CRD summary
This review of trials of people with cerebral palsy concluded that strengthening interventions were useful to increase muscle strength and gait, specifically for children. The results from small, diverse trials, which may have been subject to bias, were combined in an unorthodox and questionable way. The authors' conclusion should not be considered to be reliable.

Authors' objectives
To investigate the evidence on interventions to improve muscle strength and activity in individuals with cerebral palsy.

Searching
PubMed, Web of Science, PsycINFO, PEDro, CINAHL, and Sports Discus were searched for studies published in English in peer-reviewed journals between 2001 and 2012; key search terms were reported. Reference lists of relevant articles were examined to identify further studies.

Study selection
Randomised controlled trials (RCTs) of muscle-strengthening interventions in patients with cerebral palsy were eligible. Trials had to report sufficient strength outcome data for each group to calculate the effects. Quasi-randomised studies were excluded.

Most of the included trials were of progressive resistance exercise, electrical stimulation or cycle training. All except one were of children (range of mean age six to 16 years); in the trial of adults the mean age was 41 years. Populations varied by the affected limb, and the number of affected limbs. The interventions lasted from five to 16 weeks, with normally three sessions a week. Sessions lasted from 25 to 70 minutes. The details of the comparators were not reported.

The authors did not state how many reviewers selected studies.

Assessment of study quality
Trial methodological quality was assessed by two independent reviewers using the PEDro scale, with an external validity criterion removed. Reviewer disagreements were resolved by discussion. Trials received a score of between 0 and 10. Scores of 9 or 10 were considered to be excellent; 6 to 8 were good; 4 or 5 were fair; and below 4 were poor.

Data extraction
The data were extracted to calculate standardised mean differences with 95% confidence intervals for each outcome. Two reviewers independently extracted the data, with disagreements resolved by a third reviewer.

Methods of synthesis
The outcomes within a trial were pooled to produce a standardised mean difference, per trial, for the overall analysis. Meta-analyses, using a random-effects model, were then performed to calculate the pooled standardised mean differences with 95% confidence intervals.

Different outcomes were pooled when investigating the effects of different types (strength plus aerobic; electrical stimulation; or strength) of programme, and of the mode (frequency, duration and session length) of programme. Heterogeneity was assessed using Cochran's Q. Several tests (detailed in the paper) were used to assess publication bias.

Results of the review
Thirteen RCTs were included (368 patients; range 12 to 58). The mean PEDro score was 7 out of 10 (range 6 to 8).

For the overall analysis, the pooled standardised mean difference was 0.86 (95% CI 0.74 to 0.98; 13 trials; 150 comparisons). There was evidence of statistically significant heterogeneity, but no evidence of publication bias.
By type of programme the standardised mean differences were 1.04 (95% CI 0.70 to 1.39; 25 comparisons) for strength with aerobic exercise, 1.17 (95% CI 0.75 to 1.60; 18 comparisons) for electrical stimulation, and 1.11 (95% CI 0.93 to 1.28; 107 comparisons) for strengthening exercise.

The effect estimates were similar for short-duration interventions (less than eight weeks) compared with long-duration interventions (eight to 12 weeks).

Further results, including over 20 meta-analyses for individual outcomes, were presented. Heterogeneity results were presented only for the overall analysis. There was no evidence of publication bias.

Authors' conclusions
Strengthening and electrical stimulation could increase muscle strength and gait for individuals with cerebral palsy, specifically for children or young people.

CRD commentary
This review addressed a clear question and was supported by reproducible eligibility criteria. Several relevant databases were searched to identify trials, but the date and publication restrictions mean that some relevant trials may have been missed. Independent duplicate processes to reduce the risks of reviewer error and bias were reported, except for the screening process.

A basic tool was used to evaluate trial quality, and the results were presented only as a score; this makes it impossible to evaluate the risk of bias affecting the results of each trial, all of which had small samples. It appears that considerable clinical and statistical heterogeneity was present, but very few heterogeneity results were provided and only one forest plot was presented (limiting any visual assessment of heterogeneity). Very different outcomes were pooled, adding to the heterogeneity, and yielding results of questionable and limited clinical value. Basic trial details were provided, with no details on the comparator treatments.

In this review small, varied trials, which may have been subject to bias, were pooled in an unorthodox and questionable way. The authors' conclusion should not be considered to be reliable.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that research was needed to confirm the effectiveness of strengthening for those with non-ambulatory and other types of cerebral palsy, and for various muscle groups, such as trunk and upper extremities. They recommended investigation of the effects of exercise programmes specific to the individuals' needs, and that effect estimates should be calculated according to the intensity and volume of exercise, establishing a standard for individuals with cerebral palsy.

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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.