the programme. Any data from studies that recorded functional capacity using different parameters were ignored. Exercise-related mortality was also reported, but this was not defined.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.
Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction. Data from the studies were extracted into a database and separate tables were presented for different study designs. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for adverse events in the individual RCTs.

Methods of synthesis
How were the studies combined?
The authors stated that pooled relative risks (RR) were calculated using a Mantel-Haenszel stratified analysis. However, the results were presented as ORs with 95% CIs. Only results from RCTs were combined for clinical outcomes. Mean values with SDs were reported for changes in functional capacity. Statistical significance was set at a P-value of less than 0.05.

How were differences between studies investigated?
The authors did not report a method for assessing statistical differences between the studies. A general linear model was used to look for correlations between functional capacity and different features of the exercise programmes (type of exercise, duration and intensity).

Results of the review
Eighty-one studies (2,492 participants) were included: 30 parallel RCTs (1,197 participants), 9 randomised crossover trials (287 participants), 5 non-randomised controlled trials (126 participants), and 37 longitudinal cohort studies (882 participants).

Events (including hospitalisation) causing discontinuation of the programmes (17 RCTs): there were 30 adverse events in the exercise groups compared with 34 in the control groups (OR 0.85, 95% CI: 0.51, 1.41, P=0.52).

Mortality (11 RCTS): there were 26 deaths in the exercise groups and 41 in the control groups (OR 0.61, 95% CI: 0.37, 1.02, P=0.06).

For the composite end point of adverse event or death, exercise appeared to be favourable (18 studies, OR 0.68, 95% CI: 0.46, 1.00, P=0.05)

Safety: no exercise-related deaths were reported in any of the studies.

Functional capacity (57 studies): the mean increase in maximal oxygen uptake was 16.8% (SD 8.0, 95% CI: 13.7, 17.9). The greatest increase was in the 40 studies involving continuous or intermittent aerobic exercise (mean increase 16.5%, SD 6.9, 95% CI: 14.3, 18.7).

Exercise mode: no correlation was found between session frequency, duration, intensity or programme duration and functional improvement.

Authors' conclusions
In people with heart failure, the combined end point (adverse event or death) may be reduced in exercising people compared with non-exercising controls.

CRD commentary
The aims of this review were clearly stated and the databases searched were appropriate. However, there was no mention of a search for unpublished studies, or whether studies in languages other than English were sought, thus
studies might have been missed. The methods of the review (i.e. study selection, data extraction and quality assessment) were not described; it is possible for bias to be introduced if these processes are not conducted adequately. The authors made no mention of a validity assessment, or whether they looked for heterogeneity between the studies. This could have an affect on the reliability of the results. There was little information on the participants in the included studies (e.g. severity of illness, co-morbidities), and it is therefore difficult to assess whether the results would be generalisable to the normal population of people with heart failure.

The authors say they calculated relative risks but, in fact, they reported ORs. There were discrepancies in the numbers reported within the text and tables, e.g. the main results in the text do not match those presented in tables. In addition, it is unclear how the results in the text were arrived at. The summary effect size given in the text for the composite end point does not support the authors’ conclusion. In addition the main conclusions were drawn from small RCTs, the quality of which was not discussed. Given these comments, there seems to be insufficient evidence to support the authors’ conclusions.

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

Practice: The authors stated that exercise training should be part of standard treatment for people with heart failure.

Research: The authors stated that further studies are required to determine any effect of exercise training on mortality in people with heart failure.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.