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## Increasing physical activity in healthy adults: a meta-analysis

► **Conn VS**, Hafidahl AR, Mehr DR. Interventions to increase physical activity among healthy adults: meta analysis of outcomes. *Am J Public Health* 2011;**101**:751–8.

### BACKGROUND

Despite ample evidence showing links between physical activity (PA) and important health outcomes, many adults get too little PA. Most meta-analyses to date have focused on the health outcomes of PA while only few have addressed the question of whether interventions actually increase PA itself.

### AIMS

The authors conducted a systematic review and meta-analysis to estimate the overall effects of PA interventions on PA behaviour. The secondary aim was to identify intervention characteristics associated with best outcomes.

### SEARCHES AND INCLUSION CRITERIA

Comprehensive searches of 13 databases (incl. Medline, SCOPUS, NIH registries) were conducted by an expert reference librarian. This was supplemented by hand-searches of 82 journals and ancestry searches and author tracking for reviews and included studies. Over 54 000 titles were identified and screened for inclusion.

English language reports of interventions to increase PA among healthy adults were included. Controlled and uncontrolled longitudinal studies were included, although only controlled studies were used for the primary analysis. Published, unpublished and small sample studies were all included.

### INTERVENTIONS

Any interventions designed to change PA behaviour were eligible for inclusion. PA was defined as any bodily movement that increased energy expenditure beyond basal levels. The authors also coded 74 intervention characteristics from the reports including social context, theoretical framework, behavioural target, recommended PA, etc. The influence of these characteristics was assessed in moderator analyses.

### MAIN OUTCOME MEASURES

The outcome considered by the review was the amount of PA (steps/day and min/week).

### STATISTICAL METHODS

The primary analysis was comparison of intervention and control groups with respect to postintervention PA or change in PA. A standardised mean difference (*d*) effect size was calculated for each primary study comparison, a positive *d* reflects more favourable scores for the treatment group. A random effects model with inverse variance weighting was used to estimate the pooled effect and heterogeneity was assessed using  $I^2$  and  $Q$ .

Exploratory moderator analyses investigated the influence of intervention characteristics on the effect size and were conducted using the mixed-effects meta-analytic analogue of regression. Given the lack of consistent previous findings, authors state that these moderator analyses are hypothesis generating rather than hypothesis testing.

### RESULTS

The primary analysis used data from 206 comparisons involving 74 852 participants; the total number of included studies is not reported. The median age of participants was 44 and a median of 74% were women, sample size ranged from 5 to 17 519 (median 72).

A mean effect size (*d*) of 0.19 (95% CI 0.14 to 0.23) was found for the difference between treatment and control groups, this corresponds with a mean difference of 14.7 min PA per week or 496 steps/day. The authors found evidence that this estimate may be subject to publication bias.

Moderator analyses found that the following treatment characteristics may result in larger effects: behavioural (vs cognitive) interventions; interventions directly delivered to the individual (vs community and mass media interventions); interventions delivered by the project staff (vs train the trainer interventions); standardised (vs individually tailored) interventions, and interventions not using Bandura's social cognitive theory or Prochaska's transtheoretical model of behaviour change as an underlying theoretical foundation. Further, studies published recently and studies that reported lower treatment group attrition rates compared to control group attrition rates showed larger effect sizes.

### LIMITATIONS/CONSIDERATIONS

The authors of this meta-analysis performed a very thorough search of published and unpublished literature and used recommended methods such as independent screening and data extraction to reduce bias. They also investigated the likelihood of small sample (publication) bias and report that studies with negative or small positive effects may be missing from the effect estimate. A measure for risk of bias (methodological quality) of original studies was not included in this meta-analysis. The authors state that study quality varied widely but do not report on the influence of methodological quality on the effect estimate.

The authors do not provide an exact definition of their outcome of interest, that is, PA behaviour, which can be interpreted in many different ways. This meta-analysis appears to include a very heterogeneous group of studies in terms of type of intervention (motivational, educational or supervised exercise), duration of the programme (from single session to many weeks) and intensity of the programme. Little descriptive information regarding the included studies is provided. Overall effect sizes are consequently difficult to interpret. By performing exploratory moderation analysis, authors try to establish whether this between-study variability can be explained by characteristics of the intervention tested. The very large number of potential moderators tested raises the risk of spurious findings, and as such these findings should be interpreted cautiously.

### CLINICAL IMPLICATIONS

This meta-analysis shows that PA interventions for healthy adults lead to a moderate significant increase in PA behaviour

(14.7 min PA per week or 496 steps/day). However, it is unknown as to whether such small increases in PA have any health benefits for healthy adults. Behavioural interventions appear to show better results than cognitive interventions. Therefore, the authors recommended that future interventions should focus on behavioural components; these might include self-monitoring, goal setting and rewards. Future research can establish which exact components of behavioural interventions are most effective in increasing PA behaviour.

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