Long-term effectiveness of interventions promoting physical activity: a systematic review
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CRD summary
The review concluded there was evidence for long-term effectiveness of physical activity interventions on physical activity behaviour and physical fitness for healthy adults. Additional tailored exercise prescription strategies seemed promising to improve uptake of physical activity. Given the potential for publication and language biases and the differences between studies the authors’ conclusions should be regarded with caution.

Authors' objectives
To evaluate the long-term effectiveness of physical activity interventions aimed at healthy adults and identify effective intervention components.

Searching
PubMed, EMBASE, The Cochrane Library and PsycINFO databases were searched for articles published in English or German between January 2001 and June 2007. Search terms were reported. Bibliographies of retrieved articles were scanned.

Study selection
Randomised controlled trials that evaluated physical activity interventions aimed at promotion and maintenance of physical activity (regardless of setting) for healthy adults (aged 18 or over) were eligible for inclusion. Studies needed to have a minimum duration of 12 months. Outcomes of interest were participation in or level of physical activity or physical fitness. Studies with samples of less than 10 participants and studies that did not state level of physical activity or physical fitness in the title or abstract were excluded.

Walking was the most common physical activity component specified in the included studies, but most studies did not specify what physical activities were undertaken. Other components included counselling, exercise planning and prescription print materials and group sessions, work site health promotion programs and internet programs. Intervention groups were compared with either no-intervention control, minimal intervention control or different intervention strategies. Comparators included usual care, no intervention, delayed intervention or counselling by health professionals, internet program and printed materials. Booster interventions (such as mail, phone, internet, group sessions or a combination of these) were utilised in 16 studies. Participants' age ranged from 18 to 80 years. Outcomes were assessed with a variety of measures, including minute walk test, American Heart Association test, leisure time physical activity, total energy expenditure and metabolic equivalents.

Two reviewers independently assessed studies for inclusion from full-text papers. Disagreements were resolved through discussion.

Assessment of study quality
Validity was assessed with established checklists and then rated according to SIGN (Scottish Intercollegiate Guidelines Network) criteria as high (minimal risk of bias), good (moderate risk of bias) and fair (high risk of bias). Two researchers independently assessed methodological quality.

Data extraction
Data on the proportion of participants who met recommended targets of physical activity were extracted and used to calculate odds ratios (ORs) and 95% confidence intervals (CI). Data on measures of physical fitness, energy expenditure and time spent for physical activity were extracted and used to calculate the standardised mean difference (SMD) between groups. Data were extracted by one reviewer and checked for accuracy by a second reviewer.

Methods of synthesis
Studies were grouped into three categories by control group and included no-intervention control, minimal intervention...
control and alternative-intervention control groups. Data from individual studies were pooled using a random-effects model. Only studies assessed as being of high or good methodological quality were included in the meta analysis. Heterogeneity was assessed using the $\chi^2$ and the $I^2$ test. Sensitivity analyses were conducted using fixed-effect models and including methodologically less rigorous studies and excluding outliers.

**Results of the review**

Twenty five studies ($n=8,660$) were included in the review, but only nine studies were included in the meta analysis. Seven RCTs were rated as high methodological quality, six as good and 12 as fair. Methodological limitations included differences at baseline between groups, high attrition rates and inadequate reporting of outcomes.

**Long-term effectiveness of physical activity interventions:** Four RCTs reported increases in weekly energy expenditure of up to 975kcal and physical fitness of up to 11% for intervention groups compared to no-intervention and minimal-intervention control groups. The proportion of participants in the physical activity intervention group who met recommended targets or adhered to physical activity prescriptions ranged between 4.5% and 81%.

One RCT found significant increases in the proportion of participants who met recommended physical activity targets in the physical activity group compared to no intervention group (OR 3.31, 95% CI 1.99 to 5.52). No statistically significant differences were reported between physical activity groups compared to minimal intervention control (two RCTs) or health-care staff advice (two RCTs). There was evidence of significant increases in self-reported energy expenditure for physical activity groups compared to no intervention control (SMD 0.24, 95% CI 0.12 to 0.37; two RCTs). There were no statistically significant differences between a physical activity group and a no-intervention control group for minutes per week of physical activity (one RCT). There were significant increases in physical fitness in the physical activity intervention groups compared to the physician advice control groups (SMD 0.15, 95% CI 0.06 to 0.24; three RCTs) and for minutes per week of physical activity intervention groups compared to the minimal control groups (SMD 0.13, 95% CI 0.01 to 0.24; one RCT), but no statistically significant differences between physical activity interventions and minimal control group for physical fitness (two RCTs).

There was evidence of statistical heterogeneity for the analyses that compared physical activity intervention groups with minimal intervention control for physical fitness ($I^2=97.7\%$). There was no evidence of statistical heterogeneity for any other analysis. No differences were reported to results after sensitivity analyses. Mixed results were reported for sustainability of intervention effects up to 24 months. Results for the effectiveness of intervention-specific populations were also reported.

**Effectiveness of specific intervention components:** No significant differences were reported between groups for initial intervention intensity (two RCTs). Mixed results were reported for written exercise prescriptions as part of a physical activity intervention compared to control groups. Mixed results were also reported for tailored versus standard intervention messages; one RCT found evidence of effectiveness of culturally tailored strategies.

**Authors' conclusions**

There was evidence for long-term increases in physical activity behaviour and physical fitness. Additional tailored exercise prescription strategies seemed promising to improve uptake of physical activity. Booster interventions can help to facilitate long-term effectiveness.

**CRD commentary**

The review addressed a broad research question that encompassed a wide range of intervention types. Inclusion criteria were defined in terms of study design, participants, outcomes and intervention. Several relevant sources were searched, but restriction to studies published in English and German may have caused some relevant data to be missed. No efforts were made to reduce the potential for publication bias. Appropriate methods were used to reduce reviewer error and bias for study selection, validity assessment and data extraction. A validity assessment was conducted using published criteria and results of the assessment were partially reported. Only nine of 25 included studies were included in the meta-analysis due to poor methodological quality and differences between studies in terms of outcomes. This resulted in pooled effect estimates being based on a limited number of studies. Statistical heterogeneity was assessed and evidence of this was found for only one of the analyses. Given the potential for publication and language biases and the differences between studies the authors' conclusions should be regarded with caution.
Implications of the review for practice and research

Practise: The authors did not state any implications for practice.

Research: The authors stated that further methodologically rigorous studies were required to determine the sustainability of current physical activity interventions. Cost-effectiveness analysis of physical activity interventions was needed to evaluate the feasibility of these strategies on a broad population basis. Future studies should also assess single intervention components.

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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.