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Workplace Physical Activity Interventions: a Systematic Review

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Paper classification: Literature review

Workplace Physical Activity Interventions: a Systematic Review

Abstract

Purpose: This paper reports a synopsis of a recent systematic review of the literature regarding the effectiveness of workplace physical activity interventions, commissioned by the National Institute for Health and Clinical Excellence (NICE), UK (Dugdill et al., 2007).

Methods: A search for English-language papers published between 1996-2007 was conducted using 12 relevant databases and associated grey literature. Search protocols and analysis regarding study quality as recommended by NICE were utilised (NICE, 2006). Key inclusion criteria were 1) workplace intervention aiming to increase physical activity, 2) intervention aimed at working adults, 3) intervention initiated/endorsed by the employer, 4) physical activity outcome. Thirty three studies (38 papers) met the inclusion criteria and were independently reviewed (checked by 2 reviewers) with a narrative synthesis of findings.

Findings: Fourteen studies were graded as **++** (high quality) or **+** (good quality). Evidence from previous systematic reviews was inconclusive. Data regarding the effectiveness of stair walking interventions was limited and intervention effects were short-lived. Three public sector studies provided evidence that workplace walking interventions using pedometers can increase daily step counts. One good quality study reported a positive intervention effect on walking to work behaviour (active travel) in economically advantaged female employees. There was strong evidence that workplace counselling influenced physical activity behaviour. There is a dearth of evidence for small and medium enterprises (SMEs).

Limitations: Due to the necessary UK focus and time constraints, only studies from Europe, Australia, New Zealand and Canada were included.

Implications: There is a growing evidence base that workplace physical activity interventions can positively influence physical activity behaviour.

Workplace Physical Activity Interventions: a Systematic Review

Background

The benefits of a physically active lifestyle in health promotion and disease prevention are well-documented (DH, 2004; WHO, 2004). Populations, especially in the developed world, are becoming increasingly sedentary in their behaviour (WHO, 2004). Every year, physical inactivity is estimated to cause 600,000 deaths in the EU region (about 6% of the total), and conditions such as obesity contribute to over 1 million more deaths. Approximately 31% adults (aged 15+), in the European Region, take sufficient physical activity (that is moderate physical activity for 30 minutes on at least 5 days of the week)(Sjostrom et al., 2006). This varies across countries, from 44% taking sufficient physical activity for health in the Netherlands, to 28% in the UK and only 23% in Sweden (Cavill et al., 2006).

The more sedentary nature of work, alongside increasing use of the car is affecting a decline in physical activity behaviour amongst adults (National Travel Survey, 2002). *'Not enough time'* is often the most commonly cited barrier to being physically active. Indeed, the UK workforce tends to spend more hours at work than most other EU countries and have less paid leave/annum (The Work Foundation, 2005). Although the workplace setting affords great potential for the promotion of physical activity, managers have been slow to respond to these opportunities, perhaps because they have yet to be convinced of the effectiveness of such interventions. Against this background, the National Institute for Health and Clinical Excellence (NICE) commissioned a review of workplace physical activity intervention effectiveness with a view to developing guidelines for public health for England (NICE, 2006).

Objectives

The primary purpose was to identify which types of workplace physical activity intervention were effective in changing physical activity behaviour (and other related outcomes) for different workforce sectors and types of workplace. A secondary purpose was to ascertain which aspects of intervention design (length/intensity) and delivery (including employee involvement) contributed to effectiveness and contributory motivators, barriers and facilitators (for employers and employees). These secondary findings are reported elsewhere (Dugdill et al., 2007). All types of workplace, and physical activity interventions were considered as long as their primary aim was to increase physical activity of employees, were applicable to England, and met the inclusion criteria (Figure 1).

Methods

The review followed the protocol set out by NICE (2006). Twelve electronic databases were selected to reflect the broad nature of the topic area and were searched for studies published between 1996-2007 (Appendix 1). Full search strategies and methods can be found in Dugdill et al. (2007). The electronic searches were supplemented by hand checking the references of all the papers included at the screening full papers stage. An overview of the search process can be found at Figure 2.

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The electronic searches identified 4564 unique references. Titles and abstracts of all these references were screened by one member of a team of five. Full papers of relevant studies were screened by one member of a team of four (n=423). At both stages, a minimum 20% sample of papers were checked by a second reviewer. Studies were eligible for inclusion if they fell within the criteria set out in Figure 1 (n=68).

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Due to the necessary UK focus and time constraints, only studies from Europe, Australia, New Zealand and Canada with similar cultural contents and potential applicability to the UK were included. A total of 38 papers representing 33 studies were included, and critically appraised using tools provided in the NICE protocol (2006). Each study was reviewed by one team member, checked by another two and graded according to the following criteria: **++** high quality, **+** good quality, **-** poor quality.

Results

A total of 14 studies were graded as **++** (high) or **+** (good) and as such can be classified as reliable evidence. The conclusions reported below are drawn from these studies with supporting evidence only from the poorer quality studies where appropriate. Studies were grouped into five key intervention areas: systematic reviews; stair walking; walking; active travel; and other (including interventions such as counselling/motivational interviewing, health checks/screening, health promotion messages/information, led activity sessions, or combinations of all of these (i.e. multi-component programmes). Within each of these categories evidence is provided using a narrative synthesis, supported by evidence tables, drawing out the key features of each study.

Systematic Reviews

Three systematic reviews were identified for inclusion (Table 1). These reviews examined the effectiveness of workplace interventions which aimed to increase physical activity, and/or fitness and/or health in employees. Two of these were of good quality and both included US studies. One (Dishman et al., 1998) concluded that workplace physical activity interventions have a small, non-significant positive effect on physical activity or fitness, which is not sustained over time. The other (Proper et al., 2003) concluded that there was a significant intervention effect for physical activity, but this was made on the basis of only two high quality studies (both RCTs). Both reviews (Dishman et al., 1998; Proper et al., 2003) reported that the methodological quality of the published literature was weak due to poor study design, and outcomes being measured solely by self-reported physical activity. Hence, there is inconclusive review-level evidence that workplace physical activity interventions have a significant effect on physical activity.

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Stair Walking

Seven studies (Table 2) assessed the effectiveness of health signs (posters) or health messages/information (written, email or doctor's email) on workplace stair walking. With the exception of one study (Badland et al., 2005) measurement consisted of behavioural observation of stair/lift usage in a workplace setting rather than objective tracking of individual physical activity behaviour. Three of the studies (Titze et al., 2001; Auweele et al., 2005; Eves et al., 2006) used overt rather than covert methods of observation which may have influenced employee behaviour. Baseline data varied widely with 158,350 observational counts for stair/lift usage (and employee self-reported data, n=53) in the best quality study (Marshall et al., 2002) to only a few thousand observational counts (Titze et al., 2001; Auweele et al., 2005). Another methodological weakness was the lack of control over who entered the building during the observational periods and inability to distinguish employees from visitors in the sample counts (Adams and White et al., 2002; Marshall et al., 2002). Two studies (Titze et al., 2001; Marshall et al., 2002) used automatic counting devices on lifts and stairs but there were inconsistencies when correlated with observational data (Titze et al., 2001).

Four studies (Kerr et al., 2001; Marshall et al., 2002; Auweele et al., 2005; Eves et al., 2006) demonstrated that the use of posters/signs can increase stair (instead of lift) use. Two other studies (both poor quality) reported significant increases in stair use which were sustained between baseline and follow up (Titze et al., 2001; Eves et al., 2006) However, in the other two studies, stair usage declined back to baseline levels at follow up (Auweele et al., 2005) or by the end of the study period (Marshall et al., 2002) suggesting that the effectiveness of posters is short term. Kerr at al., (2001) reported no significant intervention effect for stair climbing only stair descent. In addition, two studies (Adams and White, 2002; Badland et al., 2005) reported a decline in stair use/step count. When posters were visible in the workplace mean step counts decreased (Badland et al., 2005). In summary, the studies identified showed little evidence of the effectiveness of interventions to increase stair walking; further research is required.

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Walking Interventions

Four studies which aimed to increase walking (step counts) in employees (but not as part of active travel) met the inclusion criteria (Table 3). Three of the studies (Chan et al., 2004; Murphy et al., 2006; Gilson et al., 2007) measured physical activity objectively with pedometers (giving daily step counts of employees). All the studies relied on self-reported step counts/walking activity which could result in bias and over-estimation.

The study by Gilson et al. (2007) aimed to assess the impact of two different types of walking intervention (n= 70). This study showed a significant effect for both intervention groups compared with controls ($p<0.008$). Small non-significant changes were reported in % body fat, waist circumference and blood pressure. Chan et al. (2004) reported an average daily step count increase from 7,029 ± 3,100 to a plateau of 10,480 ± 3,224 Significant decreases were reported in BMI, waist girth and resting heart rate ($p<0.001$ for all).

Murphy et al. (2006) reported significantly more steps on days of prescribed walking compared to rest days ($p<0.001$) but the sample size was small (n=37) and it was unclear if the mean number of steps had increased. Thomas et al. (2006) reported a 10% increase in the number of steps taken per day and a 25% increase in the average number of days that participants reached 10,000 steps. **At follow-up, 63% of participants reported maintained or increased levels of walking and 65% reported changes to routine to increase physical activity. However, it was unclear if these changes were statistically significant.** (Please review) In summary, evidence from public sector studies indicated that workplace walking interventions using pedometers can increase daily step counts, where accompanied by facilitated goal setting (Chan et al., 2004; Thomas et al., 2006), diaries and self monitoring (Chan et al., 2004; Murphy et al., 2006; Thomas et al., 2006) and walking routes (Gilson et al., 2007).

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Active Travel

Three studies were identified for inclusion, all of which primarily aimed to increase the active travel of employees (Mutrie et al., 2002; Wen et al., 2005; Gatersleben and Appleton, 2007). (Table 4)

Mutrie et al. (2002) reported on the '*Walk in to Work Out'* intervention which aimed to increase walking and cycling to work through the use of written health materials. Participants were mainly economically advantaged women. The intervention group (received health pack at baseline), were almost twice as likely to report walking to work after 6 months as the control (received pack at 6 months): a significant effect was seen. Twenty five percent of the intervention group were also regularly, actively commuting at 12 month follow-up. However, the intervention had no significant effect on cycling.

Wen et al. (2005) assessed the impact of a social marketing campaign on active travel (walking and cycling) to work. Although no significant increase in reported active travel to work at 12 weeks was found, there was a significant reduction in the proportion of staff who reported driving to work 5 days/week ($p=0.012$).

In summary, there is evidence from one UK public sector workplace (Mutrie et al., 2002) that a walking and cycling to work campaign, through use of written health materials distributed to employees, can increase walking (but not cycling) to work in economically advantaged women.

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Other - including multi-component interventions

Sixteen studies (Table 5) were included, covering a range of intervention types (counselling, motivational interviewing, health checks, screening, health promotion messages, information, led activity sessions, active travel or combinations of all of these i.e. multi-component programmes). For many, it was difficult to attribute intervention effects to any particular component of the intervention due to their complexity (multi-component). In several instances increasing physical activity was only one of the primary objectives of the intervention.

Four of the studies (Talvi et al., 1999;; Proper et al., 2003; Aittasalo et al., 2004; Osteras and Hammer, 2006) indicated that workplace counselling had positive effects on physical activity. Of the two studies that focused solely on counselling, Proper et al (2003) showed positive effects on increasing physical activity compared to the control. Another (Aittasalo et al., 2004) whilst showing positive improvements, showed no significant difference between groups receiving counselling, counselling and fitness testing or the control. The other two studies (Talvi et al., 1999; Osteras and Hammer, 2006) were multi-component interventions that included counselling, motivational interviewing and health screening, making it difficult to attribute effects to a single factor.

Evidence from one study (Titze et al., 2001) suggested that employee designed interventions, that included written health and physical activity information, active commuting, stair climbing, led walks, fitness testing and counselling (all as required) can increase physical activity. There was inconclusive evidence from two studies (Marshall et al., 2003; Plotnikoff et al., 2005) regarding the effectiveness of health messages delivered by e-mail. Marshall et al. (2003) reported increases in participation in physical activity by those receiving information by print or electronically, but when analysed by intention to treat there was no significant increase in total physical activity; Plotnikoff et al. (2005) reported positive results on physical activity for health messages received by e-mail. There was further evidence (Cook et al., 2001) that health information delivered through regular workshops increased participants' (ethnic) physical activity levels. However, further study is required as the ethnic composition of the sample may limit the applicability of findings.

Finally, there was evidence from one study (Perkio-Makela, 1999) to suggest that group led exercise sessions could increase physical activity levels for female farmers, but only in the short term. The applicability and transferability of this intervention requires further investigation with a different group. Evidence for sustained change in physical activity is not available in the other categories.

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Discussion

The purpose of this review was to clarify the effectiveness of workplace physical activity interventions with respect to physical activity behaviour change. It builds on the previous evidence base as presented by Dishman et al., (1998) and Proper et al., (2003) which overall revealed inconclusive evidence of effectiveness.

Our review differs somewhat in approach from previous reviews. Dishman et al (1998) used a quantitative approach to quality assessment of studies whereas both Proper et al., (2003) and this review used a qualitative approach. A paradigmatic shift in thinking about the relative importance of the RCT, as a gold standard in intervention research, has led to a more inclusive model with a broader range of study designs becoming more widely accepted within intervention research (Coote et al., 2004). This is especially important in the evaluation of complex programmes (which fits the model of many interventions included in this review) where the application of a RCT design may be methodologically and ethically inappropriate. This review embraced this wider philosophy.

The issue of the quality of the evidence remains important. Both Dishman et al. (1998) and Proper et al. (2003) concluded that the methodological quality of studies in this field was generally poor. Proper et al. (2003) graded 6 RCTs (from 26 included studies) as of high methodological quality. Our review, embracing additional study designs found that 3 of the included studies were of high quality (++) and 11, of good (+) quality. The high category included one interrupted time series (Marshall et al., 2002), one individual RCT (Marshall et al., 2003) and one cluster RCT (Proper et al., 2003). Overall, we would suggest that there is a slight improvement in the quality of study since the publication of the review by Proper et al. (2003).

The volume of evidence has also increased. Our review included 33 studies. Due to time pressures (the limitations imposed by NICE for the review process), our review excluded a similar number of studies that took place in the United States and Asia within the same time period. Most of the included studies were undertaken in large companies or the public sector; indeed, there was a dearth of evidence from SME's. This is of concern when considering that the majority of the workforce in the EU, are employed within the SME sector (SBS, 2002; European Union on Health and Safety at Work, 2003). The sector in general is notoriously difficult to engage in research due to constraints on managers' time and mistrust of health and safety professionals who have predominantly used enforcement as a model of practice (Wright et al., 2004).

This review reinforces the need for greater emphasis to be placed on the verified or independently assessed measurement of physical activity behaviour during interventions, rather than sole reliance on self-report. Most of the included studies, other than those within the walking interventions category, used a survey, self-report method for measuring physical activity. Also, the measurement of overall change in daily physical activity behaviour as well as change during the intervention would be useful. This would address the concern that even though the intervention may be affecting some change in a population it is only as a *replacement* activity and other aspects of daily physical activity may decrease to compensate.

Conclusion

In this review the evidence of the effectiveness of stair walking interventions was limited and intervention effects were short-lived (Marshall et al., 2002; Auweele et al., 2005). Three public sector studies provided evidence that workplace walking interventions using pedometers can increase daily step counts, if accompanied by: facilitated goal setting (Chan et al., 2004; Thomas et al., 2006), diaries and self monitoring (Chan et al., 2004; Murphy et al., 2006; Thomas et al., 2006) and walking routes (Gilson et al., 2007). One good quality study (Mutrie et al., 2002) reported a positive intervention effect on walking to work behaviour (active travel) in middle-class, female employees. There was strong evidence from four studies (Talvi et al., 1999;; Proper et al., 2003; Aittasalo et al., 2004; Osteras and Hammer, 2006) that workplace counselling influenced physical activity behaviour. Further, well-designed research studies are required to boost the developing evidence base on workplace physical activity interventions. Emphasis needs to be on researching workplaces that have so far been under-represented – the SME and voluntary sectors in particular.

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Appendix 1

Electronic Databases Searched from 1996-2007

- ABI Inform
- ASSIA
- Cinahl
- CDSR
- CENTRAL
- DARE
- Embase
- Psycinfo
- Social Science Citation Index
- Social Policy and Practice
- SportsDISCUS
- Transport

Table 1: Systematic Reviews

Author, Year	Overall assessment	Inclusion criteria	Exclusion criteria	Conclusions
Dishman et al., 1998	+	Dependent variable was a measure of PA or a standard measure of physical fitness; dependent variable quantified in a way that permitted change after the intervention to be calculated and compared with a change in a comparison group.	Workplace studies on retired populations; pre-experimental designs, studies with insufficient data for calculating effect sizes, studies with unstandardised measures.	Many studies subject to serious design flaws No confidence that workplace interventions are currently an effective means for increasing PA. Part of this conclusion is based on the poor research designs of studies included.
Proper et al., 2003	+	English language; RCT or non-RCT, healthy working population, workplace programme aimed at enhancing levels of PA, exercise and/or fitness, outcome measure included PA, health related fitness or health.	Not stated	Conclusions based on 2 of 8 studies that examined different outcomes and types of workers. These were not representative of all workplace PA programmes, therefore it is misleading to say that there is strong evidence that workplace PA programmes increase PA. It is more accurate to state that 2 high quality studies demonstrated a positive trend or there is strong evidence for certain types of programmes. Concluded that the design of many of the studies were flawed
Badland et al., 2004	–	Not stated	Not stated	Many of conclusions are related to New Zealand so not necessarily relevant in UK context. Main conclusion was that studies comprise serious design flaws but these illustrate the complexity of the topic area and provide direction for future interventions.

Table 2: Stair Walking

Author, Year	Study Design	Study Quality	Research Question	Workplace type	Description of Intervention	Main Results
Marshall et al., 2002	Interrupted time series	++	Do signs promote the use of stairs in a health care facility?	Health care facility, Australia. Stairs used by staff/visitors	Signs and vinyl 'footsteps' leading people to stairs.	Initial significant increase in stair walking (1.05 Adj OR, 1.01-1.10 CI, p=0.02) but decline back to baseline over study period.
Adams & White, 2002	Control before and after	+	Do signs designed by employees have long-term effects on stair climbing?	Large public sector , UK Stairs used by staff/visitors	Signs near lift, in lift /stairwells.	Non significant increase in stair climbing (retrospective control) (p=0.77, baseline to week 1) Non significant decrease in stair climbing (p=0.74, baseline to week 4)
Kerr et al., 2001	Before and after study	+	Can posters prompt stair use in a workplace?	Private sector, UK	Signs near lift entrance.	No significant effect of poster for stair climbing, but there was for stair descent, an increase in 25%-30% (OR 1.21, CI 1.07-1.37).
Auweele et al., 2005	Before and after study	–	Do health signs and a workplace doctor's email increase stair use in female employees?	Socio-cultural organisation, Belgium	Week 1 health sign placed near lift & stairs on each floor. Week 2 doctors email promoting health benefits of stair climbing.	Stair use increased significantly with use of health sign (Chi square (1) =12.97, p<.001) and with doctors email plus health sign (Chi square (1) =15.58, p<.001). In follow up decline back to baseline.
Badland et al., 2005	Control before and after	–	Do posters increase stair use and objectively measured PA ?	Public sector, New Zealand	Posters	No significant increase
Eves et al., 2006	Before and after study	–	Do posters increase ascent and descent in stair climbing?	Public sector, UK	Health posters in lobby, fixed to stair rises and a point-of-choice prompt at lift.	Significant effect on stair climbing (OR 1.12, p<0.05) greater effect in the overweight. Also, significant effect on stair descent (OR 1.15, p<0.005).
Titze et al., 2001	Before and after study	–	Does provision of written health material encourage stair rather than lift use?	Large, public sector (6 offices), Switzerland	Written information re health benefits of stair climbing. Incentives to stair use Disincentives to lift use	Significant increase in stair use (p=0.028) was found between baseline and follow-up, from observational data.

Table 3: Walking Interventions

Author, Year	Study Design	Study Quality	Research Question	Workplace type	Description of Intervention	Main Results
Chan et al., 2004	Before and after study	+	What are the effects of a pedometer based, walking intervention on PA and specific health indices?	Public sector, Canada	Led through curriculum which explained health benefits, and taught strategies for behaviour change and maintenance. Pedometers used to help participants monitor behaviour.	Average daily step count increase from 7029 ±3100 to a plateau of 10480 ±3224 modelled. Plateau was reached in a mean time of 3.96 ±3.28 weeks. Reductions in waist girth and heart rate were significantly related to increase in steps per day ($p=0.0073$, $p=0.023$).
Gilson et al., 2007	RCT: individual	+	What are the impacts of two different types of walking intervention on work day step counts and health status?	Large public sector, UK	One group using promoted walk routes around grounds of workplace; the other group accumulating steps between occupational tasks. Weekly group emails.	A significant increase in step count in both intervention groups ($p<0.008$, $n2= 0.17$ walking routes) and ($p<0.005$, $n2=0.17$ walking in task groups).
Murphy et al., 2006	RCT: individual	–	Can individuals achieve health benefits from outdoor walking with minimal time investment?	Large public sector, UK	Progressive outdoor walking programme: 60 mins walking week 1 progressing to 90 mins in weeks 3-8.	Significantly more steps on days of prescribed walking compared to rest days ($p<.001$).
Thomas et al., 2006	Before and after study	–	Can individuals increase walking to 10,000 steps/day using a pedometer based PA programme?	Large public sector, Australia	Subsidised pedometers, progressive walking programme to reach 10,000 steps/day, Email support .	10% increase in the number of steps taken per day; increase of 25% in the average number of days that participants reached 10,000 steps. Follow up - 63% reported maintained or increased levels of walking. 65% reported changes to routine to increase PA. Significance not reported.

Table 4: Active Travel

Author, Year	Study Design	Study Quality	Research Question	Workplace type	Description of Intervention	Main Results
Mutrie et al., 2002 Mutrie et al., 2000	RCT: individual	+	Does a self-help intervention increase active commuting?	Large, public sector, UK	Pack containing written information on transtheoretical model of behaviour change plus local information (safety, cycle routes etc)	Intervention group almost twice as likely to increase walking to work as the control group at six months (OR 1.93, 95% CI 1.06-3.52). 25% of the intervention group were regularly actively commuting at 12-month follow-up. The intervention was not successful at increasing cycling.
Gatersleben & Appleton, 2007	Qualitative study	–	What motivates/ impedes cycling to work for people who have never cycled before?	Large, public sector, UK	Cycling scheme with free bike as prize	8 said they would continue to cycling to work. 4 others cited reasons for not continuing - dangerous roads, prefer bus and moving to new job. 10 said they would continue in good weather.
Wen et al., 2005	Before and after study	–	Does a social marketing campaign modify behaviour in relation to active transport?	Large, public sector, Australia	Social marketing strategy	No significant increase in staff who reported using active transport as their usual mode of transport to work. Significant reduction (20%) in proportion of staff who reported driving to work 5 days per week (p=0.012).

Table 5: Other - including multi-component interventions

Author, Year	Study Design	Study Quality	Research Question	Workplace type	Description of Intervention	Main Results
Marshall et al., 2003	RCT: individual	++	Does promotion of PA interventions change PA and influence progression through the stages of motivational readiness?	Large public sector, Australia	Health promotion information on trans-theoretical model of behaviour change plus letters to reinforce messages in booklets. Delivered by print, email and a website	PA increased in both groups at 10 week follow up - no statistically significant differences within/between groups No significant increase in total reported PA (F[1,653]=0.41, p=0.52). Approx 26% of both groups progressed forward at least one stage through the stage of change model.
Proper et al., 2003a	RCT: cluster	++	How effective is an individual, workplace counselling intervention on PA, fitness and health using PACE protocols?	Public sector, Netherlands	7 x 20 minute counselling sessions using PACE protocols to provide a tailored plan of behaviour change.	Significant positive intervention effect for energy expenditure (p=0.003) and cardio-respiratory fitness (submax heart rate) significantly declined in intervention group (p=0.001) (ANCOVA) No statistically significant intervention effect on proportion of employees meeting public health recommendation for moderate intensity PA. (OR=1.46; 95% CI, CI=0.76-2.79).
Proper et al 2003b			As above plus sick leave	As above	As Above	For both groups mean sick leave rate increased during intervention period. After intervention period, mean sick leave for control increased further (22.9 days to 27.6 days) whereas intervention group decreased slightly (21.5 to 20.5 days).
Proper et al., 2004 Proper et al., 2006						No statistically significant intervention effect was found.

Author, Year	Study Design	Study Quality	Research Question	Workplace type	Description of Intervention	Main Results
Aittasalo et al ., 2004	RCT: individual	+	Does counselling, and/or fitness testing have long term effects on sedentary employees' leisure time PA ?	Range of private and public sector companies, Finland	Counselling sessions with occupational health staff Physiotherapists who administered fitness testing	No statistically significant differences between groups in any PA measures at follow up. Statistically significant improvement in a number of measures in *both* groups at 12 month follow up: increased energy expenditure (p=0.011); fulfilment of health enhancing PA (HEPA) recommendation at 12 month follow up (p=0.049).
Cook et al., 2001	RCT: individual	+	Can low intensity workplace intervention improve dietary behaviours, increase PA, reduce blood pressure and weight?	Large, public sector, New Zealand	Health checks/screening, Health promotion workshops and literature	Significant increase in time spent in PA (p=0.0005) from baseline to 12 months in intervention group, whilst decreasing in control (p=0.002).
O'Loughlin et al., 1996	Control before and after	+	What is the short-term impact of school-based screening on leisure time PA of staff?	Public sector, Canada	Health check/screening plus multi-component programme of PA opportunities led by exercise professionals Written materials	Screening group significantly increased their level of leisure time PA (p=0.05).
Rice & Saunders, 2001	Qualitative/extended interview	+	What are the motivating factors, benefits from participation in a workplace health/ active lifestyle programme?	Large, public sector, Australia	Led sessions, walking programme, fitness assessment, and health information	Emergent concepts relevant to participation: setting; social support etc.
Sjogren et al., 2006	RCT: cluster	+	What are the effects of a workplace exercise intervention on subjective physical well-being, psycho - social functioning and general well-being of office workers?	Large, public sector, Finland.	Light resistance training	Light resistance training time significantly increased subjective well-being. (reg co-eff: 0.03253). No significant exercise intervention or light resistance training effects were found for psychosocial functioning or general subjective well being.

Author, Year	Study Design	Study Quality	Research Question	Workplace type	Description of Intervention	Main Results
Titze et al., 2001	Control before and after	+	What impact does a lifestyle PA intervention have on stages of change and energy expenditure in sedentary employees?	Large, public sector, Switzerland.	Cycling, walking to work, counselling/motivational interview, health checks/ screening, led sessions, stair walking, subsidies/ incentives, walking programme	Control sites had significant lower median of energy expenditure (1389 kcal vs 1590 kcal, p=0.046) and significant fewer participants in stages of action and maintenance (35.7% vs 49.3%, p=0.034) cf intervention sites.
Addley et al., 2001	Cross sectional (survey)	–	Does a workplace lifestyle and PA activity programme influence the adoption of positive healthy lifestyle behaviours?	Large, public sector, UK	Health check/screening carried out by occ health dept, tailored, written literature given post check	62% increased PA (n=626); successful maintenance after 6 months in nearly 50%. 1:5 did not attempt change; 1:3 tried and failed
Hanlon et al., 1998	Cross sectional (survey)	–	Does attendance at a workplace health check change health behaviour?	Large, private sector, UK	Health check/screening for cholesterol risk	56% of those who received the health check and returned for follow-up reported one or more of desired behaviour changes, increase in PA being most common.
Lee & White, 2006	RCT: individual	–	Does a minimal exercise programme impact on PA in middle-aged women?	Large, public sector, Australia	Screening plus self-directed low impact aerobic exercise with education session.	No significant effects were reported for PA Significant effects for exercise knowledge ($F_{9,90}=3.34$, p=0.01),
Osteras & Hammer, 2006	Before and after study	–	Can PA be increased through a workplace PA programme?	Large+ medium, private sector, Norway	Counselling, motivational interview, health checks/screening	PA increased significantly (p<0.001) in intervention group in terms of days/week that participants performed PA (exceeding 10 mins) at moderate to high intensity. (mean 2.5 days/week to mean 2.9 days/week). Days/week with at least a 10 minute walk did not increase significantly.

Author, Year	Study Design	Study Quality	Research Question	Workplace type	Description of Intervention	Main Results
Perkio-Makela, 1999	RCT: individual	–	What is the effect of exercise-focused, group activities on female farmers' PA, functional capacity, and work ability over three years?	Private, Finland	Led sessions, group exercise, lectures on lifting, musculoskeletal disorders	Leisure time PA increased significantly post intervention (2.5 months) in both the intervention (p=.000) and control group (p=.001) but the increment was larger in the intervention group (p=.001). LTPA in the intervention group, at 1 year follow up, was still significantly raised (p=.001). By 3 year follow up LTPA had decreased to pre-intervention level.
Pert, 1997	Before and after study	–	Can sedentary employees be influenced to become more physically active?	Medium, public, UK	Health promotion, health check on bicycle ergometer,	Following intervention, more people reported taking regular PA, overall decrease in reported barriers of 17%. 76% reported positive attitude towards PA. No change in walk speed, no significant increase in time taken to reach 70% and 85% of HRmax.
Plotnikoff et al., 2005	Control before and after	–	Does a 12-week workplace email intervention promote physical activity and nutrition behaviour?	Large, private and public, Canada.	Email messages	Intervention group significantly increased PA at follow-up (p,.01), whereas control group significantly reduced PA (p,.01), (effect size was small).
Talvi et al., 1999	Control before and after	–	What were long term health effects of a workplace health promotion programme on oil refinery employees? What effect did health counselling have on PA?	Large, private sector, Finland	Health checks/screening Week 1-10 programme of PA at 60-70% HR max, 45 mins, 3 x week. Week 11-20 programme of PA at 70-85% HR max, 50 mins, 4 x week.	Participation in the counselling programme (group A) remained in the model (logistic regression analysis) as a statistically significant variable for PA. 24% of participants in Group A and 18% participants in Group B had crossed the threshold for PA – i.e. self reported that they were now exercising vigorously for two or more times/week at 3 year follow up.