Physical activity, absenteeism and productivity: an Evidence Review

Adrian Davis, JMP Consulting (Lead Author) and Marcus Jones, TRL (Project Manager)

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PROJECT REPORT

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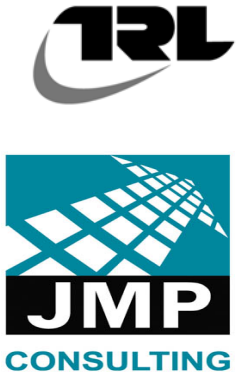

PROJECT REPORT UPR T/102/07

PHYSICAL ACTIVITY, ABSENTEEISM AND PRODUCTIVITY: AN EVIDENCE REVIEW

Version: Final Report

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Client: **Travel Demand Management team**
Transport for London

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	Approvals
Project Manager	**M. Jones**
Quality Reviewed	**I. York**

CONTENTS

Non Technical Summary

This Evidence Review has been conducted by TRL Ltd and JMP Consulting on behalf of Transport for London's (TfL) Travel Demand Management team. TfL is developing one of the largest workplace travel plan programmes in the world and is keen to understand the benefits to businesses that can be achieved through increased physical activity arising from encouraging people to walk or cycle more often as part of the journey to work.

There are already a number of widely reported studies, to varying levels of scientific quality, in the transport literature showing a link between physical activity and health and suggesting that increased levels of cycling and walking can deliver health benefits to the individual (eg Hendriksen, 1996; Andersen et al, 2000; de Gues et al, 2007). However, there is so far little reported evidence from active travel interventions to show that these expected health benefits will lead to measurable benefits to the employer such as reduced levels of sick-leave taken (absenteeism) or improvements in productivity.

This review seeks to address that gap in the evidence by providing a comprehensive evidence base of the impacts of physical activity of all kinds on employee health**,** with a particular focus on how it affects absenteeism and productivity. The lack of evidence specific to workplace travel plans means that it has been necessary to consider studies into a wider range of physical activity interventions in the workplace, however it is expected that much of the information gathered will be transferable to the promotion of walking and cycling to work. The Review therefore examines the extent of sound scientific evidence for the effectiveness of physical activity in reducing absenteeism and increasing productivity in the workplace.

Studies conducted from 1980 to 2006 were considered for inclusion in this review if they identified any differences in levels of absenteeism resulting from:

- before and after a physical activity intervention for employees;
- between employees who were active at different levels;

and in addition any identified changes in employee productivity associated with physical activity.

Because there is a paucity of studies following the principles of scientific design expected by health professionals and academics, it was decided that the study should include a wider range of types of study than would traditionally be included in the systematic reviews conducted in the medical field. Nonetheless, strict quality standards were applied to the reviewed studies, with each one being categorised by study type (identified as "Type 1-3" in the main report) and quality (using a code '++', '+' or '-'). These criteria are consistent with those that are used by the National Institute for Health and Clinical Excellence (NICE).

Type 1, the highest quality studies, are 'systematic reviews' and 'meta-analyses' of randomised controlled trials (RCTs) - the preferred type of study in medical research. Type 2 include non-randomised controlled trials and other analytical studies not meeting the standard of Type 1. Type 3 studies include case reports, case series studies, after only studies and other non-analytic studies; including non-academic sources sometimes referred to as the 'grey literature'.

To identify the studies that would be reviewed, the TRL Library conducted a literature search of international databases, using a list of search terms agreed at the start of the project but tailored for individual databases. Typical search terms included: *absentee, physical activity, exercise, sick leave, productivity, health, walk, cycle, bicycle, employ, employee lifestyle, work place, travel behaviour; work place health promotion; active transport, employee well-being; cost-effectiveness.*

From the initial 2,542 titles that were initially produced by the search, 272 studies were selected by library staff as potentially meeting the criteria for inclusion in the Review. These were then assessed in greater detail by the lead researcher.

Twenty four studies were initially included, but this number was reduced to 14 after a review of the papers found that there was insufficient outcome data for either physical activity or absenteeism or both. A further 3 studies were included after input from expert reviewers of an initial draft report. Few studies meeting the inclusion criteria also provided evidence on productivity changes. Three Type 1 studies were found. Ten studies were categorised as Type 2 with the remaining 4 as Type 3.
It is important to note that the paucity of higher level studies places limits on drawing firm conclusions.

The studies covered four main areas although it is important to recognise that there are significant overlaps between these categories:

- Work Place Health Promotion Programmes
- Exercise programmes
- Physical activity counselling
- Physical activity and health care costs

A summary of the main conclusions in each of these areas is given below. The full report explains the methodology that has been followed in the course of this review and presents the detailed quality assessment and analysis of the reviewed studies. The structure of the report is consistent with that employed by NICE.

Workplace health promotion programmes

Evidence from three studies suggests that introduction of workplace health promotion programmes can lead to increases in levels of physical activity and reductions in absenteeism by at least 12 months commitment to a programme.

Exercise programmes

There is evidence from ten studies to suggest that workplace exercise intervention programmes can lead to long term increases in levels of physical activity and reductions in absenteeism. One study provided evidence to the contrary.

There is evidence to suggest that more intense interventions, i.e. above one hour per week, can lead to long term reductions in absenteeism. Some studies reported between a third and a halving of absentee days.

Physical activity counselling

The evidence from one study tends to suggest that counselling sessions to promote physical activity (and dietary changes) can lead to self-reported increases in physical activity and observed increases in fitness in the short term.

Physical activity and health care costs

There is limited evidence from two studies to suggest that physical activity levels affect both short (up to 1 year) and long term (over 1 year) health care costs (and implicitly absenteeism rates), including among the obese and sedentary.

A barrier to implementation may be reluctance on the part of obese employees to participate in physical activity intervention programmes.

Implications for workplace travel plans

Despite limitations in the quantity and quality of the available evidence, the review has drawn some key conclusions that have direct relevance for workplace travel plan practitioners.

The most significant finding is that an increase in physical activity of over one hour per week (e.g. 90 minutes), easily achieved through walking or cycling to work, would be expected to lead to a measurable reduction in levels of absenteeism. This is of clear commercial benefit to employees and supports the business case for investing in workplace travel plans.

The most cost- effective physical activity interventions are likely to be those that are applied over longer timescales, i.e. 12 months or more, which fits well with the timescale over which a travel plan would be implemented.

Successful interventions do not necessarily have to be on-site but at least employer supported. Employer-supported physical activity interventions were found to be the most effective, suggesting that promoting physical activity through workplace travel plans will be positively received.
The greatest benefits in reduced absenteeism were achieved from getting those who are currently very inactive to take 1 to 2 hours activity per week; again a level of activity readily achievable through changed travel behaviour.

Importantly, the Evidence Review highlighted active travel as a potentially less cost intensive approach to increasing employee physical activity levels, especially among those less amenable to organised workplace activities.

Executive summary

This Evidence Review forms part of a work package being undertaken for Transport for London on Workplace Travel Plans. There is growing interest in the role of active travel in helping to address key public policy challenges, one of which is increasing the health and wellbeing of the working population. The Review seeks to provide a comprehensive evidence base of the impacts of physical activity on employee health**,** with a particular focus on how it affects absenteeism and productivity. Unfortunately, there is a limited amount of literature on the health benefits of walking and cycling to work. However, the literature on physical activity interventions in or organised through workplaces is much more substantial. The Review therefore examines the extent of sound scientific evidence for the effectiveness of physical activity in reducing absenteeism and increasing productivity in the workplace.

Studies conducted from 1980 to 2006 were considered for inclusion in this Review if they identified any potential reduction in levels of absenteeism resulting from:

- physical activity undertaken by employees including interventions made available to employees;
- lifestyle physical activity levels of employees;

and in addition any identified changes in employee productivity associated with physical activity.

Because of the paucity of studies following accepted principles of scientific design, the reported responses to all types of intervention were considered (i.e. systematic surveys, randomised controlled trials (RCTs), quasi-experimental studies, use of non-participant controls, before and after studies as well as reviews).

Each study was categorised by study type (categorised as Type 1-3) and graded for quality using a code '++', '+' or '-', based on the extent to which the potential sources of bias had been minimised (National Institute for Health and Clinical Excellence (NICE), 2006, p27). The studies were categorised into the following study types:

Type 1 Systematic reviews, meta-analyses of randomised controlled trials, (RCTs);

Type 2 Systematic reviews of, or individual, non-randomised controlled trials, case-control studies, cohort studies, controlled before-and-after) studies, interrupted time series (ITS) studies, correlation studies;

Type 3 Non-analytic studies (for example, case reports, case series studies, after only studies).

It is important to note that the paucity of higher level studies places limits on drawing firm conclusions.

Intervention durations were defined as short or long term. The former lasted no longer than 12 months while the latter included all interventions of more than 12 months duration. Most long term studies lasted no longer than 24 months.

Twenty four studies were initially included, but this number was reduced to 14 after a review of the papers found that there was insufficient outcome data for either physical activity or absenteeism or both. A further 3 studies were included after input from expert reviewers of an initial draft report. Few studies meeting the inclusion criteria also provided evidence on productivity changes.

Three Type 1 studies were found. Ten studies were categorised as Type 2 with the remaining 4 as Type 3. Neither of these categories unfortunately provide incontrovertible scientific proof.

The studies covered four main areas although it is important to recognise that there are significant overlaps between these categories:

- Work Place Health Promotion Programmes
- Fitness and physical activity focused interventions
- Physical activity counselling
- Physical activity and health care costs

The main findings from each of these categories are summarised below.

Workplace health promotion programmes

Evidence from one 2+ and two 3+ quality studies suggests that introduction of workplace health promotion programmes can lead to increases in levels of physical activity and reductions in absenteeism in both the short (up to 1 year) and long (1-2 year) terms.

There is little evidence to suggest that the setting of the delivery of the intervention may be a major influence as to its effectiveness in the short term and long term. The nature of the intervention and other factors may be more important. Further, in such studies, it is unclear which component of the wellness intervention is responsible for any benefits.

The evidence from the US studies is applicable to the UK.

Fitness and physical activity

There is evidence from eleven (two 1+, five 2++, two 2+, one 3++, and one 3+) quality studies to suggest that workplace exercise intervention programmes can lead to long term increases in levels of physical activity and reductions in absenteeism. One (2++) study provided evidence to the contrary.

Exercise classes, as a form of intervention content commonly used in workplaces to promote physical activity, appear to be effective. However, non-traditional and more environmental approaches have been proposed which may make physical activity interventions more attractive to employers through lower costs. This might also increase participation rates.

There is evidence to suggest that more intense interventions, i.e. those that increase activity by more than one hour per week, can lead to long term reductions in absenteeism.

This evidence is likely to be applicable in the UK, with limited need for adaptations.

Physical activity counselling

The evidence from one (1-) quality study tends to suggest that counselling sessions to promote physical activity (and dietary changes) can lead to self-reported increases in physical activity and observed increases in fitness in the short term. The high cost of the counselling sessions may be offset in the longer term by reductions in absenteeism but there is no statistically significant evidence to make this claim from this study.

The evidence appears to be applicable to the UK.

Physical activity and health care costs

There is limited evidence from one (2++) and one (3+) quality study to suggest that physical activity levels affect both short (up to 1 year) and long term (over 1 year) health care costs (and implicitly absenteeism rates), including among the obese and sedentary.

A barrier to implementation may be reluctance on the part of obese employees to participate in physical activity intervention programmes.

The evidence comes from one Canadian and one US study but may be directly applicable to similar private sector settings in the UK because of health care costs and related escalating levels of adult obesity.

1 Introduction

1.1 Background to this review

This Evidence Review forms part of a study being undertaken for Transport for London (TfL) by the Transport Research Laboratory and its sub-contractor JMP Consulting. The Review seeks to provide a comprehensive evidence base of the impacts of physical activity promoted through the workplace on employee health**,** with a particular focus on how it affects absenteeism and productivity.

TfL has set targets to increase levels of walking and cycling across the age range and settings. The target is to increase the modal share of cycling, with an increase in cycling trips by 80% by 2010 and 200% by 2020 compared to cycling levels in 2000. There is also a target of increasing the modal share of walking for trips under two miles by 10% by 2015, and to increase the average number of trips made on foot per person / per year by 10%. Potentially, achieving these targets could lead to a significant increase in physical activity amongst employees, with positive benefits for employers as well as employees if this in turn results in reduced absenteeism and increased productivity.

1.2 The need for evidence

1.2.1 Physical activity and active travel

There is growing interest in the role of active travel in helping to address key public policy challenges. Not least is the environmental degradation wrought by widespread use of the car for personal transportation over even short distances and the widening understanding of the contribution of road transport to climate change. At the more local level there are inherent problems of congestion and pollution associated with increasing volumes of private motorised traffic. There is a third and also increasingly understood problem of the health impacts of increasingly sedentary lifestyles in which car use has replaced walking and to a lesser degree of cycling. The growth in motor vehicle ownership and use has a parallel in the sharp rise in obesity since 1980. There is evidence that there is an association if not a causal link (Davis et al., 2007).

In 2004 the Department of Health (DH) estimated the cost of physical inactivity in England to be £8.2 billion annually, including the rising costs of treating chronic diseases such as coronary heart disease and diabetes. The contribution of inactivity to obesity is estimated to cost the health service a further £2.5 billion each year (£0.5 billion in NHS costs and a further £2 billion across the economy as a whole. (It is estimated that obesity accounts for 18 million days of sickness per year). (DH., 2004).

Only 35% of men and 24% of women (aged 16 plus) are physically active enough to meet the current national recommendations (achieving at least 30 minutes of at least moderate activity on 5 or more days a week)**,** moderate being defined in the recommendations as that which makes you feel warm and slightly out of breath.

There is a limited literature on the health benefits of walking and cycling, especially studies that address directly the changes to absenteeism or productivity associated with use of the these modes of travel. Therefore, this Evidence Review focuses on generic physical activity per se and the evidence base linking this with absenteeism and productivity.

Many exercise scientists suspect that a company with an exercise programme will reap benefits of less absenteeism, greater productivity and lower staff turnover, probably enough to warrant an in-house exercise and wellness programme.[1] On such a basis, the reason for TfL's interest in how physical activity can reduce absenteeism and improve productivity is its potential contribution to a business case that TfL has been developing for employers across London; the case will also include important cost savings to both taxpayers and more directly to companies, as cars and local bus services are

[1] Shephard, R. Personal communication 18th June 2007.

replaced by cycling and walking. It is therefore important to ascertain the value of physical activity in terms of its impact on absenteeism, and if possible, on productivity. This will then facilitate effective engagement with employers in promoting Travel Plans[2], and associated behaviour change interventions, to increase the use of the active travel modes. The review therefore presents available evidence and assesses how it can be used in TfL's promotion of travel plans. An important requirement of this work has also been to produce information in a form suitable for presenting to businesses.

A second work package involves TRL and JMP assisting the 'Activate Your Workplace' programme coordinated by St. Mary's University College, Twickenham, which will work with 15 employers in Greater London. Active travel will be one element of a programme of interventions. The Evidence Review and other information provided is welcomed as potentially very useful to the College Activate Your Workplace Programme.

1.2.2 Trends in adult physical activity

Trends between Health Surveys for England in 1997, 1998, 2003 and 2004 found small reported increases in physical activity levels between 1997 and 2004. (DH., 2006). Overall it appears that, over the past 20 or 30 years, there has been a decrease in physical activity as part of daily routines in England, but a small increase in the proportion of people reporting that they take physical activity for leisure. The overall reduction in population activity levels partly reflects other changes that have taken place in society. For example, in England, people undertake less regular travel on foot or by bicycle than in the past: over the last 25 years, both walking (which is the most common form of physical activity) and cycling are estimated to have declined by 26% (DH., 2004).

1.2.3 Physical activity and the worksite

There are limited ways that workplace settings can be influenced in order to improve health. Successes in the past have included workplace policies on healthy eating, and bans on smoking in public places. Many components of the environment can be modified by public sector agencies through changes to policy and practice which facilitate increased physical activity by employees, not the least of which is through active travel for the work journey. A 'review of reviews' by NICE reported that findings on the effectiveness of interventions in the workplace were inconsistent and they concluded it was not possible to suggest evidence-based actions for practice.

However, practitioners who have experience in promoting physical activity in the workplace identify a number of themes.

- The workplace is seen to offer great potential for the promotion of physical activity, as people spend a great deal of time at work, and the employer has an interest in promoting employee health.
- There is little firm evidence for the effectiveness of physical activity promotion in the workplace.
- The collection of evidence is problematic for most people engaged with workplace physical activity promotion because of lack of time, lack of research training, lack of research equipment, and biases associated with a desire for job preservation.
- Case studies of workplace health promotion interventions suggest both positive and negative results, but lack scientific validity.
- More successful programmes have some common components: a project 'champion', consultation with the labour force and a choice of both activities and times at which participation is possible. One important negative factor, which would not arise with cycling or walking, is conflict with

[2] A Travel Plan has been defined by the Department for Transport as: a package of measures produced by employers to encourage staff to use alternatives to single-occupancy car-use.

car-pool, bus or train schedules. Successful programmes also have interest and regular participation from senior management.

- Barriers to workplace health promotion are mainly a perceived lack of time and investment costs in the subject (NICE, 2006a).

1.3 The nature of the identified evidence

As noted above, a rationale for undertaking this Evidence Review has been to test whether specific benefits of physical activity are proven in order to develop a business case to put to employers to encourage the active travel modes among their employees. There have been studies of active commuting and health, but there is virtually no evidence base for the specific role of walking or cycling in influencing absenteeism rates and productivity levels among employees. All of the studies reviewed here focus on workplace health promotion initiatives or encouragement through employers for physical activity and a more healthy overall lifestyle (e.g. diet, back strengthening programmes, smoking withdrawal). They did not address active travel.

In addition, as a result of the limitations on research in this subject area, the broad search strategy employed, and the paucity of scientifically valid trials, a wide range of study types have been considered, from high quality randomised and/or quasi-experimental controlled trials (RCTs) to case studies that can provide no more than suggestive evidence. The majority of the evidence is not comprised of RCTs and therefore in terms of the evidence hierarchy, there is a significant risk of bias (see 2.3).

1.4 Scope of the review

1.4.1 Population groups that will be covered

The Review focuses primarily on the adult working population.

1.4.2 Areas that will not be covered

Interventions that are not evaluated in terms of effects of physical activity on workplace employees' absenteeism will not be covered.

1.4.3 Outcomes

The primary aim is to identify any potential reduction in levels of absenteeism resulting from: physical activity undertaken by employees including interventions made available to employees; lifestyle physical activity levels of employees; and in addition any identified changes in employee productivity.

Other outcomes are also to be considered if there are possible consequences of interventions aimed at increasing physical activity. An example is the impact of improved fitness on cost reductions to the National Health Service. There will be other general improvements such as improved air quality and a more pleasant environment which are beyond the scope of this Evidence Review.

1.4.4 Review team

This review has been carried out by a team from JMP Consulting and TRL. The team is supported by an additional physical activity researcher, Nick Cavill, who provided comments on the first draft. Three expert reviewers also provided comments on the first draft of the Review: Professor Roy Shephard (Emeritus), University of Toronto, Canada; Professor Nanette Mutrie, University of

Strathclyde; Dr Andrew Dannenberg, Centre for Disease Control and Prevention, Atlanta, United States.

2 Methodology

2.1 General Approach

The methodology and general approach to the Evidence Review is modelled on that utilised by the National Institute for Health and Clinical Excellence (NICE). However, some adaptations have been made where appropriate. For example, medical cost claims are likely, to a certain degree, to reflect illness and would thus have some impact on absenteeism rates; therefore studies which have reported on health care cost claims have been included if they also include data on physical activity (see Section 6). Also, two reviews have been included although it is acknowledged that strictly they are not themselves intervention studies.

2.2 Literature Search

2.2.1 Databases searched

The following databases were referenced for our Review:

TRL Library KnowledgeBase (English language ITRD + Library catalogue); ScienceDirect; PubMed; IngentaConnect. PsychInfo.

2.2.2 Search terms

All search strategies were designed by TRL and JMP. Tailored search terms were used appropriate to a particular database. Typical search terms included:

Absentee*, physical activity, exercise, sick leave, productivity, health, walk*, cycle, bicycle, employ* employee lifestyle, work place, travel behaviour; work place health promotion; active transport, employee well-being; cost-effectiveness.[3]

All searches were made from January 1980 to the most recently published version of the database (start of February 2007). Searches were also limited by searching for human studies. The date 1980 was selected for the start of the inclusion period for the search on the basis of previous searches in this field. It is acknowledged that the choice of date is somewhat arbitrary.

2.2.3 Selection of studies for inclusion

The agreed search strategy resulted in 2,542 titles, which were screened for relevance. After further screening by library staff, 272 studies were identified through the library search and other searches through titles and abstracts as potentially meeting inclusion criteria. Key authors were contacted to ascertain whether further papers were available and this resulted in three additional papers. In addition, the study team drew on existing knowledge for references from personal libraries (3 references) but found these to replicate those found through formal searches. The TRL Library search took 2.6 days to complete.

From this number the lead researcher identified 46 studies that were checked to ascertain whether they met the inclusion criteria. During this process a further 12 papers were identified from references from first papers read as being potentially eligible for inclusion. Thus, 58 studies were identified.

After a review of abstracts 44 studies were assessed to be relevant and the full papers were retrieved. All of these were subjected to independent full paper assessment by two people using the appropriate

[3] * after a search term denotes ability to search for variations of the search term eg absentee, absenteeism

critical appraisal tool[4] and all these studies were accepted for full data extraction. Of these 14 studies were assessed as meeting the full inclusion criteria and a further ten were deemed to be worth retaining for analysis but outside of the Evidence Review itself (see Appendix B1). No authors were contacted for further information. Subsequent to a first expert review of a draft report five additional papers were identified, three of which were accepted for full data extraction. Thus, the final number of papers accepted for the Evidence Review was 17.

Studies were included if they assessed how an existing employees' physical activity affected absenteeism rates, or reported on changes in absenteeism rates when physical activity interventions were offered to employees. The studies had to include an outcome measure of physical activity behaviour such as time spent per week participating in an exercise class, and data reporting on absenteeism levels.

All intervention study designs including literature reviews were included.

The main reason for exclusion of studies was that they did not specially measure physical activity as an outcome of broader work place health promotion interventions.

Effectiveness was examined over the following timescales:

- in the short term (up to and including one year)
- in the longer term (over one year)

Table 1 Numbers of studies identified at different stages of the review

	Data sources			
	Electronic databases	References from papers	Identified by reviewer	Total
Searching				
Number of hits	2,542	3	0	2,545
Assessing relevance for review (1st and 2nd sift)				
Number of studies assessed	272	0	0	272
	46	12	3	61
Data extraction and quality appraisal				
Number of included review studies	10	4	3	17

[4] The design of which was based on the SparColl form designed by David Ogilvie and with his consent

2.3 Study Type and Quality Appraisal

Each study was categorised by study type (categorised as Type 1-3) and graded for quality using a code '++', '+' or '-', based on the extent to which the potential sources of bias had been minimised (NICE, 2006, p27). The studies were categorised into the following study types:

Type 1 Systematic reviews, meta-analyses of randomised controlled trials, (RCTs).

Type 2 Systematic reviews of, or individual, non-randomised controlled trials, case-control studies, cohort studies, controlled before-and-after) studies, interrupted time series (ITS) studies, correlation studies.

Type 3 Non-analytic studies (for example, case reports, case series studies, after only studies).

Studies were quality appraised against NICE quality criteria (NICE 2006) appropriate for study types 1-3, and subsequently were classified into one of three categories (++, + or -) within a given type.

++ **All or most** of the data are adequately described and the conclusions of the study are thought very unlikely to be reversed by further studies (low risk of bias).

\+ **Some** of the data are adequately described and the conclusions of the study are thought unlikely to be reversed by further studies (risk of bias)

\- **Few or no** data are adequately described and the conclusions of the study are thought liable to be reversed by further studies (high risk of bias)

Three Type 1 studies were found. Ten studies were categorised as Type 2 with the remaining 4 as Type 3. Neither of these categories unfortunately provide incontrovertible scientific proof. Table 2 shows that the majority of the Type 2 studies were categorised as '+' or '-' quality. The main reasons for studies being assessed as (-) quality were failure to describe methods adequately and to take into account any potential confounders; with many of the methods included in Types 2 and 3, it is impossible to assure elimination of confounding variables.

Table 2 Study type and quality

Study type and quality	Lead Author
1+	Nurminen., 2002; Brox., 2005
1-	Proper., 2004
2++	Cox., 1981; Lechner., 1997; Marshall., 2004; Shephard., 1982; Song., 1982; Shephard., 1992b; Steinhardt., 1991
2+	Baun., 1986; Jacobsen., 2001; Wood., 1989
3+	Alanda., 2005; Bly., 1986; Shephard., 1992a; Wang., 2004

In order to address more fully the issue of data quality this Evidence Review includes an Appendix (D) which provides a brief overview by Professor Roy Shephard, an external reviewer, of many of the limitations faced.

2.4 Study categorisation

2.4.1 Description of studies

The 17 studies are described in Sections 3-6 and presented in the Evidence Table. They include:

- 3 individual Randomised Controlled Trails (Nurminen. et al., 2002; Proper., 2004; Brox., Frøystein., 2005).
- 3 controlled non-randomised trials (Cox et al., 1981; Song et al., 1982; Shephard., 1992b) of the Canadian Assurance company fitness programme, the last providing observations over a 12-year follow-up.
- 3 before and after studies of which the first included a control group (Lechner et al., 1997; Steinhardt et al., 1991; Wood et al., 1989).
- 1 meta-analysis of a range of Randomised Controlled Trials to non-experimental cohort studies (Marshall., 2004).
- 3 cross-sectional surveys (Baun et al., 1986; Jacobsen., Aldana., 2001; Wang., 2004).
- 3 economic analyses (Aldana et al., 2005; Shephard et al., 1982; Shephard., 1992a;), the last one a systematic review of published studies on absenteeism, productivity and turnover to date.
- 1 case study (Bly., 1986).

These studies tested a range of workplace interventions, namely:

- Work Place Health Promotion Programmes
- Fitness and physical activity focused interventions
- Physical activity counselling
- Physical activity and health care costs

2.4.2 Country of studies

None of the studies were conducted in the UK. Table 3 presents the studies by country and lead author.

Table 3 Country and lead author

Country of origin	Authors
World-wide (reviews)	Marshall., 2004; Shephard., 1992a
USA	Aldana et al., 2005; Baun et al., 1986; Bly et al., 1986; Jacobsen., Aldana., 2001; Wang et al., 2004; Wood et al., 1989
Canada	Cox et al., 1981; Shephard et al, 1982; Shephard., 1992b; Song et al., 1982
Finland	Nurminen et al., 2002
Norway	Brox., Frøystein., 2005;
Netherlands	Lechner et al., 1997; Proper et al., 2004

2.4.3 Length of outcome measures

Seven studies measured short term outcomes (up to and including 12 months follow up) only: (Baun et al., 1986; Jacobsen., Aldana., 2001; Lechner et al., 1997; Proper et al., 2004; Cox et al., 1981; Shephard et al., 1982; Steinhardt et al., 1991).

Five studies measured longer term outcomes (over 12 months follow up) only (Bly et al., 1986; Brox., Frøystein., 2005; Nurminen et al., 2002; Song et al., 1982; Wang., 2004).

Five studies provided evidence from both short term outcomes and long term (Aldana et al., 2005; Marshall., 2004; Shephard., 1992a; Shephard., 1992b; Wood et al., 1989).

2.5 Assessing applicability

Each study was assessed on its external validity: that is, whether or not it was directly applicable to the target population(s) and setting(s) in the scope. This assessment took into account the fact that none of the studies were conducted in the UK, together with any barriers identified by studies or the review team, with references as appropriate, to implementing each intervention in the UK, (NICE, 2006).

2.6 Synthesis

It was not appropriate to use meta-analysis to synthesise the outcome data as interventions, methods and outcomes were heterogeneous. This review is restricted to a narrative overview of all studies that met the inclusion criteria and contained sufficient data for data extraction and quality assessment. The effects of studies were examined within the context of existing physical activity levels among employees or as a result of interventions offered, stratified by study quality. The evidence statements were developed using NICE criteria (NICE, 2006, p37), outlined below.

- The best available evidence of the effect of an intervention;
- The strength (quality and quantity) of supporting evidence and its applicability to the populations and settings in question;
- The consistency and direction of the evidence base.

Where there was insufficient evidence to identify specific examples of physical activity levels or effective interventions upon absenteeism rates, evidence statements were drafted upon the general direction of the body of evidence within each category of interventions.

3 Workplace health promotion programmes: Summary of Findings

3.1 The studies

Company workplace health promotion programmes often include an option of a physical activity component as part of the range of wellness and employee assistance options available to employees. The fact that physical activity may be one of many components can add confounding factors or otherwise make assessment of the specific contribution of the physical activity component difficult to isolate from other intervention options. In addition, the physical activity option varies considerably between organisations, from aerobics classes to less structured interventions. Furthermore, cost data from US companies may need to be interpreted with care because medical costs are borne by the company rather than the State, as in the UK.

In options using a worksite programme, a major item on the cost side of the ledger is the cost of dedicated floor space; this varies enormously from country to country and city to city, depending on local land values.

Three studies, all US based (two case studies and one economic analysis), provide evidence for the effectiveness of workplace health promotion programmes in increasing physical activity and reducing absenteeism.

Aldana et al., (2005) documented the impact of a School District Wellness Programme on employee health care costs and rates of absenteeism over a 2 year period.

Bly et al., (1986) assessed the relationship between exposure to a comprehensive worksite health promotion programme and healthcare costs and utilisation over a period of more than 2 years.

Wood et al., (1989) compared the health risk factors and rates of absenteeism of employees at General Mills Inc. after participating for two years in a voluntary, self-directed health promotion programme.

3.2 Evidence of efficacy of workplace health promotion programmes

One (2+) quality study conducted in the US (Wood et al., 1989) reported that healthy lifestyles appear to be affected by a so-called “TriHealthalon” intervention, a health promotion programme which included physical wellbeing, fitness and nutrition and weight control. The number of people who exercised increased from 48% to 71% in the long term (24 months) although the exercise was not defined. Paired t-test results showed that there was no significant change in mean days absent in the participant group from 1984 to 1986. No significant change was seen in the non-participant group from 1985 to 1986 but there was a significant increase in mean days absent from 1984 to 1986. Thus, after two years absenteeism was significantly less in the participating than in the non-participating group, that is, a halving of absentee days among participants. It is likely that the sample was biased, with the participants including a greater proportion of healthy, “fitter” and conscientious workers.

One (3+) quality study conducted in the US (Aldana et al., 2005) reported that there were no short-term differences in health care costs between those who participated in voluntary wellness programmes and those who do not but there was a graded and significant difference after 2 years in absenteeism among those who participate in voluntary wellness programmes as opposed to those who do not participate. Days of missed work significantly decreased with the level of wellness participation. Findings indicate that individuals who participated in wellness programmes in the long term (24 months) had a 20% (3-day) difference in absenteeism compared with those who did not participate in the programmes. 63% of eligible employees reported 90% compliance to exercise recommendations.

Another (3+) quality study conducted in the US (Bly et al., 1986) reported that attendance at exercise classes or facilities led to reported reduced health care cost claims relative to those in the non-intervention group. No details of time duration or monitoring of adherence to programme were reported. Intervention group participants experienced lesser rates of increase in medical costs and

utilisation compared with a non-intervention group. Expressed in 1979 US dollars, hospital costs for the intervention groups doubled over a five year period, while costs in the non-intervention group increased four fold. Interpretation of this data is again complicated by the dramatic change in claims experience for both experimental and control workers.

Evidence from one (2+) and two (3+) quality studies suggests that introduction of physical activity interventions within workplaces can lead to increases in physical activity and reductions in absenteeism in the long term (24 months) but not in the short term (up to 12 months). Moreover, one study (3+) reported decreases in health care costs in the long term while another study (2+) reported reduced absenteeism unrelated to health-care costs in the long term.

3.3 Key Questions

3.3.1 What is the aim/objective of the intervention?

Each study directly sought to improve health and offered options to increase physical activity as part of an overall workplace health promotion programme. In one study 63% of 3288 programme participants engaged in physical activity, committing to 30 minutes of moderate activity on five days a week. The programme was offered to all employees, dependents and retirees and participants engaged in physical activity for either one or two years (Aldana et al., 2005). One study programme's principal goals were to provide a means for employees "to become the healthiest in the world" and to curb the increasing illness and accident costs of the corporation (Bly et al., 1986). 8451 employees reported participating in exercise. One intervention was a longitudinal study of a worksite "TriHealthalon" scheme comparing the lifestyle risks and absenteeism rates of 688 field sales employees participating in a voluntary multi-optioned health promotion programme (Wood et al, 1989). All interventions were offered to employees as activities to be undertaken in their own time, including lifestyle physical activities.

3.3.2 How does the content of the intervention influence effectiveness?

In one US based (3+) quality study (Aldana et al., 2005) participants committed to exercise and/or participate in a fitness challenge as two of 11 programmes that participants could engage in. In another US based (3+) quality study (Bly et al., 1986) attendance at exercise classes were offered in an environment where the company sought to improve the working environment and promote healthy lifestyles by providing exercise facilities, as well as other changes such as improving the nutritional value of food offered in the company canteen. In a third US based (2+) quality study (Wood et al., 1989) volunteer participants of a "TriHealthalon" scheme were required to complete one of three optional lifestyle activities, fitness being one of the options. On completion of each of the specific activities participants received an incentive award for his or her accomplishment. These incentives were used to enhance the programme adherence.

In summary, companies sought to encourage participation through offering a range of health promotional interventions of which exercise was one. As noted previously, this creates difficulties in isolating the effects of physical activity from other intervention measures. Nonetheless, physical activity packaged as part of a broader programme of healthy lifestyle intervention options may offer an effective route to increase physical activity levels among employees.

3.3.3 How does the way that the intervention is carried out influence effectiveness?

Three studies were effective in increasing levels of physical activity. One US (3+) quality study (Aldana et al., 2005) where employees were dispersed over a large geographical area but concentrated at the 90 schools or buildings within a school district promoted all wellness programmes via the internet and email. Participants each made a commitment to undertake exercise. The programme included a promotional challenge to encourage participation.

In one (3+) quality study (Bly et al., 1986) there was some variation among intervention sites in programme contents and facilities. For example, with respect to fitness facilities, some sites developed elaborate fitness facilities, while others offered exercise classes. Despite these differences, the basic strategy remained the same at all sites: to offer a combination of lifestyle improvements including regular exercise. One (2+) quality study (Wood et al., 1989) included internal competition as a stimulus to be physically active through a "TriHealthalon" scheme which was introduced and promoted at annual sales meetings. Quarterly incentives ranged from gift catalogues to jogging suits, plus the sales region with the largest participation was the winner of a "National TriHealthalon" trophy.

In summary, the way that the intervention is carried out varied between studies but most had a long term impact on effectiveness in terms of physical activity and absenteeism (with the exception of Bly et al, 1986), and also possibly in terms of reduced health care costs.

3.3.4 Does the site/setting of delivery of the intervention influence effectiveness?

The three studies reported an intervention delivered through a workplace, but not necessarily completed in the workplace. One (3+) quality study was implemented across a county School District and concentrated at the 90 schools or buildings within the district in the US (Aldana et al., 2005), another (3+) across three worksites in the US (Bly et al., 1986), and a third through 17 regional sales offices across the US (Wood et al., 1989). Each achieved significant increases in physical activity levels reported by participants over the long term and each (where measured) had an impact on absenteeism. One (3+) quality study also reported a slower increase of health care cost claims over the long term relative to the non-intervention group (Bly et al., 1986).

There is little evidence to suggest that the setting of the delivery of the intervention may be a major influence as to its effectiveness in either the short term or the long term. The contents of the intervention and other factors may be more important.

3.3.5 Does the intensity (or length) of the intervention influence effectiveness/duration of effect?

All three interventions (Aldana et al., 2005; Bly et al., 1986; Wood et al., 1989) lasted over 12 months: 24 months, more than 30 months (for the first intervention group), and 24 months, respectively. Intensity of the County School District Wellness Programme intervention remained constant across the two years. No post intervention monitoring was reported. The principal research objective was to assess whether during the two year period health care costs and rates of absenteeism changed from those at baseline. Of the 6246 employees eligible for the study, 1407 (22.5%) participated in the wellness programme in either 2001 or 2002, and 1264 (20.2%) participated in the wellness programme both years (Aldana et al., 2005). In a Johnson and Johnson "Live for Life" programme three groups were identified for analysis, based on length of time that the intervention had been in operation: Group 1 sites where the intervention programmes had been operational for more than 30 months as of the end of 1983. Group 2 sites where the intervention programmes had been operational for 18-30 months, and Group 3 sites with no intervention. The strongest effect for health care utilisation costs (and thus possibly absenteeism levels) were between Group 2 and Group 3 (Bly et al., 1986). This suggests that a 12 month intervention may maximise the possible reductions in health care costs claims for a physical activity intervention, after which the benefits may decline; this could reflect a "loss of newness," and/or a decline in adherence to the programme. The General Mills Corp. TriHealthalon programme compared lifestyle risk and absenteeism rates of field sales staff. Absenteeism was reported to be significantly less after 2 years in the intervention group and there was a statistically significant ($p<.05$) difference in absenteeism between participant and non-participant groups during 1985 and 1986 (Wood et al., 1989). There is some evidence to suggest that a 12 month intervention may be sufficient in order to achieve a reduction in absenteeism and any associated health care cost utilisation, although it is not clear whether this level of benefit can be maintained in the longer term.

3.3.6 How does the effectiveness vary with age, gender, class, ethnicity etc?

Two studies included data according to age, gender and participation. In a worksite only intervention, the mean age of participants was 36 years while non-intervention group employees were marginally older. Men were slightly more likely to participate. (Aldana et al., 2005; Bly et al., 1986).

Women incurred higher health care utilisation and costs than men (Bly et al., 1986). In one study mean age was influenced because retirees could participate (Aldana et al., 2005). However, one and two year wellness participation was highest in the age group 30-39 and lowest in the age group 60 years and older. (Aldana et al., 2005). There is some evidence that those choosing to participate in worksite health promotion programmes have a relatively young age profile (and may have a higher fitness level, as fitness levels decline with age).

Neither study reported on the ages or genders of employees participating specifically in the physical activity options (nor the gender of the instructor which may be important for some participants), so it is not possible to make any firm conclusions that these findings are replicated specifically for physical activity interventions.

3.3.7 What are the barriers to implementation?

None of the studies specifically addressed barriers to implementation. In the opinion of the reviewers, in order for these interventions to be successful in the long term they need to be attractive to a wider range of employees. This issue has been considered in detail in a number of reports on worksite programmes. Factors include expense (payroll deductions and need to purchase special clothing and equipment), participation in car-pools or use of buses with a limited schedule, ability to participate as a family, and approval of the immediate supervisor. However, overall there is insufficient evidence from these studies to make any firm conclusions about barriers to implementation.

3.3.8 What are the non-physical activity outcomes of the intervention?

In each of the three studies, cost savings of the workplace health promotion programmes in terms of reductions in absenteeism, reduced medical costs, or both were reported. However, these were not disaggregated so as to be able to report costs directly associated with the physical activity interventions, although it is of note that the physical activity options were popular options.

3.4 Applicability (of evidence from efficacy studies) to UK population/setting

All three studies were from the US, but there is no evidence as to why such intervention programmes could not be applicable in a UK workplace context. *In summary, the evidence from the US studies is applicable to the UK (with the proviso that medical costs in the US are borne by the company).*

3.5 Implementability of intervention

The three US studies provide no information to suggest that the intervention is not applicable to the UK. Such workplace programmes are likely to be similar to those which have been implemented in the UK.

Workplace health promotions summary evidence statement:

Evidence from one (2+) and two (3+) quality studies suggests that introduction of workplace health promotion programmes can lead to increases in levels of physical activity and reductions in absenteeism in both the short (up to 1 year) and long (1-2 year) terms.

There is little evidence to suggest that the setting of the delivery of the intervention may be a major influence as to its effectiveness in the short term and long term. The contents of the intervention and

other factors may be more important. Further, in such studies, it is unclear which component of the wellness intervention is responsible for any benefits.

The evidence from the US studies is applicable to the UK.

4 Fitness and physical activity: Summary of Findings

4.1 The studies

This section concerns studies of the effect of workplace fitness or exercise interventions on absenteeism rates and associated economic costs.

Eleven studies: two world-wide reviews (one meta-analysis and one economic analysis), one Finnish based (individual randomised controlled trial), one Norwegian based and two Canadian based (controlled non-randomised trials), one Dutch (uncontrolled before and after study), one Canadian (case study) and three US based (one controlled non-randomised trial, one uncontrolled before and after study, and one cross-sectional survey) studies provide evidence for the effect of workplace fitness or exercise interventions on absenteeism rates and associated economic costs.

Nurminen et al., (2002) assessed the impact of a multi centred trial which evaluated the impact of a workplace exercise intervention on perceived work ability and sick leave among women with physically demanding laundry work.

Marshall., (2004) reviewed the evidence of the benefits of physical activity in the workplace and specifically the quality of the intervention studies conducted since 1997.

Brox, J., Frøystein., (2005) evaluated the effectiveness of physical exercise at the workplace among nurses and nurse aides in a Norwegian care home, looking at aerobic fitness, health-related quality of life and sickness leave.

Lechner et al., (1997) evaluated the effectiveness of different levels of participation in an employee fitness programme on the change in sick days in three different worksites (police, chemical industry, banking company).

Cox et al., (1981) sought to assess the effects of employee fitness programme upon physiological fitness scores and measures of job satisfaction, productivity and absenteeism in the short term.

Song et al., (1982) undertook a long term evaluation of adherence to an employee fitness programmes (18 months).

Steinhardt et al., (1991) firstly sought to determine if the level of physical activity and cardiovascular fitness were significantly related to absenteeism and medical care claims among law enforcement officers over a one year period. Secondly, they sought to determine if moderate levels of physical activity and fitness were inversely associated with reduced absenteeism and medical care claims.

Jacobsen., Aldana., (2001) sought to compare the frequency of self-reported exercise participation (aerobic activity of at least 20 minutes) with annual illness-related absenteeism in a large sample of adult workers.

Baun et al., (1986) sought to compare the illness and absenteeism rates, medical care utilisation rates, and costs of fitness programme participants and non participants employed by a corporation.

Shephard., (1992a) sought to address the issues involved in economic appraisals of work-site fitness programmes.

Shephard., (1992b) provided a 12 year follow-up of a selected group of high physical activity participants from the first large-scale, private sector, employee fitness programmes in Canada. It also sought to provide a longer term assessment of effectiveness.

4.2 Evidence of efficacy

All eleven studies addressed workplace exercise interventions or assessments which varied in programme duration and amount of time devoted to exercise each week.

One (1+) individual randomised controlled trial study conducted in Finland (Nurminen et al., 2002) reported that there was no statistically significant differences in the cumulative amount of sick leave between the intervention, a one hour session per week of moderate and vigorous exercise intensity, and control groups at any follow-up time.

This group may have had higher baseline activity than some, because depending on the type of installation, laundry can be physically demanding work.

Physiologically, 1 hour of exercise during work hours on a weekly basis was found to be inadequate to improve physical fitness in this population, while for the company, it was a moderately costly intervention due to lost production time and additional health care personnel costs. The intervention duration was 15 months.

One (1+ quality) study (Brox., Frøystein., 2005), conducted in Norway, reported that sickness absence increased in both the intervention and control groups although the increase was significant only in the observed intervention group. The overall difference in sick leave between the two groups was not significant. The intervention consisted of one hour of light group exercise per week. Fitness was objectively tested. The difference between groups was 4.7 days in favour of the control group. Sick leave was precisely recorded and seasonal variations in sickness absence were eliminated by comparing similar times of the year. Fitness levels among participants did not increase. The authors reported no plausible explanation for the large increase in sickness absence. The intervention duration was 24 months.

One (2++) quality study (Marshall., 2004), a world-wide review, reported on 32 intervention studies, mostly with a short-term duration (up to 1 year). It found that the more successful individually-based programmes were those which tailored materials to individual needs, expectations and abilities. The greatest potential for influencing the overall workforce appeared to be programmes that included less 'organised' approaches and promoted incidental physical activity within and around the workplace. However, most studies included volunteer participants who were either sufficiently motivated to change their behaviour or were already active. They also highlighted the difficulty of recruiting and retaining participants, especially ones leading sedentary lifestyles.

One (2++) quality study (Lechner et al., 1997), conducted in The Netherlands, reported that in a physical activity intervention a low exercise participation rate (less than once a week) and a no participation group hardly showed any decline in sick days. The high exercise participation group (more than once a week) on average showed a decline of 4.8 sick days, approximately a reduction of one-third. The authors report that the results strengthen the belief that high exercise activity (i.e. an average of at least once a week) can indeed have a positive effect on reduced absenteeism. The benefits would be even bigger if employees with more pre-intervention sick days would also exercise regularly in the programme. The intervention duration was 12 months. However, the reviewers note that this may be a case of recruiting conscientious employees with a low initial sickness rate.

One (2++) quality study (Steinhardt et al., 1991), conducted in America, reported that the overall effect for objectively measured activity level revealed that sedentary law enforcement officers were absent significantly more than officers who were occasionally active or active three times per week. Among male officers where the differences were greatest, absenteeism varied from 9.82 among sedentary officers compared to 5.83 days per year for those who were active three times per week, approximately a 40% difference in annual absenteeism levels. Also, female officers were absent significantly more often than their male counterparts. Although medical care claims tended to be lower for the more active and fit officers within a sub-sample, results of the analysis for differences in both activity level and fitness category were not significant. The intervention duration was 12 months. Participation was obligatory.

Three (2++) quality studies addressed a physical activity intervention in a Canadian Life Insurance Company both at six months (Cox et al., 1981) at eighteen months (Song et al., 1982) and at twelve years (Shephard., 1992b). Physical activity was objectively measured for an intervention which was comprised of exercise classes of up to three times per week of 30 minutes duration which volunteer participants were encouraged to attend. At six months despite the relatively low intensity programme

and the slow rate of progression the majority of programme adherents showed substantial gains in conventional measures of fitness (body fat, aerobic power and flexibility). By eighteen months observation the majority of former high adherents had become low adherents or drop-outs from the programme. However, at the same time a small number of low adherents and drop-outs became high adherents. The total of initial class members still attending exercise sessions was 176, 13.7% of employees (6 class leaders, 52 high adherents, 118 low adherents). 17.2% of total staff.

While the 6 month report (Cox et al., 1981) established a clear improvement in fitness scores among high adherents from January to June 1978, the subsequent changes from 1978 to 1979 (Song et al., 1982) are of more interest, since only a small proportion of subjects participated in the 1979 tests. The programme was sufficient to sustain physiological gains won from January to June 1978, but was insufficient to induce additional training.

The effects after 12 years of the employee fitness programme were reported (Shephard., 1992b). Only a small minority of employees, some of whom were undoubtedly very active before initiation of the programme, were persuaded to sustain a sufficient volume of exercise to have a long term impact on their lipid profile and slow the normal age-related loss of aerobic power. Although long-term adherents to the onsite fitness programme were limited to approximately 13%, participants in community exercise programmes were also increased.

One (2+) quality study (Jacobsen., Aldana., 2001), conducted in America, reported that results from self-reported behaviour suggested that 1 aerobic activity exercise session of at least 20 minutes a week reduces absenteeism when compared with no weekly exercise and that 2 days of weekly exercise is favourable relative to 1 day, but at 12 months no reduction in absenteeism occurs between 2 days and more than 2 days of weekly exercise. Absenteeism reduced most among those undertaking 2 days of weekly exercise where it was halved in comparison with those taking no exercise per week. The reviewers noted that this might indicate a 'ceiling effect' in terms of noticeable increased benefit ie above 2 days the benefits are minimal.

One (2+) quality study (Baun et al., 1986) reported that results from an American company with a health and fitness programme indicated a trend for exercisers to have fewer sick hours than non-exercisers with a significant difference only demonstrated between female exercisers and non-exercisers.

In both male and female exercise groups there was a (weak) trend for sick hours to be inversely related to advancing age, whereas in the non-exercising groups the reverse was found. Exercisers were healthier and utilised the health care system for relatively minor illnesses. Exercisers were slightly younger. The intervention duration was 12 months. The reviewers note, however, that statisticians are critical of data mining in sub-groups when there is no difference in the main sample.

One (3+) quality study (Shephard., 1992a) was a world-wide review, reporting on 82 studies, mostly with a short-term duration. It noted that in the short-term, work-site fitness and health programmes appear to yield corporate benefits that more than match programme costs, although this view would be strengthened by more controlled experiments and a more robust methodology of quantifying the benefits financially. The proportion of employees who participate in work-site programmes is quite small, and the author noted that it remains to be seen whether similar benefits could accrue if attempts were made to involve a large section of the work force.

There is evidence from ten (two 1+, five 2++, two 2+, and one 3+) quality studies to suggest that workplace exercise intervention programmes can lead to long term increases in levels of physical activity. However one (1+) quality study suggests that fitness levels were not increased through a weekly one hour intervention of light exercise, nor that absenteeism declined among the intervention group. Overall, the majority of the studies did report that absenteeism rates were reduced among participants compared to non-participants. Caveats are that participants may be those who are motivated to become active or already are active, that non-participant rates remain high, and only a small minority were long term voluntary participants.

4.3 Key Questions

4.3.1 What is the aim/objective of the intervention?

The interventions sought to improve physical fitness among employees and (among other objectives) to reduce absenteeism and/or health care costs.

4.3.2 How does the content of the intervention influence effectiveness?

Among the eleven studies a wide variety of interventions took place, but an important component of most interventions was that participants took part in on-site exercise classes (Nurminen et al.,. 2002; Marshall., 2004; Brox ., Frøystein., 2005; Lechner et al., 1997; Cox et al., 1981; Song et al., 1982; Baun et al., 1986; Shephard., 1992b). Other interventions offered included health checks, education programmes, motivational prompts, incentives (e.g. prizes), organised sports, and non-workplace activities such as jogging, walking, and cycling as part of lifestyle changes programmes.

In summary, on the basis of the studies, the evidence would suggest that exercise classes are offered to employees at least as part of a wider range of exercise options which could include lifestyle changes beyond the workplace.

4.3.3 How does the way that the intervention is carried out influence effectiveness?

As shown above, it appears that a voluntary approach may only attract a relatively small section of employees and that these participants may not be those who would benefit most in terms of health from participation and that consequently employers may gain less than they might through reductions in absenteeism and associated costs. One of the studies (Steinhardt., et al., 1991) was unique in that participation was not voluntary. In a study of law enforcement officers all were required through the programme to achieve a minimum fitness level above that of the general population. The intervention did reveal that more physically active officers were absent less frequently than sedentary or occasionally active officers. The reviewers note that greater use of incentives and/or more attractive incentives may be a means to increase employee voluntary participation.

4.3.4 Does the site/setting of delivery of the intervention influence effectiveness?

The eleven studies reported an intervention delivered through a workplace but not necessarily completed on-site. Given that exercise classes appear to be a common feature of fitness and physical activity programmes, the setting may be important and also the site consequently in terms of the availability of suitable accommodation for the classes. The reviewers note that this type of approach is likely to result in bias towards larger employers. In addition, one study (Shephard., 1992a) has speculated that unsupervised walking and cycling are the least expensive forms of exercise, since they can be built into the normal structure of the day, and because of low overall cost are likely to be the most cost-effective methods of inducing a given weekly energy expenditure. This could be an important consideration for employers. It is also of note that other factors can also be important. This includes the design of workplaces, such as having walkways, attractive accessible stairs, as well as the location of the workplace in terms of making walking and/or cycling for accessing local shops a viable option. Town and city centre sites are likely to be more favourable with regards to the latter point.

There is some evidence to suggest that the setting of the delivery of the intervention through workplace settings and sites can lead to short (up to 1 year) and long term increases (more than one year) in physical activity and decreases in absenteeism, also with implications for intervention costs.

4.3.5 Does the intensity (or length) of the intervention influence effectiveness/duration of effect?

The intensity of the interventions varied considerably from some short term studies (largely reported through two reviews) to long term. Most interventions were for a minimum of 12 months and one study provided a 12 year review (Shephard., 1992b). One of the findings appears to be that single sessions of 1 hour of exercise per week are insufficient to improve physical fitness or reduce absenteeism. Interventions that led to more than one hour per week were reported to result in lower absenteeism rates among participants compared to those participating in one hour or less per week as well as compared to non-participants. These were reported in four (2++) quality studies (Lechner et al., 1997; Cox et al., 1981; Song et al., 1982; Steinhardt et al., 1991) one (2+) quality study (Jacobsen., Aldana., 2001).

The reviewers surmise that this limited amount of physical activity may be the underlying reason for the failure to improve fitness and reduce absenteeism rates, reported in two (1+) high quality studies (Nurminen et al., 2002; Brox ., Frøystein., 2005). Current Department of Health guidance recommends at least a minimum of 150 minutes of moderate physical activity per week (DH., 2004).

There is evidence to suggest that more intense interventions in terms of duration of physical activity time per week, i.e. achieving an increase of physical activity of more than one hour per week, can lead to long term reductions in absenteeism. In most studies there is little evidence as to whether the physical activity is moderate or vigorous.

4.3.6 How does the effectiveness vary with age, gender, class, ethnicity etc?

Eight studies reported data on age and or gender. One of these reported an intervention involving women only (Nurminen et al., 2002); while a second was very largely comprised of women (Brox., Frøystein., 2005). It is of note that both of these intervention failed to improve fitness and reduce absenteeism rates. Given only one session per week, this is not necessarily a reflection of gender.

As noted above, the reviewers note that this may have been because the limited intensity and duration of the interventions was insufficient to improve health. In addition, Steinhardt et al (1991) mentions gender effects, where women were shown to take more leave, while, Baun et al., (1986) mentions higher improvement rates amongst women (approximately 3 days sickness leave reduction after the intervention opposed to approx. 1 for men). The mean age for participants across the studies was between 36 and 40 years (Lechner et al., 1997; Steinhardt et al., 1991; Jacobsen., Aldana., 2001; Baun et al., 1986). This suggests that it may be hard to recruit significant numbers of participants for physical activity programmes from those older than 40 years. However one of the Canadian Assurance company intervention studies (Song et al., 1982) noted that the programme appealed to an older segment of employees, possibly to the point of discouraging those who were younger. In interventions involving men and women where data was reported, slightly more men than women participated and this was true as a percentage share as well as numerically. In one of these studies it was reported that the women's sample was too small for robust analysis (Steinhardt et al., 1991).

One of the studies, from the US, also reported on the ethnicity of participants (Jacobsen., Aldana., 2001) of which 85% were Caucasian, and 12.5% African American. It is not possible from this one study to make any conclusions about ethnicity or gender but participants appear more likely to be aged under 40.

4.3.7 What are the barriers to implementation?

None of the studies specifically addressed barriers to implementation (other than age, as noted above). However, programme costs could be a barrier and it has been noted in one study (Shephard., 1992a) that the cost of developing an exercise facility at the workplace, relative to subsidising exercise that an employee takes elsewhere, or encouraging walking and cycling to and from work, may influence the decision by employers to establish workplace fitness and physical activity programmes. Similar considerations as to the potential of less cost- intensive approaches to increasing employee physical

activity and absenteeism have been raised including the promotion of incidental activity (e.g. using stairs instead of lifts) (Marshall., 2004).

However, overall there is insufficient evidence from these studies to make any firm conclusions about barriers to implementation.

4.3.8 What are the non-physical activity outcomes of the intervention?

The issue of staff retention was addressed in four studies, one a world-wide review. Overall some positive effects were reported, but mainly in samples of motivated volunteers. Most studies, however, reported retention rates between 51% to 63% over the long term (Marshall., 2004). Another world-wide review addressed issues of retention in terms of lower turnover rates, as well as turnover and productivity. Some studies reported significant reductions in staff turnover. For example, the Canadian Assurance programme reported a turnover rate drop from 18% to 1.8% per annum in programme adherents in the first year (Song et al., 1981; Shephard., 1992b). Self-selection and novelty of a programme are noted to be possible causes of bias and overall or long-term retention levels may be lower. With regards to productivity it is reported that there have been many claims for improved productivity. Moreover, early gains in productivity and reduced employee turnover appear to have persisted, so that from the company's perspective the 12 year programme remains cost-effective (Shephard., 1992b). Yet there is limited robust data to support this finding. Shephard (1992b) also addressed retention in terms of staff turnover, as well as highlighting problems for small companies with limited resources, differences between salaried staff versus wage earners, and issues relating to commuting.

In summary, in three studies there was limited evidence for non-physical activity benefits of interventions in the workplace.

4.4 Applicability (of evidence from efficacy studies) to UK population/setting

The evidence from the eleven studies is likely to be directly applicable to UK settings.

In summary the evidence is likely to be applicable in the UK, with limited need for adaptations.

4.5 Implementability of intervention

In the opinion of the reviewers, all the studies would be feasible to implement in UK work settings where employers have sufficient resources available to provide exercise or other physical activity interventions. This implies that larger employers may be better able to afford the costs of establishing workplace fitness and physical activity interventions. The issue of non-work settings is included in several of the studies reported, such as the promotion of walking and cycling for the work journey. While conditions, especially for cycling, are likely to be less conducive in the UK than in other European countries from which studies are drawn, the public policy, social and cultural environment is arguably more favourable in the UK and in London specifically (partly due to Congestion Charging in central London) than in recent decades.

Fitness and physical activity: summary evidence statements:

There is evidence from ten (one 1+, five 2++, two 2+, one 3++, and one 3+) quality studies to suggest that workplace exercise intervention programmes can lead to long term increases in levels of physical activity and reductions in absenteeism. One (1+) study provided evidence to the contrary.

Exercise classes, as a form of intervention content commonly used in workplaces to promote physical activity, appear to be effective. However, non-traditional and more environmental approaches have been proposed which may make physical activity interventions more attractive to employers through lower costs and might also increase participation rates.

There is evidence to suggest that more intense interventions i.e. above one hour per week can lead to long term reductions in absenteeism.

This evidence is likely to be applicable in the UK, with limited need for adaptations.

5 Physical activity counselling: Summary of Findings

5.1 The studies

'Counselling' describes an approach to physical activity promotion whereby individuals are offered one or a series of counselling sessions with a counsellor trained in physical activity promotion. It is sometimes offered with specific physical activity interventions being available at the work place, or alternatively employees may be offered a lifestyle assessment, and on this basis physical activities are 'prescribed' in consultation with the employee, to be performed within the community (this could include walking or cycling to work).

One Dutch based study (Proper et al., 2004) involving a randomised controlled trial, provided evidence for the effectiveness of worksite physical activity counselling in changing levels of physical activity (and diet), but (perhaps because of a limited sample size) the observed and substantial trend had no statistically significant impact on absenteeism. Proper et al., (2004) evaluated the impact of worksite physical activity counselling using cost-benefit and cost-effectiveness analysis. The Stages of Change model (Prochaska and DiClemente, 1983) was used to assess intention to act.

5.2 Evidence of efficacy

One (1-) quality study (Proper et al., 2004) showed that a significant positive intervention effect was observed for weekly energy expenditure and cardiorespiratory fitness post counselling sessions. The intervention participants expended more calories per day, whereas the control group decreased their weekly energy expenditure over the period of observation. Outcomes were measured objectively over a nine-month term. Cost-effectiveness analysis indicated a positive effect on fitness but not absenteeism at high costs for the counselling intervention when compared with the control condition over the 9 months.

In conclusion, the study does not provide a financial justification for implementing worksite counselling in terms of reductions in sick leave (which were not statistically different between groups). However, positive effects were shown for energy expenditure and cardiorespiratory fitness over the nine month trial.

There is evidence from one (1-) study to suggest that counselling can lead to self-reported increases in physical activity and observed increases in physical fitness; other work site interventions support this conclusion.

5.3 Key questions

5.3.1 What is the aim/objective of the intervention?

The objective of the study was to test whether worksite physical activity counselling results in reduced sick leave costs, changes in physical activity levels, energy expenditure, cardiorespiratory fitness and upper extremity symptoms.

5.3.2 How does the content of the intervention influence effectiveness?

The Dutch based study reported that a counselling intervention in the workplace was effective in increasing levels of physical activity among Dutch civil servants (Proper et al., 2004). Intervention participants were offered seven consultations, all of which took place during work time for approximately 20 minutes each. Counselling was mainly aimed at physical activity and healthy diets. A stage of change questionnaire was used to assess intention to act.

In summary, there is insufficient evidence from one study of this size to make any firm conclusions about the extent to which the specific content of counselling influences the effectiveness of the intervention in changing physical activity levels among employees.

5.3.3 How does the way that the intervention is carried out influence effectiveness?

The one study used counselling to promote physical activity. The high costs for the counselling intervention when compared with the control condition made the intervention financially questionable in the short-term. Financial effectiveness was measured partly through a cost benefit analysis which was carried out to compare the intervention costs with the monetary benefits due to sick leave reduction. However, the cost-effectiveness based on this analysis was zero, since there was no significant change in absenteeism. No data were provided as to the quality of the counselling.

5.3.4 Does the site/setting of delivery of the intervention influence effectiveness?

The setting for the intervention, a local municipal authority, is likely to be reflective of a large and often main employer in many towns and cities in The Netherland and elsewhere, where desk-based work may comprise at least half of job tasks.

It is worthy of note that Enschede, the location for the intervention, like many other Dutch towns, has a relatively high level of cycle use for the journey to work and for other purposes and that unlike in some other locations in Europe cycling is considered normative in Enschede and thus an available way for employees to increase their levels of physical activity. An additional consideration is that the setting for the intervention is a public sector organisation. It is known that in the UK public sector organisations have higher levels of absenteeism than in the private sector (CBI, 2006) and this may be true also for the Netherlands where absenteeism rates are also understood to be high.

5.3.5 Does the intensity (or length) of the intervention influence effectiveness/duration of effect?

The intensity of the intervention remained constant across seven counselling sessions of approximately 20 minutes duration each. Although changes in sick leave were not statistically significant, there was a trend to financial effectiveness; this increased from a EUR 125 reduction in sick leave costs during the intervention period (9 months), to a total of 635 EUR during the 9 months after the intervention. These benefits were compared against the estimated intervention costs (salary costs of employees and counselling costs) of EUR 430 per participant to calculate the cost benefit ratio. However, there is insufficient evidence from the study to make any firm conclusions about either cost-benefit ratios or the intensity (or length) of the interventions' influence.

5.3.6 How does the effectiveness vary with age, gender, class, ethnicity etc?

The study included data concerning effectiveness of counselling to promote physical activity among adults, of which 27.8 percent were women. No details were provided as to the effectiveness of the intervention according to gender or other variables. Sick leave prevalence was marginally higher among women, but since the experimental effect was not significant in the overall sample, it would be inappropriate to make post-hoc comparisons by age, gender, class or ethnicity.

5.3.7 What are the barriers to implementation?

There was insufficient evidence from the single study to make clear inferences about barriers to implementation, although the main reported change in activity appeared to be in the area of formal sports rather than other leisure activities.

5.3.8 What are the non-physical activity outcomes of the intervention?

A cost benefit analysis was carried out to compare the intervention costs with the monetary benefits due to sick leave reduction. For the remaining outcome measures (physical activity, energy expenditure, cardiorespiratory fitness), a cost effectiveness ratio was calculated. Although statistically non-significant, the Cost Benefit Analysis suggested that the financial effectiveness augmented by reductions in sick leave continued for 9 months after the end of the intervention. Cost-effectiveness analysis suggested a positive effect at high costs for the counselling intervention when compared with the control condition.

The analysis of the data is complicated not only by the lack of a significant inter-group difference, but also because any trend to benefit rests largely on increasing sick leave (costs) in the control group. Although not statistically significant, the difference between sick leave costs between the intervention and the control group was large, and if verified by a larger scale trial might be considered relevant in the long term.

5.4 Applicability (of evidence from efficacy studies) to UK population/setting

This Dutch based study may be applicable to the UK provided account is taken of the differences of opportunities for routine physical activity and differences in initial engagement in active commuting between the Netherlands and the UK. There is therefore greater potential for cycling in the former, but a greater proportion of workers in the UK may be able to take up cycling, because they have learnt to cycle but have not done so in recent years.

In summary the evidence may be applicable to the UK with some caution.

5.5 Implementability of intervention

It is likely that the study would be feasible to implement in a UK worksite location such as a local authority. Some consideration would be needed as to the physical activity opportunities available to UK employees via the employer or in the local environment. In addition, the follow-up was short term (up to 1 year). Additional counselling might be needed in order to have a long term impact (more than 1 year).

Counselling summary evidence statement:

The evidence from one (1-) quality study tends to suggest that counselling sessions to promote physical activity (and dietary changes) can lead to self-reported increases in physical activity and observed increases in fitness in the short term. The high cost of the counselling sessions may be offset in the longer term by reductions in absenteeism but there is no statistically significant evidence to make this claim from this study.

The evidence appears to be applicable to the UK.

6 Physical activity and health care costs: Summary of Findings

6.1 The studies

It is postulated that being physically active can decrease the risks of having ill-health and consequent absenteeism. One particular risk is obesity-related comorbidities regardless of any change in weight. Physical activity can reduce health care use and costs among overweight and obese populations. Obesity and sedentary lifestyles are increasingly challenging health care services across the developed world and are also likely to place major costs onto businesses through absenteeism. However, the WHO has emphasized that most world-wide guidelines do not demand enough activity to be effective against obesity.

One US based study (cross-sectional survey) provides evidence for the effectiveness of physical activity in reducing health care cost claims according to different weight groups among employees.

One Canadian study reported (economic analysis) provided evidence for the effectiveness of a physical intervention in reducing health care costs

Wang et al., (2004) reported on a study which examined the relationship between physical activity and health care costs by different weight groups across a number of employees who selected an indemnity or medical insurance plan and were not in Medicare during the years 1996 to 1997.

Shephard et al., (1982) assessed the health care costs associated with an intervention encouraging employees to participate in up to three 30 minute exercise classes per week. The study utilised data from the Ontario Health Insurance Plan as to hospital stays, the hospital diagnostic code and medical claims.

6.2 Evidence of efficacy

One (2++) quality Canadian study reported that participation in up to three exercise class sessions of 30 minutes per week resulted in an increase in predicted maximum oxygen intake, a decrease in body fat, and an increase in flexibility. After twelve months of the intervention compared with monitoring of health care claims twelve months prior to the intervention allowing $100/ day for hospital use, the total saving would be $84.50 per individual, or $84,500 for a company with 1,000 employees ($43.50 in males, and $132.40 in females).

The study revealed that lower health care costs are associated with those who participate in a regular exercise regime. Increasing health care costs in the control group was noted to be the main reason for the significant savings reported within the test group.

One (3+) quality US based study reported that physically moderately active (1 or 2 times a week of at least 20 minutes) and very active (3+ times/week) employees had approximately $250 less paid health care costs annually than sedentary employees (0 time/week) across all weight categories. The difference was greatest in the obese subpopulation at approximately $450 less between most and least active.

The study demonstrated that lower health care costs are associated with physically active behaviour among the obese active employees but this relationship was not observed among normal weight and overweight employees. This indicates that physical activity behaviour could offset at least some of the adverse effects of excess body fat, and in consequence help moderate the escalating health care costs. Efficacy was evaluated over 24 months for effects on health claims. Physical activity levels were self-reported as was Body Mass Index (BMI). The reviewers note that health costs are implicitly linked with absenteeism rates.

There is some evidence from one (2++) and one (3+) quality study to suggest that physical activity levels affect health care costs both in the short term (twelve months) and also in the long term (and implicitly absenteeism rates), including among obese employees.

6.3 Key Questions

6.3.1 What is the aim/objective of the intervention?

The study was designed to examine the relationship between physical activity behaviour and health care costs (medical and pharmaceutical costs) among normal weight, overweight, and obese active employees.

6.3.2 How does the content of the intervention influence effectiveness?

One (2++) quality study included 1281 employees who participated in the exercise class intervention, while 645 employees from a separate company acted as controls. A total of 1,125 employees from both the intervention and control completed a fitness assessment and agreed to statistical analysis of data from the Ontario Health Insurance Plan for 1977 and 1978. All participants were encouraged to participate in up to three thirty minute sessions of physical activity per week, supervised by a health professional. Those attending classes also received a personal prescription for individual home exercise. Supervised sessions were grouped according to the age, sex, and initial fitness level of the participants.

Both rhythmic callisthenics and endurance-type activity (60% or more of maximum oxygen intake) were required. There was a gradual progression to 17 minutes of endurance activity per session after six months.

One (3+) quality study was focused on a large sample (23,490) of active employees working for a US manufacturing corporation. Employees were surveyed using a Health Risk Appraisal which asked about physical activity (exercise or work which is hard enough to make one breathe more heavily or to make your heart beat faster) “in an average week” for at least 20 minutes duration. There were four answer options: 0 times per week; 1-2 times per week; 3 times per week, and 4+ times per week. Three levels of habitual physical activity were named as ‘sedentary’, ‘moderately active’, and ‘very active’.

Physical activity examples included brisk walking, running and heavy labour. Thus the interventions were not necessarily conducted in the workplace but could be part of lifestyle physical activities.

In summary, on the basis of two studies, there is limited evidence of effectiveness through exercise classes for reductions in health care costs. However, it is noted that non-participant health care costs at the intervention company were equally reported to have reduced which suggests that the benefit arose from the overall increase in health awareness in the company. With regards to the effectiveness of physical activity among obese employees, the reviewers note that it is possible that subsequent to the Appraisal some employees could have become motivated to undertake more physical activity.

6.3.3 How does the way that the intervention is carried out influence effectiveness?

The Canadian study used health care use data including hospital stays and medical claims over a 24 month period. The US study also used health use and claim data including medical and pharmaceutical costs incurred during a 24 month period. There was some evidence from two studies to support this approach in order to assess effectiveness of physical activity levels on health care costs and absenteeism.

6.3.4 Does the site/setting of delivery of the intervention influence effectiveness?

Both studies monitored the effects of interventions made by employers which could be part of a physical activity conducted in the workplace but also included the potential for activity which could be conducted elsewhere. There is insufficient information to assess whether the site or setting of delivery influenced effectiveness in reducing health care costs. However, the Canadian study does

note that it should also be asked whether health education might earn greater dividends than a corresponding investment in facilities for supervised physical activity.

6.3.5 Does the intensity (or length) of the intervention influence effectiveness/duration of effect?

The intensity of both the Canadian and US interventions remained consistent, with physical activity being monitored once and health care cost claims being monitored over 24 months. In the Canadian study three 30 minute sessions built up endurance-type activity so that physical activity could be defined as moderate to vigorous. This appears to be sufficient to be effective in reducing health care costs. That physical activity intensity levels among US obese employees correlated with health care cost claims suggests that physical activity on at least once or twice a week amongst these weight group results in the largest cost savings to employers ($7.1 million dollars at 2002 prices). There is limited evidence from two studies to suggest that the intensity and length of the interventions was sufficient to positively influence the effectiveness of effect.

6.3.6 How does the effectiveness vary with age, gender, class, ethnicity etc?

In the US study the average age of participants was 47.1 years. Males, who comprised 78.5% of the participants, were more likely than females to be physically active. Data on age profiles were not reported in the Canadian study, however it did provide data on health care claims by gender which were approximately three times greater among women than among men. There is, however, insufficient data to assess how effectiveness varies with age or gender.

6.3.7 What are the barriers to implementation?

The studies do not present data on any barriers to implementation. However, it seems possible that in the US study some overweight or obese employees would decline to volunteer to participate.

6.3.8 What are the non-physical activity outcomes of the intervention?

In terms of health care costs, in the Canadian study, potential savings averaged 0.57 hospital days per employer-year, plus $28.5 in Insurance Plan claims, a saving of $84,500 for a company of 1,000 employees (at 1982 prices). In the US study in the normal weight group, the moderately active cost $229 less than the sedentary people (a marginal effect), but the very active people did not cost significantly less. In the obese group, the moderately and very active employees had $458 and $421 less medical costs than the sedentary overweight employees.

In summary, in the two studies there was some evidence that at least an hour a week of physical activity was effective at reducing health care costs and also that the most significant savings may arise from physical activity among obese employees.

6.4 Applicability (of evidence from efficacy studies) to UK population/setting

The evidence comes from one Canadian and one US study but may be directly applicable to similar private sector settings in the UK because of health care costs and related escalating levels of adult obesity. A caveat is that US companies can directly benefit financially through reductions in health insurance premiums as a result of reduced health care claims unlike in the UK where any savings as a result of reduced medical claims results in a saving to the government.

6.5 Implementability of intervention

In the opinion of the reviewers interventions through the workplace which encourage physical activity at work or in other settings appears to offer considerable scope for reducing absenteeism as well as

reducing health care costs to the NHS. In particular they may be especially beneficial where targeted at sedentary and obese populations.

Physical activity and health care costs summary evidence statement:

There is limited evidence from one (2++) and one (3+) quality study to suggest that physical activity levels affect both short (up to 1 year) and long term (over 1 year) health care costs (and implicitly absenteeism rates), including among the obese and sedentary.

A barrier to implementation may be reluctance on the part of obese employees to participate in physical activity intervention programmes.

The evidence comes from one Canadian and one US study but may be directly applicable to similar private sector settings in the UK because of health care costs and related escalating levels of adult obesity.

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Hendriksen, I. (1996) The Effect of Commuter Cycling on Physical Performance and on Coronary Heart Disease Risk Factors, Amsterdam: Free University.

National Institute for Health and Clinical Excellence., (2006a) Promotion of physical activity among adults. Evidence into practice briefing. London: NICE.

National Institute for Health and Clinical Excellence., (2006b) Public health guidance: development process and methods. London: NICE.

Prochaska, J., DiClemente, C., (1983) Stages and processes of self-change of smoking: Towards an integrative model of change. Journal of Consulting and Clinical Psychology, 51: 390-395.

Appendix A: Included studies

(001) Aldana, S., Merrill, R., Price, K., Hardy, A., Hager, R., (2005) Financial impact of a comprehensive multi-site workplace health promotion programme, Preventive Medicine, 40: 131-137.

(011) Shephard, R., (1992a) A critical analysis of work-site fitness programmes and their postulated economic benefits, Medicine and Science in Sports and Exercise, 24(3): 354-370.

(014) Marshall, A., (2004) Challenges and opportunities for promoting physical activity in the workplace, Journal of Science and Medicine in Sport, 7(1) Suppl: 60-66.

(018) Brox, J., Frøystein, O., (2005) Health-related quality of life and sickness absence in community nursing home employees: randomised controlled trial of physical exercise**,** Occupational Medicine, 55: 558-563.

(024) Wang, F., McDonald, T., Champagne, L., Edington, D., (2004) Relationship of body mass index and physical activity to health care costs among employees, Journal of Occupational and Environmental Medicine, 46(5): 428-436.

(025) Jacobsen, B., Aldana, S., (2001) Relationship between frequency of aerobic activity and illness-related absenteeism in a large employee sample, Journal of Occupational Environmental Medicine, 43(12): 1019-1025.

(028) Lechner, L., de Vries, H., Adriaansen, S., Drabbels, L., (1997) Effects of an employee fitness program on reduced absenteeism, Journal of Occupational and Environmental Medicine 39(9): 827-831.

(031) Steinhardt, M., Greenhow, L., Stewart, J., (1991) The relationship of physical activity and cardiovascular fitness to absenteeism and medical care claims among law enforcement officers, American Journal of Health Promotion, 5(6): 455-460.

(033) Baun, W., Bernacki, E., Tsai, S., (1986) A preliminary investigation: Effect of a corporate fitness program on absenteeism and health care cost, Journal of Occupational Medicine, 28(1): 18-22.

(037) Nurminen, , E., Malmivaara, A., Ilmarinen, J., Ylöstalo, P., Mutanen, P., Ahonen, G., Aro, T., (2002) Effectiveness of a worksite exercise program with respect to perceived work ability and sick leave among women with physical work, Scandinavian Journal of Work Environment and Health, 28(2): 85-93.

(038) Proper, K., Bryne, M., Hildebrandt, V., van der Beek, A., Jan Meerding, W., van Michelen, W., (2004) Costs, benefits and effectiveness of worksite physical activity counselling from the employer's perspective, Scandinavian Journal of Work Environment and Health, 30(1): 36-46.

(040) Shephard, R., (1992b) Twelve years experience of a fitness program for the salaried employees of a Toronto Life Assurance Company, American Journal of Health Promotion, 6(4): 292-301.

(041) Bly, J., Jones, R., Richardson, J. (1986) Impact of worksite health promotion on health care costs and utilization. Evaluation of Johnson and Johnson's Live for Life program, Journal of the American Medical Association, 256(23): 3235-3240.

(042) Wood, A., Olmstead, G., Craig, J. (1989) An evaluation of lifestyle risk factors and absenteeism after two years in a worksite health promotion programme, American Journal of Health Promotion, 4(2): 128-133.

(045) Cox, M., Shephard, R., Corey, P., (1981) Influence of an employee fitness programme upon fitness, productivity and absenteeism, Ergonomics, 24(10): 795-806.

(046) Song, T., Shephard, R., Cox, M., (1982) Absenteeism, employee turnover and sustained exercise participation, Journal of Sports Medicine, 22: 392-399.

(047) Shephard, R., Corey, P., Renland, P., Cox, M., (1982) The influence of an employee fitness and lifestyle programme upon medical care costs, Canadian Journal of Public Health, 73: 259-263.

Appendix B1: Excluded studies

These studies did not meet the inclusion criteria for the Evidence Review but will be of interest to those engaged in workplace health promotion.

	Study Reference	**Reason for exclusion**
1	(002) Bertera, R., (1990) The effects of workplace health promotion on absenteeism and employment costs in a large industrial population, American Journal of Public Health, 80(9): 1101-1105.	Physical activity outcomes not included
2	(007) Matson Koffman, D., Goetzel, R., Anwuiri, V., Shore, K., Orenstein, D., LaPier, T., (2005) Heart healthy and Stroke free. Successful business strategies to prevent cardiovascular disease, American Journal of Preventive Medicine, 29(5S1): 113-121.	Physical activity outcomes not included
3	(009) Shephard, R., (1983) Employee Health and Fitness: The State of the Art, Preventive Medicine, 12: 644-653.	Limited of physical activity outcome data
4	(017) Blair, S., Smith, M., Collingwood, T., Reynolds, M., Prentice, M., Sterling, C., (1986) Health promotion for educators: Impact on absenteeism, Preventive Medicine, 15: 166-175.	Limited of physical activity outcome data
5	(021) Proper, K., van der Beek, A., Hildebrandt, V., Twisk, J., van Mechelen, W., (2004) Worksite health promotion using individual counselling and the effectiveness on sick leave; results of a randomised controlled trial, Occupational Environmental Medicine, 61: 275-279	Physical activity outcomes not included
6	(026) Stein, A., Khoury Shakour, S., Zuidema, R., (2000) Financial incentives, participation in employer-sponsored health promotion, and changes in employee health and productivity: HealthPlus Health Quotient program, Journal of Occupational Environmental Medicine, 42(12): 1148-1155.	Limited of physical activity outcome data
7	(027) Goetzel, R., Jacobsen, B., Aldana, S., Verdell, K., Yee, L., (1998) Health care costs of worksite health promotion participants and non-participants, Journal of Environmental Medicine, 40(4): 341-346.	Physical activity outcomes not included
8	(032) Lynch, W., Golaszewski, T., Clearie, A., Snow, D., Vickery, D., (1990) Impact of a facility-based corporate fitness program on the number of absences from work due to illness, Journal of Occupational Medicine, 32(1): 9-12.	Physical activity outcomes not included
9	(039) Conrad, K., Riedel, J., Gibbs, J., (1990) Effect of worksite health promotion programmes on employee absenteeism, AAOHN Journal, 38(12): 573-580.	Physical activity outcomes not included
10	(044) Jones, R., Bly, J., Richardson, J. (1990) A study of a work site health promotion program and absenteeism, Journal of Occupational Medicine, 32(2): 95-99.	Physical activity outcomes not included

Appendix B2: Excluded studies

1 Shephard, R., (1983) A short history of occupational fitness and health promotion. Preventive Medicine, 20:436-445.

2 Shephard, R., (2000) Worksite health promotion and the older worker, International Journal of Industrial Ergonomics, 25: 465-475.

3 Cerin, E., Leslie, E., du Toitc, L., Owen, N., Frank, L., (in press) Destinations that matter: Associations with walking for transport, Health and Place.

4 Fielding, J. (1982) Effectiveness of employee health improvement programs. J Occ Med, 24 907-916.

5 Gundewell at al., (1998) Primary prevention of back symptoms and absence from work. Spine 18, 587-594.

6 Kellett, K., Kellett, D., (1991) Effects of an exercise program on sick leave due to back pain. Phys Ther 71; 283-291.

7 US Department of Health and Human Services, Public Health Service. (1992) National Survey of Worksite Health Promotion Activities. AM J Health Promotion 7: 452-463.

8 Spencer, L., Pratt, D., Hausman, A. (1996) Using health benefits as an incentive to change employee health risks: preliminary program results. Empl Benefits J. 21: 26-29, 36.

9 Aldana, S., Jacobsen, B., Harris, C., (1994) Influence of a mobile health promotion programme on health care costs, J Prev Med, 9: 378-382.

10 Kingery, P., Ellsworth, C., Corbett, B., Bowden, R., Brizzolara, J., (1994) High-cost analysis: a closer look at the case for work-site health promotion, J. Occ. Med, 36: 1341-1347.

11 Tucker, L., Aldana, S., Friedman, G., (1990) Cardiovascular fitness and absenteeism in 8,301 employed adults, Am J Health Prom, 4: 140-145

12 Hatziandreu, E., Koplan, J., Weinstein, M., Casperson, C., Warner, K., (1988) A cost-effectiveness analysis of exercise as a health promotion activity, Am J Public Health 1988: 78: 1417-1421.

13 Shephard RJ, Cox M, Corey P (1981) Fitness program participation: its effect on worker performance. J Occup Med. 1981 May;23(5):359-63.

14 Conrad K. (1990) Effect of worksite health promotion programs on employee absenteeism. AAOHN;38(12):573-580.

15 Dishman, R., Oldeberg, B., O'Neal, H., Shephard, R., (1998) Worksite physical activity interventions. American Journal of Preventive Medicine, 15(4): 344-361.

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17 Gilson, N., McKenna, J., Cooke, C., Brown, W., (2007) Walking towards health in a university community: A feasibility study. Preventive Medicine, 44: 167-169.

18 Noblett, A., LaMontagne, A., (2006) The role of workplace health promotion in addressing job stress. Health Promotion International, 21(4): 346-353.

19 Wen, L., Orr, N., Bindon, J., Rissel, C., (2005) Promoting active transport in a workplace setting: evaluation of a pilot study in Australia. Health Promotion International, 20(2): 123-133.

20 Tsai, S., Bernacki, E., Baun, W., (1988) Injury prevalence and associated costs among participants of an employee fitness programme. Preventive Medicine, 17: 475-482.

21 Proper, K., Heymans, M., Paw, M., van Sluijs, E., Poppel, M., van Michelen, W., (2006) Promoting physical activity with people in different places – a Dutch perspective. Journal of Science and Medicine in Sport, 9: 371-377.

22 Building Research Establishment (1999) Transport and buildings: the environmental perspective. London: BRE.

23 Payne, N., Jones, F., Harris, P., (2002) The impact of working life on health behaviour: The effect of job strain on the cognitive predictors of exercise, Journal of Occupational Health Psychology, 7(4): 342-353.

24 Lloyd, P., (2006) Creating healthy, high-performance workplaces strategies from health and sports psychology, Consulting Psychology Journal: Research and Practice, 58(1): 23-39.

25 Addley, K., McQuillan, P., Ruddle, M., (2001) Creating healthy workplaces in Northern Ireland: evaluation of a lifestyle and physical activity assessment programme. Occupational Medicine, 51(7): 439-449.

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27 Bertera, R., (1993) Behavioural risk factor and illness day changes with workplace health promotion: Two-year results. American Journal of Health Promotion, 7(5): 365-373.

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30 Hanebuth, D., Meinel, M., Fischer, J., (2006) Health-related quality of life, psychological work conditions, and absenteeism in an industrial sample of blue- and white-collar employees: A comparison of potential predictors. Journal of Occupational and Environmental Medicine, 48(1): 2837.

31 Pollitt, D. (2006) Pressure management keeps down the stress at Toshiba UK. Human Resource Management International Digest, 14(5): 29-30.

32 Jeffrey, R., Forster, J., Dunn, B., French, S., McGovern, P., Lando, H., (1993) Effects of work-site health promotion on illness-related absenteeism. Journal of Occupational Medicine, 35(11): 1142-1146.

33 Brown, D., Russell, M., Morgan, J., Optenberg, S., Clarke, A., (1984) Reduced disability and health care costs in an industrial fitness programme. Journal of Occupational Medicine, 26(11): 809-816.

34 Lovelace, K., Neck, C., Manz, C., (2001) Virtual team fitness: Enhancing team performance through team member health. Virtual Teams, 8: 215-237.

Appendix C: Example search strategy

OVID Medline

Search terms

Search strategy:

English[lang] AND (medline[sb] OR pubmed pmc local[sb]) AND "humans"[MeSH Terms] AND ("1980/01/01"[PDAT] : "2007/02/02"[PDAT])

AND

((employee* OR employer* OR workplace* OR "place of work" OR personnel OR staff)

AND

(health* OR productiv* OR absent* OR sick* OR "well being" OR "well-being" OR illness OR turnover)

AND

(fitness OR "physical activity" OR exercis* OR walk* OR cycl* OR bicycle* OR bike* OR lifestyle OR "travel behaviour" OR "travel behavior" OR "workplace health promotion" OR "active transport" OR "active travel" OR "travel plans" OR active))

1474 records returned - 104 selected

Appendix D[5]: Data quality

Author's note. The text below sets out comments received on a draft of the report which the authors agreed should be included as helpful background information about the limitations of data quality.

Observer reporting bias. A high proportion of the reports on work-site programmes were collected by relatively untrained physical educators. They not only lacked experience in how to conduct trials, but were biased by a pressing need to justify their programme to a critical corporation.

This is critical in that many of the variables measured such as programme adherence are somewhat subjective.

Subjective reporting bias. There is also a need for caution in accepting self-reports of participation in physical activity. If either the government or a company has been pressing for this, and has offered incentives to those reporting participation, then an increased proportion of workers may report the socially desired activities without any actual change in behaviour. This bias is a particular problem when interpreting "before and after studies."

Lack of controlled experiments. The normal standard for inclusion of a report in a clinical meta-analysis is a double-blind, randomized controlled trial. However, it is not possible to conduct a controlled trial in most corporations, even without attempting to blind either participants or observers: unions insist on equal access to any new benefits for all of their members, and even if a control group can be organized in non-union organizations, there is a strong likelihood of contamination between experimental and control groups (the latter becoming infected with an interest in exercise).

There are two ways around this dilemma: a quasi-experimental trial (trying to recruit a closely matched, nearby company as a control, as in the Toronto Life Assurance Study), or seeking out a mega-corporation with multiple factories which are hopefully somewhat similar to each other (as in Johnson & Johnson); in the latter case, the working population unfortunately tends to show large differences between one work site and another. But there is almost no possibility of a double-blind RCT in the work-place. This explains the dearth of good studies (there are probably less than ten reports that have any real scientific content).

Other ineffective approaches. Given the above problems, many alternatives have been sought. However, it seems inappropriate to include either before and after trials or the use of non-participant controls in an analysis of this particular issue, as they contribute virtually nothing in the way of scientific "evidence."

Before and after trials. The issue of placebo response has been well-known for work-site health interventions for many years; indeed, it was in a study of productivity at the Hawthorne works of the Westinghouse Company that the "Hawthorne response" was first described. Productivity was increased both by an improvement of illumination, but was further augmented by a return to original standards of lighting, because in both cases workers were showing a placebo response. Before and after trials of absenteeism and productivity are also vulnerable to the effects of season and changing employee market place conditions, which affect both absenteeism and productivity.

[5] Section supplied by Shephard, R., Personal communication, 18th June 2006

Non-participant controls. Non-participants are known to have a greater chance of being unfit, unhealthy and smokers, all of which bias comparisons of absenteeism and productivity with participants in an exercise programme.

Indicating quality of data. The scheme adopted to indicate the quality of available reports does not seem very easy to follow. There are other methods of assessing the quality of data which may be more appropriate to studies of the interactions between participation in fitness programmes and a range of health outcomes.

Appendix E: Glossary

DfT	Department for Transport
DH	Department of Health
NHS	National Health Service
NICE	The National Institute for Health and Clinical Excellence
RCT	randomised controlled trial[6]
TfL	Transport for London
Exercise classes	Structured and supervised workplace located activities

[6] A randomized controlled trial (RCT) is an experiment in which investigators randomly assign eligible subjects (or other units of study, e.g. classrooms, clinics, workplaces) into groups to receive or not receive one or more interventions that are being compared. The results are analysed by comparing outcomes in the groups.