

Evidence-based lifestyle interventions in the workplace – an overview

S. Schröer, J. Haupt and C. Pieper

Institute for Medical Informatics, Biometry and Epidemiology, University Hospital of Essen, Essen 45145, Germany.

Correspondence to: S. Schröer, Department of Medical Informatics, Biometry and Epidemiology, University Hospital of Essen, Hufelandstr. 55, Essen 45145, Germany. Tel: +49 (0)201 9223 9243; fax: +49 (0)201 9223 9333; e-mail: Sarah.Schroer@UK-Essen.de

Background	Lifestyle-related health issues affect the economic position of organizations and contribute to reduced productivity, increased absenteeism and health care costs.
Aims	To summarize the effectiveness of different workplace health interventions for promoting healthy lifestyle, preventing diseases and reducing health care costs.
Methods	We searched MEDLINE via Pubmed, EMBASE, Cochrane Library, NelH, HighWire Press and Google Scholar in March 2012. Systematic reviews and meta-analyses of workplace interventions aimed at promoting physical activity, healthy weight and good nutrition were included. Three authors assessed the quality of the reviews and extracted data on methods, interventions, outcomes, results and effect sizes.
Results	We identified 15 publications covering a total of 379 original studies. Three systematic reviews found beneficial effects of workplace nutrition interventions on employees' dietary behaviour. Three reviews found multi-component physical activity interventions to be effective in increasing employees' physical activity and fitness. The other activity promotion interventions were less effective regarding physical activity and weight-related outcomes. In terms of weight management, our findings favour multi-component interventions that focus on both physical activity and nutrition over single dietary programmes.
Conclusions	Workplace health promotion interventions may improve physical activity, dietary behaviour and healthy weight. There is no evidence of increased efficacy associated with specific intervention types. Workplace health promotion should focus on either physical activity or weight or nutrition behaviour to maximize effectiveness. Best evidence is available for multi-component interventions.
Key words	Diet; health promotion; lifestyle; occupational; physical activity; weight loss; workplace.

Introduction

Work and employees' physical and mental health are interconnected in different ways. Work environment factors including shift work, work stress and work demands directly impact on employee health and well-being. On the other hand, a poor state of health may lead to sick leave, lost working days, increased absenteeism, presenteeism, and reduced productivity and influences the profitability of organizations [1]. Maintaining employees' health and work performance therefore is of great importance and is reflected in the introduction of workplace health promotion and prevention programmes.

A number of chronic diseases are strongly associated with unhealthy lifestyle including poor nutrition and being sedentary, overweight or obese [2]. Thus, nutrition and exercise are important starting points for health promotion and disease prevention. However, it is not known which approach leads to the best economic and health-related results. Previous systematic reviews that have assessed evidence of the effectiveness of workplace health promotion and prevention have either focused on physical activity, nutrition or weight management.

We therefore aimed to summarize the current evidence from systematic reviews on the efficacy and cost-effectiveness of different workplace lifestyle interventions. We report the main results of recently published

systematic reviews to determine which intervention types are associated with improvements in nutrition, physical activity and healthy weight.

Methods

A comprehensive literature search was conducted in six electronic databases and search engines (MEDLINE via Pubmed, EMBASE, Cochrane Library, NelH, HighWire Press, Google Scholar) in March 2012. Secondly, the websites of relevant organizations and institutions were screened. Reference lists of all the retrieved articles were checked for further relevant publications.

The systematic literature search consisted of simple and specific terms and word combinations related to workplace health promotion and prevention with a focus on nutrition, weight management and/or physical activity. The same combinations of search terms were run in all six databases. The following terms were used in the initial search: health promotion, meta-analysis, systematic review, prevention, effectiveness, effect, evaluation, evidence, health program, cost-benefit analysis, worksite/workplace, enterprise, employee, intervention, occupational health, organizational health, physical activity promotion, nutrition, diet, work environment. Based on these terms the electronic databases were searched for various combinations.

Publications had to meet several eligibility criteria to be included in the review. The literature was limited to peer-reviewed systematic reviews and meta-analyses published from August 2006 to March 2012. Interventions had to be focused on either individual, organizational- or combined-level health promotion or prevention at work. To be eligible, reviews had to assess obesity/overweight (body weight, body fat, body mass index—BMI), disease (mental health, musculoskeletal disorders, metabolic disease, cardiovascular disease), nutrition (intake of fruit, vegetables, fat, fibre, energy), physical activity (amount of physical activity, physical fitness) or work-related outcomes (productivity, absenteeism, presenteeism, work attendance). Reviews were excluded if the intervention was not targeted at a working population.

The study selection was carried out in two stages based on eligibility criteria. In the first stage, the authors checked the titles of the search results and reviewed the abstracts to determine whether to obtain the identified articles for a full-text review. In the second stage, full papers were checked on eligibility criteria (Figure 1).

To maximize the validity of the findings and to reduce bias we limited our scope to systematic reviews published in peer-reviewed journals. All included publications were formally rated as systematic review articles. However, methodological quality often did not meet the Cochrane Collaboration quality criteria for systematic reviews [3]. We performed a synthesis of included reviews. Quantitative statistical analyses and meta-analyses were

not conducted. Instead, analyses reported in the reviews were extracted and systematically presented. Principal summary measures were mean effect sizes (Cohen's *d*) or stated evidence levels.

Ethical approval was not required as the study was designed as a secondary literature review without human subjects, medical records or human tissues being directly involved.

Results

The searches yielded 82 potentially relevant publications. Of these, 46 publications were rejected because of inadequate study design or inappropriate study population. Of the remaining 36 full papers, 21 were excluded due to inappropriate outcome evaluation or interventions without focus on physical activity and/or nutrition. Our final sample consisted of 15 reviews [4–18]. Main characteristics including study design, number and characteristics of participants involved, outcomes, intervention types examined and main results are presented in Table 1 (available as Supplementary data at *Occupational Medicine Online*).

Reviews originated from the USA ($n = 4$), Australia ($n = 3$) and Europe ($n = 8$), including 379 single studies carried out in the USA, Australia, Canada, Mexico, India, Japan and Europe. The majority of reviews comprised a variety of interventional and observational study designs. Most reviews were randomized controlled trials ($n = 9$).

Study populations included employees from different work settings. The sample size of trials included in the reviews varied from 10 to 48 835 participants. The age of participants ranged from 18 to 67 years and covered the whole working-age population. One review included men only [18]. The remaining reviews included both men and women in varying percentages.

Three types of review aims were identified: seven reviews focused solely on physical-activity promotion [4,6,8–10,17–18], two reviews included only studies evaluating workplace dietary interventions [12,15] and six reviews evaluated combined interventions with nutritional and physical activity components [5,7,11,13–14,16]. The evaluated interventions were implemented at individual, organizational or combined level with a majority of interventions that were individually focused. Environment-focused interventions are presented in seven reviews [5,10,12,14–16,17].

We included reviews that assessed weight, physical activity or nutrition-related outcomes. Eight reviews were of studies that used weight-related outcomes as body weight, BMI or body fat percentage [5,7,11–14,16,17]. Dietary behaviour was assessed in three reviews [12,14,15]. Physical activity or physical fitness outcomes as step count, self-reported amount of physical activity, muscle strength were considered in seven reviews

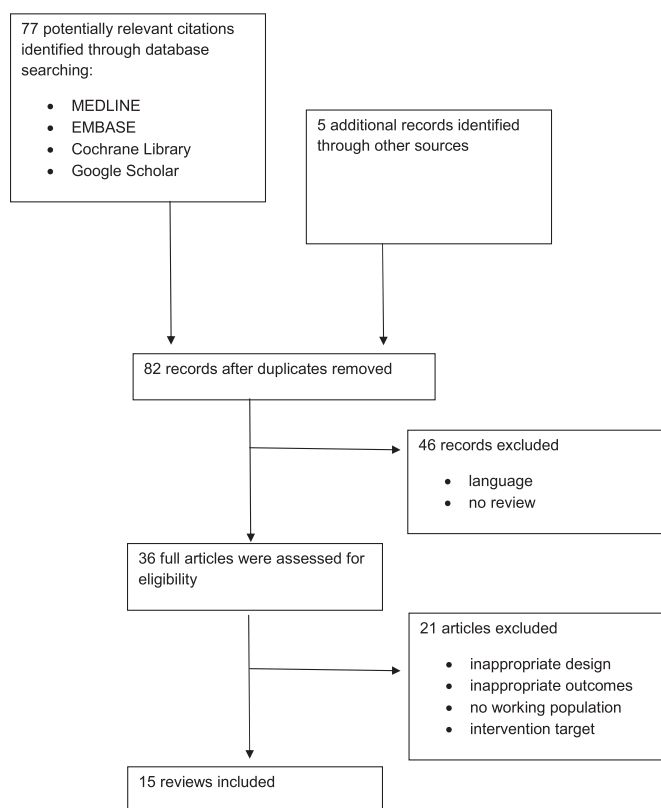


Figure 1. Flow chart of study inclusion.

[4,6,8–10,17–18]. Economic variables were reported in three reviews [8,12,15].

Reviews examining dietary behaviour [12,14–15] analysed outcomes as nutritional knowledge and daily consumption of fruit, vegetables, and fat. Interventions included education, counselling and development of diet plans. Change of nutrition policies and offering healthy meal options in cafeterias and vending machines were common environmental interventions. All reviews found that nutritional interventions were associated with small to moderate improvements in dietary outcomes. Interventions led to positive effects regarding dietary behaviour [12,14–15] and nutritional knowledge [12]. Daily intake of fruit and vegetables increased by 0.3–0.5 servings (+3–16%), daily intake of fat was reduced by 1–10% [12,15]. Evidence was graded moderate for educational, environmental and multi-component nutrition interventions and as inconclusive for combined physical activity and nutritional interventions [14]. However, potential reporting bias due to self-reported dietary assessment may have led to an overestimation of effects [15]. Calculation of quantitative effect sizes was not possible in any of the included reviews because of heterogeneity of outcome measurement and interventions. Economic consequences were evaluated by one systematic review based on 13 studies [15], suggesting that interventions improve employers' profitability in terms of reduced absenteeism, productivity losses and

costs related to labour turnover. Overall, these reviews indicated that employees' dietary behaviour is a suitable target for workplace interventions based on nutritional education solely or combined with environmental modifications.

Seven reviews reported physical activity outcomes covering a variety of different intervention types [4,6,8–10,17–18]. Interventions consisted of one or more of the following components: education, counselling, exercise, and/or environmental modifications. Evaluation of health signs, posters, and messages aiming to promote worksite stair use resulted in small [10] or inconclusive evidence [17]. For active commuting interventions, one review [17] found moderate evidence for an improvement in physical activity and limited evidence for increased physical fitness. Another systematic review [18] found that beneficial effects were confined to a small subgroup of economically advantaged women. Evaluation of walking interventions [17–18] resulted in contradictory findings. Vuillemin [17] graded evidence as inconclusive while Dugdill [18] suggested that walking interventions accompanied by goal setting, diaries and self-monitoring impacts on employees daily physical activity.

There was no consistent evidence for individual or group counselling interventions. Whereas one review [17] found inconclusive evidence, another [10] found strong evidence that counselling was successful in achieving physical activity improvement. Two of four reviews [6,8,11,17] evaluating exercise interventions did not find evidence for an increased amount of physical activity, but reported an improvement in physical fitness [11,17]. Vuillemin *et al.* [17] found moderate evidence for increased physical fitness. A meta-analysis by Hutchinson [11] supported effectiveness by adding a quantitative effect size ($d = 0.34$). In addition, two reviews [6,8] found evidence for the improvement of general health [6], mental health including anxiety, depression and stress [6,8] and economic outcomes including reduced absenteeism and increased productivity [8]. Three [4,9,18] of four reviews evaluating multi-component interventions [4,9,17–18] found at least small positive effects on activity behaviour. Additionally, two reviews [9,11] found improvements in mental and physical health outcomes including stress, quality of life, mood, blood lipids. Another meta-analysis [11] found positive effects for education, cognitive behavioural therapy and motivational enhancement on physical activity. Types and results of physical activity interventions were manifold. Overall, multi-component interventions including a physical activity component and organizational changes were most effective regarding amount of physical activity. Many interventions led to additional health benefits.

Obesity-related outcomes including BMI, body weight and/or body fat percentage [5,7,11–14,16,17] were evaluated in eight reviews. Interventions can be grouped

into physical activity promotion, nutritional intervention and combined. Physical activity interventions comprised educational components and various types of exercise. Vuillemin [17] found either no evidence (active commuting) or inconclusive evidence (exercise, walking, and counselling) of effectiveness on body weight, body fat and BMI. Verweij [16] reported low-quality evidence that physical activity interventions were successful in achieving a significant reduction in body weight and BMI. For dietary behaviour interventions, Verweij [16] did not provide a conclusion as there was only one study on BMI. Moreover, there were no studies reporting sufficient information on body fat or body fat for quantitative analysis. Two further reviews [12,15] did not find an association between nutrition interventions and weight-related outcomes either. A systematic review of Jensen [12] found a small reduction in BMI.

For other weight-related outcomes, no effects were observed. Reviews that targetted both physical activity and nutrition evaluated a multiplicity of different strategies at individual (education, counselling, health risk assessment, psychological interventions and exercise) and environmental level (cafeteria, exercise facilities). Most reviews evaluated and compared different intervention types or multi-component interventions. Hutchinson [11] found a small effect on body weight for interventions based on exercise combined with diet education. Kremers *et al.* [13] reported a small but significant reduction in BMI and consistently modest weight loss. Effect sizes depended on the intervention type. Specific weight loss programmes tended to be more effective. Due to overall poor methodological study quality, evidence of effectiveness was graded as fair. A systematic review by Anderson [5] included interventions mainly based on combined information and behavioural strategies targeting diet and physical activity. Interventions yielded modest improvements in body weight and BMI. For these outcomes, evidence of effectiveness was graded as strong. Another meta-analysis [16] found significant reductions in weight-related outcomes due to combined interventions as well. Evidence was rated as moderate for all outcomes. Maes *et al.* [14] did not find positive effects on BMI and concluded that there was insufficient evidence of effectiveness. In summary, five of six reviews found positive effects. Altogether, the findings favoured complex multi-component interventions over single dietary interventions in terms of weight-related outcomes.

Most studies did not report on programme costs nor provide information on whether the programme had led to reduced health care costs, absenteeism or increased productivity. Only three reviews reported economic evaluation studies [5,8,12]. Anderson [5] showed favourable effects of a weight-management intervention on productivity and employers' health care costs. Nutritional interventions were found to increase companies' profit in terms of reduced absenteeism and productivity losses

[12]. Brown [8] found limited evidence for the cost-effectiveness of physical activity interventions based on one single study. The same review failed to prove a positive association between physical activity and absenteeism. Two further reviews emphasized the lack of economic outcome assessment and their importance for future research [7,15].

Discussion

This review of workplace interventions focusing on diet and/or physical activity found that almost all interventions achieved small but significant changes in physical activity, fitness, dietary behaviour or weight. Interventions with specifically targeted goals (weight management or physical activity promotion) based on multi-component programs tended to be more successful.

Our review had some limitations. Firstly, our literature research was restricted to articles published in English or German between 2006 and 2012. Thus, potentially relevant articles published in other languages may have been overlooked. Consequently, selection bias cannot be ruled out. In addition, we included only systematic review articles. Secondly, there was great heterogeneity of studies, making it difficult to draw general conclusions. A wide variety of study designs were covered due to different inclusion criteria, outcomes and quality demands of reviews. Several reviews [5,7,10–11,14–16,18] mentioned suboptimal quality of available research. The most common methodological weaknesses were lack of information regarding randomization, blinding, treatment allocation concealment, statistical analyses and outcome measurement. Some reviews downgraded detected evidence because of methodological issues. In contrast, others performed separate analyses by taking into account different study quality and designs. Verweij [16] and Anderson [5] reported consistent findings across study designs and quality. Hutchinson [11], Barr-Anderson [6], Abraham [4] and Maes [14] found larger effects in trials with a more rigorous design. This may indicate that low study quality is associated with an underestimation of effects.

Another unanswered question is which intervention type is effective for which specific employee population. Most reviews did not report on employee characteristics and did not conduct subgroup analyses. Future research should also consider individual factors of employees.

A further critical issue is long-term efficacy. Reviews focusing on dietary or physical activity outcomes did not report on sustainability at all. Four of six reviews evaluating weight-management programmes aimed to gain information on sustainability of achieved weight loss. As the majority of studies did not follow-up participants, maintenance of workplace weight-management interventions remains unknown. In addition, short-term evaluations may have led to biased estimations of effect. Most

studies implemented short programmes of six months or less, ignoring possible weight regain and sustainability of changed activity and dietary behaviour. Thus, effects may have been overestimated. Furthermore, only long-term changes of health behaviour will achieve an improvement in health status. Self-reported dietary and physical activity outcomes used in most studies are another potential cause of effect overestimation and source of bias. A final issue that has to be considered is publication bias due to selective publishing of positive associations.

Within these limitations, our review provides a structured summary of workplace health promotion programmes based on best available evidence. Although effects were generally small, worksite health promotion can achieve health benefits and economic impact [19–20]. The number and diversity of studies reflect the importance of this topic. Almost all authors recommend further well-planned research with emphasis on long-term effectiveness and profitability.

Key points

- Our review found that employees' dietary behaviour could be influenced by workplace interventions based on nutritional education solely or combined with environmental modifications.
- Physical activity was increased by multi-component interventions including step counting, active commuting and organizational changes.
- Multi-component programmes were most effective in promoting a healthy weight among employees.

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Conflicts of interest

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References

1. Cancelliere C, Cassidy JD, Ammendolia C, Côté P. Are workplace health promotion programs effective at improving presenteeism in workers? A systematic review and best evidence synthesis of the literature. *BMC Public Health* 2011;**11**:395.
2. Reilly JJ, Methven E, McDowell ZC *et al*. Health consequences of obesity. *Arch Dis Child* 2003;**88**:748–752.
3. Furlan AD, Pennick V, Bombardier C, van Tulder M; Editorial Board, Cochrane Back Review Group. 2009

- updated method guidelines for systematic reviews in the Cochrane Back Review Group. *Spine* 2009;**34**:1929–1941.
4. Abraham C, Graham-Rowe E. Are worksite interventions effective in increasing physical activity? A systematic review and meta-analysis. *Health Psychol Rev* 2009;**3**:108–144.
5. Anderson LM, Quinn TA, Glanz K *et al*.; Task Force on Community Preventive Services. The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: a systematic review. *Am J Prev Med* 2009;**37**:340–357.
6. Barr-Anderson DJ, AuYoung M, Whitt-Glover MC, Glenn BA, Yancey AK. Integration of short bouts of physical activity into organizational routine: a systematic review of the literature. *Am J Prev Med* 2011;**40**:76–93.
7. Benedict MA, Arterburn D. Worksite-based weight loss programs: a systematic review of recent literature. *Am J Health Promot* 2008;**22**:408–416.
8. Brown HE, Gilson ND, Burton NW, Brown WJ. Does physical activity impact on presenteeism and other indicators of workplace well-being? *Sports Med* 2011;**41**:249–262.
9. Conn VS, Hafdahl AR, Cooper PS, Brown LM, Lusk SL. Meta-analysis of workplace physical activity interventions. *Am J Prev Med* 2009;**37**:330–339.
10. Dugdill L, Brettle A, Hulme C, McCluskey S, Long AF. Workplace physical activity preventions: a systematic review. *Int J Workplace Health Manag* 2008;**1**:20–40.
11. Hutchinson AD, Wilson C. Improving nutrition and physical activity in the workplace: a meta-analysis of intervention studies. *Health Promot Int* 2012;**27**:238–249.
12. Jensen JD. Can worksite nutritional interventions improve productivity and firm profitability? A literature review. *Perspect Public Health* 2011;**131**:184–192.
13. Kremers S, Reubsæet A, Martens M *et al*. Systematic prevention of overweight and obesity in adults: a qualitative and quantitative literature analysis. *Obes Rev* 2010;**11**:371–379.
14. Maes L, Van Cauwenberghe E, Van Lippevelde W *et al*. Effectiveness of workplace interventions in Europe promoting healthy eating: a systematic review. *Eur J Public Health* 2012;**22**:677–683.
15. Ni Mhurchu C, Aston LM, Jebb SA. Effects of worksite health promotion interventions on employee diets: a systematic review. *BMC Public Health* 2010;**10**:62.
16. Verweij LM, Coffeng J, van Mechelen W, Proper KI. Meta-analyses of workplace physical activity and dietary behaviour interventions on weight outcomes. *Obes Rev* 2011;**12**:406–429.
17. Vuillemin A, Rostami C, Maes L *et al*. Worksite physical activity interventions and obesity: a review of European studies (the HOPE project). *Obes Facts* 2011;**4**:479–488.
18. Wong JYL, Gilson ND, van Uffelen JGZ, Brown WJ. The effects of workplace physical activity interventions in men: a systematic review. *Am J Men's Health* 2012;**20**:1–11.
19. Chapman LS. Meta-evaluation of worksite health promotion economic return studies: 2012 update. *Am J Health Promot* 2012;**26**:TAHP1–TAHP12.
20. Mills PR, Kessler RC, Cooper J, Sullivan S. Impact of a health promotion program on employee health risks and work productivity. *Am J Health Promot* 2007;**22**:45–53.