

Interventions to promote walking: systematic review

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ABSTRACT

Objective To assess the effects of interventions to promote walking in individuals and populations.

Design Systematic review.

Data sources Published and unpublished reports in any language identified by searching 25 electronic databases, by searching websites, reference lists, and existing systematic reviews, and by contacting experts.

Review methods Systematic search for and appraisal of controlled before and after studies of the effects of any type of intervention on how much people walk, the distribution of effects on walking between social groups, and any associated effects on overall physical activity, fitness, risk factors for disease, health, and wellbeing.

Results We included 19 randomised controlled trials and 29 non-randomised controlled studies. Interventions tailored to people's needs, targeted at the most sedentary or at those most motivated to change, and delivered either at the level of the individual (brief advice, supported use of pedometers, telecommunications) or household (individualised marketing) or through groups, can encourage people to walk more, although the sustainability, generalisability, and clinical benefits of many of these approaches are uncertain. Evidence for the effectiveness of interventions applied to workplaces, schools, communities, or areas typically depends on isolated studies or subgroup analysis.

Conclusions The most successful interventions could increase walking among targeted participants by up to 30-60 minutes a week on average, at least in the short term. From a perspective of improving population health, much of the research currently provides evidence of efficacy rather than effectiveness. Nevertheless, interventions to promote walking could contribute substantially towards increasing the activity levels of the most sedentary.

INTRODUCTION

Physical inactivity increases the risk of many chronic diseases—notably, coronary heart disease, type 2 diabetes, and cancer of the colon.¹ Accumulating 30 minutes of moderate intensity physical activity on most days is enough to provide substantial health benefits,² but most adults in the United Kingdom do not currently achieve this.^{1,3,4} Increasing the population level of physical activity, particularly among the most sedentary, has therefore become a leading aim of contemporary public health policy.^{5,6}

Walking has been described as near perfect exercise.⁷ Even walking at a moderate pace of 5 km/hour (3 miles/hour) expends sufficient energy to meet the definition of moderate intensity physical activity.⁸ Numerous systematic reviews have examined the effectiveness of

interventions to promote physical activity in general,^{9,10} but we know of none that has examined how best to promote walking in particular; furthermore, many—including those underpinning recent guidance issued by the National Institute for Health and Clinical Excellence (NICE)—have been restricted to particular types of intervention^{11,12} or study design.¹³ We conducted a systematic review to determine what characterises interventions effective in promoting walking; who walks more and by how much as a result of effective interventions; and the effects of such interventions on overall physical activity and health.

METHODS

Search strategy

We searched 25 databases for studies of interventions or changes related to walking published from 1990 onwards. We imposed no limits on characteristics of participants, study design, intervention, or language. We also searched a purposive sample of 12 websites as well as reference lists, existing systematic reviews, and our own archives. We then invited an international group of experts to nominate additional primary studies. Further details of the search strategy and inclusion criteria are on <http://sparcoll.org.uk/images/bmj supp.pdf>.

Study selection and inclusion criteria

We included randomised controlled trials and non-randomised controlled before and after experimental or observational studies of the effects of any type of intervention—including environmental and fiscal, legislative, and other policy interventions—on how much people walk. The effects of the intervention had to be compared with those observed in a “no intervention,” “attention control,” or “minimal intervention” control or comparison group, area, or population. Studies had to report a specific measure of walking (self reported, objective, or both) at both baseline and follow-up.

Data extraction and validity assessment

For each included study, a pair of reviewers extracted data, assessed validity, and verified each other's work, with any discrepancies being resolved by discussion (see bmj.com).

Data synthesis

We categorised studies according to the main approach of the intervention studied. We summarised the outcome for each study in terms of the net change in walking after adjustment for changes in the control group, using the most inclusive measure of walking available for each study, and tabulated the key characteristics and outcomes of the studies within each category in descending order of study validity (see bmj.com). The types of

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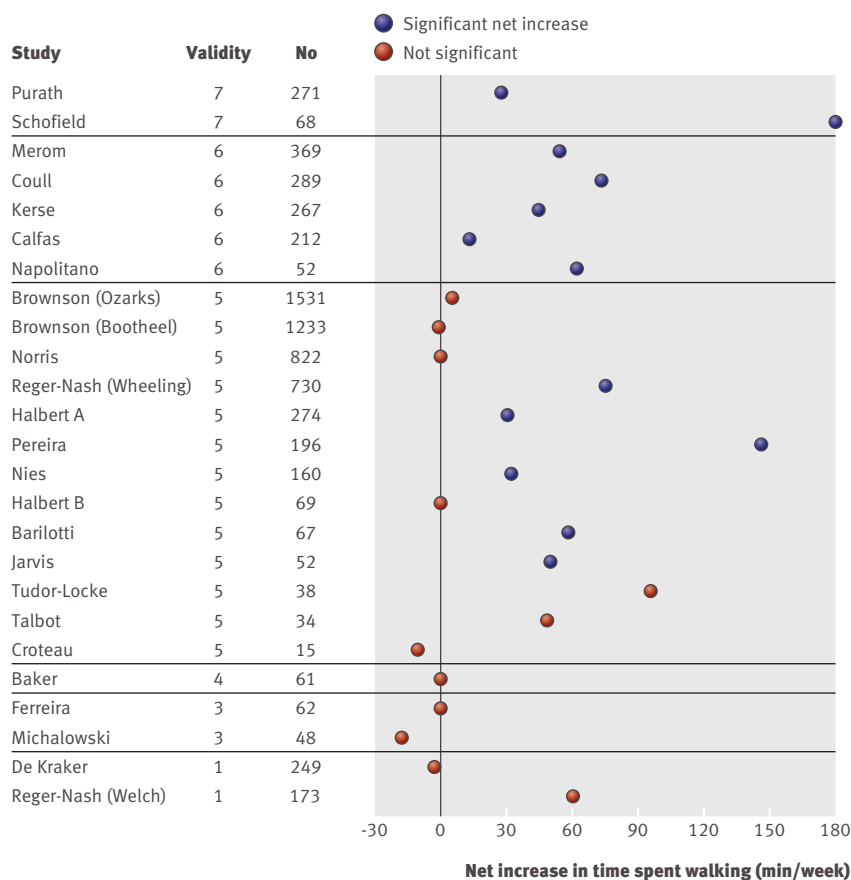


Fig 1 | Estimated net increase in walking in general. Studies are ranked by validity (number of criteria met, see bmj.com), then sample size

interventions, study designs, participants, and outcome metrics and the durations of follow-up were too heterogeneous to permit meta-analysis, even within categories of intervention; in addition, many studies did not report confidence intervals so we could not construct a conventional forest plot. By making a set of simplifying assumptions (see bmj.com), however, we were able to summarise the outcome data for most studies as an approximate net change in time spent walking (minutes/week) and plot the relation between estimated effect size, sample size, and study validity (figs 1 and 2).

RESULTS

We screened 53 491 references and assessed the full text of 441 documents. Forty eight studies met our inclusion criteria: 19 randomised controlled trials and 29 non-randomised controlled studies.^{w1-w60} Twenty seven studies were concerned with walking in general; 21 studies were concerned solely with walking as a mode of transport (see also <http://sparcoll.org.uk/images/bmj supp.pdf>) and the specific effects of interventions in these studies are detailed on bmj.com.

Characteristics of interventions found to be effective

The most convincing evidence of effectiveness was for interventions delivered at the level of the individual or household or through group based approaches. Although no single method of promoting walking

emerged as the most effective, and we were not able to reach any conclusions about the relative merits of different types of provider (such as doctor, nurse, exercise specialist) on the effectiveness of interventions, we were able to identify two general characteristics of those interventions found to be effective: targeting and tailoring.

Targeting—Most interventions associated with an increase in walking as a mode of transport were offered only to those individuals or households identified through prior screening as already motivated to change their behaviour.^{w31-w50} Interventions to promote walking in general were often aimed at target groups such as sedentary people or patients with particular conditions. Many of the interventions found to be effective were targeted at sedentary people^{w1 w2 w4 w7 w9 w11 w17 w18}; the potential value of such targeting was also shown indirectly by other studies in which significant net increases in walking were observed only in the most sedentary subgroup within the study population.^{w8 w27 w28 w30} The value of targeting specific clinical populations was less clear. A group based lay mentoring intervention for patients with heart disease was effective,^{w10} but studies of other approaches (brief advice or pedometers) targeted at patients with diabetes or osteoarthritis did not find them to be effective at final follow-up.^{w5 w22 w23}

Tailoring—Effective interventions typically involved content tailored to participants' requirements or circumstances. Such tailoring ranged from the provision of individualised counselling^{w1 w2 w8} or written materials^{w17 w18} (for example, tailored to the participant's position in the transtheoretical model of behaviour change), through inviting households to choose from a menu of information resources and incentives promoting environmentally friendly modes of transport,^{w32-w50} to the mapping of individual children's journeys to school.^{w51}

Magnitude and social distribution of effects on walking

Magnitude of effect—Evidence from the most promising studies suggests that, among targeted participants, successful interventions could increase walking in general by up to 30–60 minutes a week on average; more robust studies were most likely to report significant net increases in walking than less robust studies (fig 1). In the transport sector, successful interventions could increase walking as a mode of transport in the general population by rather less, up to about 15–30 minutes a week on average; this estimate depends on a group of studies that are larger but less robust than the studies of walking in general (fig 2).

Social distribution of effects—In 29 studies, most of the participants were women; in three studies, men were more likely than women to increase their walking.^{w5 w26 w29} Most (34/48) studies, however, did not report how the effect of interventions on walking varied between demographic or socioeconomic groups.

Effects on overall physical activity and health

Twenty studies reported effects on overall measures of physical activity. Of these, seven reported some evidence of a net increase in overall physical activity at

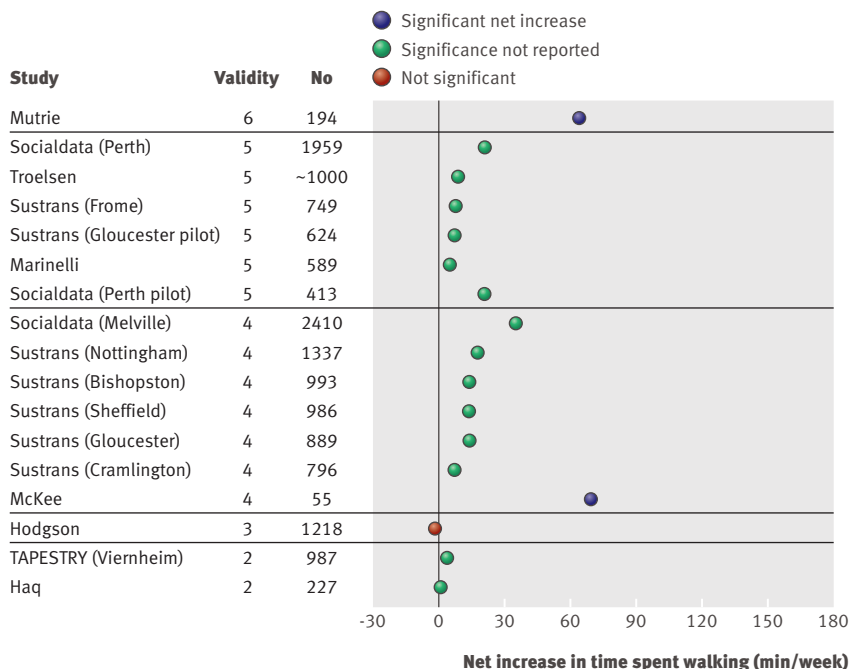


Fig 2 | Estimated net increase in walking as a mode of transport. Studies are ranked by validity (number of criteria met, see bmj.com), then sample size

final follow-up, but in each of these studies different measures of physical activity gave conflicting results.^{w1 w2 w4 w10 w14 w16 w18}

Three of the studies that found a significant net increase in walking also reported effects on cardio-respiratory fitness or functional capacity in terms of maximal oxygen uptake (VO₂max) or one mile (1.6 km) walking time in sedentary women or adolescent girls^{w9 w17} or exercise tolerance in adults with ischaemic heart disease.^{w10} None found a significant difference between intervention and control groups.

Two of the studies that found a significant net increase in walking also reported effects on other risk factors (anthropometry, resting heart rate, blood pressure, lipid profile, or fasting blood glucose) in specific clinical populations (adults with ischaemic heart disease^{w10} or type 2 diabetes^{w23}). Neither found any significant differences between intervention and control groups.

Six of the studies that found a significant net increase in walking also reported effects on self reported health, wellbeing, or quality of life measured with either a generic instrument such as the SF-36 or a more specific symptom or mood score. Three found a significant overall difference between intervention and control groups^{w3 w9 w11}; two found significant differences, but only on subscales of the SF-36^{w10 w31}; one found no significant difference.^{w12 w13}

DISCUSSION

Principal findings

We found clear evidence that people can be encouraged to walk more by interventions tailored to their needs, targeted at the most sedentary or at those most

motivated to change, and delivered either at the level of the individual or household or through group based approaches. The balance of available evidence about interventions applied at the level of the institution (workplace or school), community, or area is less convincing; evidence that these have led to a significant overall increase in walking typically depends on isolated studies or subgroup analysis.

Strengths and weaknesses of the available evidence

The best available evidence is somewhat skewed in favour of studies of interventions that seem easier to evaluate, or perhaps easier to randomise, typically individually focused interventions such as brief advice or pedometers, often studied in small, convenience, or volunteer samples and sometimes over short follow-up periods of only a few weeks.¹³ From a perspective of improving population health, much of this research therefore constitutes, at best, evidence of efficacy rather than effectiveness. This caveat is particularly well illustrated by the case of pedometers. None of the studies in our review found that any short term benefits associated with pedometers were sustained. The limited evidence base for the effects of attempts to change the societal or environmental determinants of walking may simply reflect the political or practical difficulties of implementing changes at the required scale to influence population patterns of activity^{w25} or the scientific challenges of detecting comparatively dilute effects in whole population samples.¹⁴

Implications for policy and practice

About a third of adults in Britain report fewer than one episode of 30 minutes' moderate intensity physical activity of any kind each week.³⁴ Against this background, the average increase in walking of 30-60 minutes a week observed among targeted participants (typically sedentary, motivated to change, or both) in the most promising studies in this review is important. Over the longer term, or at the level of the population as a whole, the increase in walking attributable to a single intervention is likely to be substantially lower than this. Nevertheless, the successful implementation of combinations of interventions to promote walking clearly has the potential to make a substantial contribution towards increasing the activity levels of the most sedentary. Our findings are consistent with (but certainly not proof of) an assumption that different types of people may respond to different approaches, tailored to their psychological characteristics or life circumstances. In other words, one size may not fit all and various approaches should be offered: some people may respond best to personal advice from their doctor, others may prefer the private feedback from a device such as a pedometer, others (perhaps those in a more advantaged socioeconomic position) may benefit from interventions delivered through the internet, others may benefit from the social support of a walking group, and others may increase their walking in response to prompts about reducing their car use on environmental grounds.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Accumulating 30 minutes of moderate intensity physical activity on most days of the week substantially reduces the risk of many chronic diseases

Walking is a popular, familiar, convenient, and free form of exercise by which many sedentary people could gain the health benefits of moderate intensity physical activity

Walking may be influenced by environmental and societal conditions as well as by interventions targeted at individuals

WHAT THIS STUDY ADDS

Interventions tailored to people's needs, targeted at the most sedentary or at those most motivated to change, and delivered either at the level of the individual or household or through groups can increase walking by up to 30-60 minutes a week on average, at least in the short term

Unanswered questions and future research

Few studies in this review found unequivocal improvements in health, risk factors for disease, or even overall levels of physical activity attributable to an increase in walking. Most studies did not look for (or were inadequately powered to detect) such benefits or possible adverse effects. Future intervention studies should therefore include the capacity to investigate whether increases in walking are sufficiently frequent, intense, or sustained to produce measurable improvements in anthropometric, physiological, biochemical, or clinical outcomes, or alternatively whether increases in walking might be counterbalanced or outweighed by decreases in other forms of physical activity or an increase in injuries.

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Competing interests: NC sells pedometers in his capacity as a health promotion consultant. NM is an author of three of the primary studies included in the systematic review but played no part in the appraisal of those studies for the review.

Ethical approval: Not required.

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Side effects of phenobarbital and carbamazepine in childhood epilepsy: randomised controlled trial

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ABSTRACT

Objective To compare the behavioural side effects associated with two commonly used antiepilepsy drugs—phenobarbital and carbamazepine—in children in Bangladesh.

Design Prospective randomised controlled single centre trial.

Setting Specialist children's hospital in Dhaka, Bangladesh.

Participants 108 children aged 2-15 with generalised tonic-clonic (n=51) or partial and secondarily generalised seizures (n=57).

Main outcome measures Seizure control and behavioural side effects.

Results 91 children were followed up for 12 months.

Six required a change of antiepilepsy drug. Side effects were compared in 85 children. In the last quarter of the 12 month follow-up 71 children were seizure free after one year's treatment. Thirty two in the phenobarbital group and 39 in the carbamazepine group had no seizures for 74 and 102 days after randomisation, respectively. Ten children had increased behavioural problems, which were unacceptable in four (one in the phenobarbital group and three in the carbamazepine group). Independent *t* tests, however, showed no difference between the two trial drugs.

Conclusion There was no excess in behavioural side effects with phenobarbital in children with epilepsy in a country with limited resources.

Trial registration NCT00381537.