The economic impact of workplace physical activity interventions in Europe: a systematic review of available evidence

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Abstract

Purpose – There is growing interest in the economic impact of workplace physical activity interventions, but the evidence is still lacking — especially in Europe. Although, some evidence on the return on investment (ROI) is found in literature, the included studies may not be applicable to the Europe situation. Therefore, the objective of this study was to review current evidence on the economic impact of workplace physical activity interventions in European countries.

Design/methodology/approach – A systematic review on the economic impact of worksite health promotion programs aiming at increasing physical activity was conducted. Five electronic databases (MEDLINE (Ovid), MEDLINE (PubMed), EMBASE, NHS-EED and Emerald Insights) were searched for relevant studies published between 2000 and 2020.

Findings – A total of 953 abstracts were screened, and 28 were reviewed, 11 of which met all inclusion criteria. The studies varied substantially in sample size, intervention type, duration and frequency of follow-up measurements, valuation methods and assessed economic outcomes. There is inconclusive evidence for decreasing absenteeism, positive net benefit (NB) and positive ROI. No evidence was found to indicate an effect on self-assessed productivity or job satisfaction.

Originality/value – This study is the first try to take the different working conditions from Europe into consideration. The authors found that working conditions could have some impact on the valuation of absenteeism costs and thereof on the ROI. Further, this study provides insight into how to deploy effective and efficient workplace physical activity interventions, based on a standardized and validated methodology and program scope.

Keywords Health promotion, Productivity, Occupational health, Workplace health management

Paper type Research paper

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1. Background

There is incontrovertible evidence of the positive impact of physical activity on an individual's health and well-being. Regular physical activity has been shown to help prevent the development of several chronic and non-communicable diseases (Reiner *et al.*, 2013). Physical exercise can also help with the management of musculoskeletal disorders and may reduce the risk of premature death (Holth *et al.*, 2008). Given these well-proven health benefits and associated economic advantages (avoiding medical costs and productivity losses), promoting physical activity has become an important human resource and business issue (Malik *et al.*, 2014). However, according to the most recent Eurobarometer on Sport and Physical Activity, a large proportion of the European population is still physically inactive, a trend that is increasing (2009: 39%; 2013: 42% and 2017: 46%) (European Union, 2017). Current figures for the European Union show that 13% of physical activity already takes place at work (European Union, 2017). There is also a growing evidence base on the effectiveness of workplace physical activity interventions on behavioral changes that may improve employees' health and worksite outcomes (Conn *et al.*, 2009; Dugdill *et al.*, 2008; ECORYS, 2017; Jacobs *et al.*, 2017; White *et al.*, 2016). However, as employers are interested not only in the effectiveness of health promotion interventions but also in their financial returns, research on this issue is also increasingly gaining attention (van Dongen *et al.*, 2011). This means that from a financial perspective, cost–benefit margin (net benefit (NB)) and a positive financial return on every monetary unit spent (return on investment (ROI)) are crucial parts of the employer's decisions and were prioritized in this study. In addition, other issues like public image and good reputation could be an important piece for employers. This specific economic perspective is considered in this review in order to contribute to the evidence on this question.

2. Purpose or aim

There is already some evidence on the positive economic effects of workplace health promotion programs, but high-quality evidence is mostly lacking (Aldana, 2001; ENWHP, 2004; Baicker *et al.*, 2010; Lerner *et al.*, 2013; White *et al.*, 2016). A number of well-cited studies report a positive ROI (Aldana, 2001; Baicker *et al.*, 2010; Lerner *et al.*, 2013), but they also note that the results are difficult to compare since the programs undertaken either are unspecific, lack an experimental design, have too broad a focus or focus only on people with pre-conditions (Aldana, 2001; Baicker *et al.*, 2010; Lerner *et al.*, 2013; White *et al.*, 2016). Furthermore, a lack of evidence has been found on whether specific workplace physical activity interventions may have an economic impact on enterprises for healthy workers (ECORYS, 2017). This research gap was primarily identified in the European context, as many well-cited systematic reviews have focused on studies from the United States or Canada, which are limited in their comparability to other national worksite health promotion strategies (Aldana, 2001; Pelletier, 2001; Baicker *et al.*, 2010; van Dongen *et al.*, 2011; Chapman, 2012; Lerner *et al.*, 2013; Jacobs *et al.*, 2017; Steel *et al.*, 2018; Baid *et al.*, 2021). For instance, there is some difference in work absences between European countries with a strong scheme of continuing payment in case of illness and the United States, which could, for instance, influence the valuation of absenteeism (costs) (van Dongen *et al.*, 2012). Further, it is crucial to consider that besides the difference in valuation, it is also clear that the differences in labor legislation, like that regulating minimum wage, working conditions and working cultures, are also diverging from the European Union to the US. Also, the gap between income and unemployment varies to a broad extent between North/South and post-communist/West and Central member states of Europe.

Due to heterogeneity of working conditions between the different continents and valuation methods, there is some lack of evidence on economic efficiency, and nearly all the

evidence that exists is based in the US and therefore presents some problems for transferability to European countries. Strengthening the evidence by focusing on Europe could help employers to more clearly understand the efficiency of workplace sports interventions. Therefore, the key objective of the study was to review current evidence on the economic efficiency (NB, ROI and work-related outcomes) of workplace physical activity interventions in the European Union and to provide an up-to-date overview in this field of research. This leads us to the following research question: What is the economic efficiency of workplace physical activity programs from the employer's perspective in the European Union?

3. Methods

This systematic literature review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology (Moher *et al.*, 2009). Following this methodology of systematic reviews, all investigators developed a search strategy oriented on the Populations, Intervention, Control, Outcomes, Study (PICOS) design framework (Table 1).

In developing and deploying a concise and systematic review by conducting the search strategy, some internal pre-tests were undertaken by two investigators (A.B. and A.F.). In addition, a checklist for inclusion and exclusion criteria for the abstract and full-text screening was developed to guarantee a high coding validity among the reviewers. By using all search strings, such as full word, short terms, truncations and medical subject headings (MeSHs), the search string was conducted using the Boolean operators (AND/OR/NOT). All of the keywords used are listed in Appendix 1.

3.1 Search strategy

Five electronic databases from the medical, social and economic sciences were searched for studies that assessed the economic efficiency of workplace physical activity interventions. These databases were MEDLINE (Ovid), MEDLINE (PubMed), EMBASE, the NHS Economic Evaluation Database (NHS-EED) and Emerald Insights.

After the inclusion process, further search strategies, including forward citation tracking for key articles to identify eligible studies and manual searching of the reference lists of pertinent articles, were applied.

3.2 Primary economic outcomes

Amortization, the positive return for every monetary unit spent, is one key performance indicator that is measured by cost–benefit analysis (CBA) (Drummond *et al.*, 2015). In this respect, amortization is one key element of financial decisions for employers, because based on this evidence they can decide whether some investment pays-off or not. The CBA uses therefore two measures, which relies the same economic determinants, to inform the financial decision: (1) NB, which is the monetarized difference between benefit and cost and (2) the ROI, is a ratio between the benefit and cost (Drummond *et al.*, 2015). Since the methodology for evaluating the benefits from healthcare interventions is not standardized, we also found it

Population	Healthy workers in the EU-27 countries + United Kingdom
Intervention	Workplace physical activity promotion
Control	Employees without workplace physical activity promotion or some placebo
Outcomes	Economic outcomes, e.g. return on investment, cost-benefit, absenteeism, fluctuation rate, job satisfaction
Study design	(quasi)experimental studies

Table 1.
Inclusion criteria defined by PICOS

interesting to take a deep look into the work-related outcomes. In this respect, the following economic outcomes were considered as main outcome measures: NB, ROI and work-related outcomes (job satisfaction, productivity, absenteeism, workability and need for recovery) (Verbeek *et al.*, 2009).

3.3 Study inclusion and exclusion criteria

Only primary studies on workplace health interventions aimed at increasing physical activity in the working population of the European countries (EU-27 + United Kingdom after Brexit has been in effect), which meet at least a level of evidence of 2b (which indicates that weak RCT designs and observational studies could be include into the review), were eligible for selection (Oxford Centre for Evidence-based Medicine, 2009). Articles were included if they were written in English, German, Italian or Polish and published between January 2000 and December 2020. As health economic evaluation is based on the overall effect for the economy and society, establishing the scope of the evaluations is essential (Drummond *et al.*, 2015). For instance, the cost for statutory health insurances may differ from the cost that follows from the financial account of an employer (e.g. cost savings for medications due to reduced work absence are not crucial for the economic evaluation for employers). Hence, the perspective from an employer was thus an essential inclusion criterion and defined the scope of the review. This means studies were required to be conducted from the employer's perspective (Drummond *et al.*, 2015). Hence, our interest is based on the employer's decision to financially support health interventions as seen on this meso-level of care delivery. Excluded were literature reviews, opinion papers and studies focused on complex interventions or ergometric and rehabilitation programs for workers with pre-conditions. Articles targeting only employees with pre-conditions, long-term sick-listed employees or retirees were also excluded.

All four reviewers made independent determinations of whether each article fully met the inclusion criteria, using the AbstrackR literature evaluation tool; a software tool for semi-automatic citation screening. All four reviewers appraised whether the studies met the inclusion criteria or should be excluded without knowing the decision of the other reviewers. In addition, to test the reliability of the inclusion and exclusion process, any disagreements were discussed in a meeting of all four reviewers, who came to a consensus. After full-text screening, the extraction of data was undertaken by one reviewer and double-checked by a second reviewer to guarantee valid data.

The included studies also addressed at least one of the investigated economic outcomes (table is shown in Appendix 2). These economic outcomes are standardized measures from business administration methodology to raise productivity, amortization and effectiveness to a broad extent (van Dongen *et al.*, 2011). We included monetarized and non-monetarized measures as economic outcomes to identify differences from and similarities to former reviews.

3.4 Quality assessment for synthesis of results

The methodological quality of the selected studies was assessed using a modified version of the Critical Appraisal Checklist for Economic Evaluations (see Appendix 3) (Drummond *et al.*, 2015). Based on these 10 main criteria, which were weighted equally, the numerical quality score was developed (the results are listed in A.4). These 10 criteria were evaluated independently by 2 investigators and were assessed as YES, fulfilled (+1 point), or NO (0 points) (Drummond *et al.*, 2015). The mean score was calculated from both appraisals, and the studies were graded as "high quality" if they fulfilled eight or more criteria, "moderate quality" if they met between five and seven positive checks, and "low quality" if they had a sum score between one and four points. Each study was assessed by one reviewer and was

then checked by a second independent reviewer. A five-level evidence rating system was applied for drawings conclusions with regard to the effectiveness of workplace physical activity programs on financial and work-related outcomes (Proper *et al.*, 2002). This was applied in a best-evidence synthesis in earlier com-parable reviews (Proper *et al.*, 2002):

(1) Strong evidence: at least two high-quality studies with consistent results

(2) Moderate evidence: one high-quality study and at least one moderate-quality study with consistent results.

(3) Limited evidence: one high-quality study and at least one low-quality study, or at least two medium-quality study with consistent results.

(4) Inconclusive evidence: only one low-quality study or contradictory results.

(5) No evidence: more than one study with the consistent result that no significant or relevant results were shown

Work-related outcomes were checked for statistical significance and differences were considered significant when p-value $p \leq 0.05$. In case no significance level was reported, we assumed that a difference of more than 20% between groups has some practical significance for employers (Proper *et al.*, 2002).

4. Results

4.1 Literature search and study selection

The electronic search yielded 963 results. After removing 10 duplicates, 953 abstracts and titles were assessed for eligibility. Additionally, reference lists of selected articles were checked for eligible studies. Eight further studies that met the inclusion criteria were identified through snowballing (Pohjonen and Ranta, 2001; Nurminen *et al.*, 2002; Aittasalo *et al.*, 2004; Proper *et al.*, 2004; Mills *et al.*, 2007; Strijk *et al.*, 2013). In sum, 961 abstracts were screened, and 28 studies were identified for full-text screening. The exclusion reasons and the method used for filtering the studies during the review process are shown in Figure 1. From these identified 28 studies, 11 met the inclusion criteria and were included in the review; 63% ($n = 7$) of the studies included were graded as "high quality," 27% ($n = 3$) as "moderate quality," and 9% ($n = 1$) as "low quality" (results are listed at Appendix 4).

4.2 Study characteristics

Of the 11 studies included, 5 were conducted in the Netherlands (Hengel *et al.*, 2014; Proper *et al.*, 2004; Strijk *et al.*, 2013; van Dongen *et al.*, 2013, 2017), 4 in the United Kingdom (Audrey *et al.*, 2015; Hartfiel *et al.*, 2017; Hunter *et al.*, 2019; McEachan *et al.*, 2011), 1 in Finland (Nurminen *et al.*, 2002) and 1 in Sweden (von Thiele Schwarz and Hasson, 2012). The study descriptions and the implemented interventions are described in Appendix 5.

4.3 Economic outcomes

If no economic outcome was provided on that aggregated level, it was calculated on the basis of the data reported in the included studies. To compare the costs and monetary benefits of the intervention, we performed a CBA including NB and ROI. The NB was calculated by subtracting the costs from the benefits: *NB = Benefits–Costs*. The ROI, a more specific monetized outcome measure using the financial background of the investment character of every euro spent on physical activity at the worksite, was calculated as follows: *ROI = (Benefits–Costs)/Costs [*100%]*. Financial return was positive in the following case: NB >0,

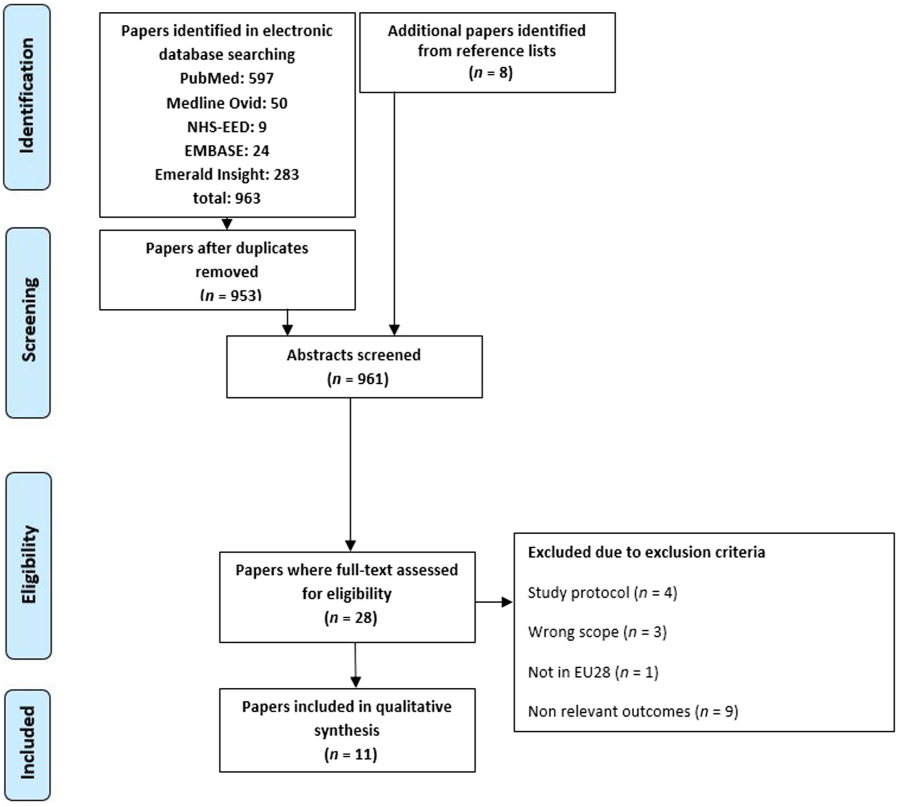

Figure 1.
PRISMA flow-chart

ROI >0. Provided CBAs were checked to verify that they were calculated according to these formulas. All economic outcomes raised are summarized in Table 2.

4.4 Work-related and financial outcomes

4.4.1 Absenteeism. All included studies reported on absenteeism, investigating the effect of the intervention on sick days and/or the monetary consequences (cost/savings) of absenteeism. Seven studies measured absenteeism by company by means of administrative records (Hartfiel *et al.*, 2017; Hengel *et al.*, 2014; Hunter *et al.*, 2019; Nurminen *et al.*, 2002; Proper *et al.*, 2004; van Dongen *et al.*, 2017; von Thiele Schwarz and Hasson, 2012). The other studies employed a single-item question from the Productivity and Disease Questionnaire (PRODISQ) (Koopmanschap, 2005; Strijk *et al.*, 2013; van Dongen *et al.*, 2013) or other self-reporting generic instruments (Audrey *et al.*, 2015; McEachan *et al.*, 2011). The study of Hengel *et al.* showed a statistically significant reduction of 760 sick days (95% CI: −1,497 to −156) by promoting physical activity and health literacy at the workplace (Hengel *et al.*, 2014). Two other high-quality studies observed a favorable effect of the intervention on absenteeism that might be considered to be relevant for the employer (>20% difference between groups) (Hartfiel *et al.*, 2017; Proper *et al.*, 2004). Hartfiel *et al.* observed a favorable effect of yoga classes on sickness absence caused by back pain and musculoskeletal conditions (Hartfiel *et al.*, 2017). Proper *et al.* also concluded that individual counseling promoting physical activity and healthy nutrition might reduce sickness absence costs (Proper *et al.*, 2004). The authors reported non-significant

First author	Net-Benefit/ROI	Absenteeism†‡§	Productivity/ Presenteeism†‡	Job satisfaction
Audrey		Hours at worked missed per worker (mean): I: 1.04 h (SD: 3.81) C: 0.58 h (1.86) Incremental difference: 0.45 h (95% CI: −0.60 to 1.51)	Self-assessed productivity I: 1.99 (SD: 2.00) C: 2.05 (SD: 2.22) Incremental difference: −0.06 (95% CI: −0.77 to 0.65)	
Hartfiel	Net-benefit: 31.90£ [ROI: 56%; calculated by: net-benefit 31.90£/ intervention costs 56.53£]	Days missed per person: OR: 0.81 (95% CI: −0.29 to 1.91)		
Hengel	Net-benefit per worker (without presenteeism): 254 EUR (95% CI: −486 to 989) ROI: 115% Net-benefit per worker (with presenteeism): 1,179EUR (95% CI: 82to 2,370) ROI:999%	Sickness days: I−C: 760 days (95% CI: −1,497 to −156)	Savings due to avoided presenteeism: 537 EUR (95% CI: −315 to 1,429)	
Hunter	Incremental cost: 25.85£ (95% CI: −29.89 to 81.60)	4-week absolute absenteeism hours at the mean, adj. for stratum, season and cluster I: 4.04 h (SD: 66:11) C: 7.01 h (SD: 51.50) Difference at mean: −2.59 h ($p = 0.62$) This is a net-cost decrease from −65.53£ to 734.53£ depending on the wage rate	6-month absolute presenteeism hours at the mean, adj for stratum and cluster I:78.62 (SD: 14.58) C: 78.47 (SD: 14.21) Difference at mean: 0.82 h ($p = 0.54$)	
McEachan	Incremental net-benefit:− 103.02£ (95% CI: −4,961 to 4,748.04)	Sickness costs: −39£ (NR)		
Nurminen		Cumulative amount of sickness leaves: I: 87 h C: 82 h (No statistical significant difference)	Difference work ability index (mean of 7–49 points): 0.5 (95% CI: −0.6 to 1.7)	Job satisfaction (% "very" or "rather good" at a five-point Likert scale): −2.2 (95% CI: −11.2 to 6.6)

(*continued*)

Table 2.
Economic outcomes

First author	Net-Benefit/ROI	Absenteeism†‡§	Productivity/ Presenteeism†‡	Job satisfaction
Proper	Difference between group in total costs: 305 EUR (95% CI: 1,029 to 1,419) [ROI: −71%; calculated by net-costs −305EUR/ intervention costs 430EUR]	Sickness costs: −125 EUR (95% CI: −1,386 to 1,062)		
Strijk		Sickness leaves (% yes): I: 34% of workers C: 27.2% of workers OR: 1.4 (95% CI: 0.94 to 2.0)	Self-reported productivity (scale: 1–10): I: 7.84 C: 7.85 OR: 0.02 (95% CI: −0.11 to 0.15)	
van Dongen	Net-benefit: 59 EUR (95% CI: −1,137 to 1,471) ROI: 40%	Difference monetarized absenteeism benefits: −223 EUR (95% CI: −1,636 to 1,284	Difference monetarized presenteeism benefits: −106 EUR (95% CI: −1,650 to 1,454)	
van Dongen	Total net-benefit: −3,102 EUR (95% CI: −5,897 to −93) Total ROI: −666% (95% CI: −1,266; −20) Employer's net-benefit: −922 EUR (95% CI: −4,703 to 2,466) Employer's ROI: 1,286% (95% CI: −6,564 to 3,442)	Absenteeism costs (mean): I: 2,345 EUR (SD: 715) C: 2,691 EUR (SD: 677) I−C: 347 EUR (95% CI: −1,394 to 1,817)	Presenteeism costs (mean): I: 19,284 EUR (SD: 1,276) C: 18,068 EUR (SD: 919) I−C: 1,216 EUR (95% CI: −638 to 3,102)	Job satisfaction on a five-point Likert scale from "very dissatisfied"(1) to "very satisfied"(5): I−C: −0.1 (95% CI: −0.6 to 0.5)
Van Thiele Schwarz		Absenteeism days per worker (mean): I: 22.6 days C: 25.5 days (NR)		

Note(s): Outcomes calculated by us are in squared brackets; †I: Intervention group, C: Control group; I is in all outcomes reference group, ‡OR: Odds ratio §NR: Not reported

Table 2.

lower sickness absence costs of EUR 125 (95% CI: EUR –1,386 to 1,062) per worker in the intervention group. This difference increased to EUR 635 (95% CI: EUR –1,885 to 814) per worker one year after the intervention, but this effect is still insignificant. In contrast to these three high-quality studies reporting favorable results, two high-quality studies, three moderate-quality studies, and one low-quality study did not observe a favorable statistically significant or relevant effect of workplace physical activity programs on absenteeism (Hartfiel *et al.*, 2017; Hengel *et al.*, 2014; Proper *et al.*, 2004). McEachan *et al.*, for instance, find that the decrease in cost is mostly driven by reduced work absences, and Hunter *et al.* oppose this finding, because they did not find any significant decrease in the absolute absenteeism measures (Hunter *et al.*, 2019; McEachan *et al.*, 2011). Based on the results of the included

studies, we concluded that there was *inconclusive evidence* for the effectiveness of workplace physical activity programs on absenteeism.

4.4.2 Self-assessed productivity. Four high-quality studies investigated cost consequences associated with presenteeism (reduced productivity while working) (Hengel *et al.*, 2014; Hunter *et al.*, 2019; van Dongen *et al.*, 2013, 2017). All four studies measured presenteeism using an item from the World Health Organization Health and Work Performance Questionnaire (WHO-HPQ) (Kessler *et al.*, 2003). The two studies of van Dongen *et al.* did not find a statistically significant effect of the intervention on presenteeism (van Dongen *et al.*, 2013, 2017); nor did that of Hunter *et al.* (2019). Hengel *et al.* (2014) considered cost consequences associated with presenteeism in their sensitivity analysis. They reported a positive effect on ROI when presenteeism was included.

Neither a high-quality study nor a moderate-quality study observed relevant effects of the intervention on workability (Hengel *et al.*, 2014; Nurminen *et al.*, 2002). Nurminen *et al.* observed a slight improvement in self-perceived workability at the eight-month follow-up after introducing weekly training sessions (Nurminen *et al.*, 2002). However, the authors found inconsistent results in sub-dimensions of workability. One low-quality study investigated the effect of a walk-to-work intervention on self-assessed productivity but did not specify the employed research instrument (Audrey *et al.*, 2015). Over the study period, no clear trends in productivity and slightly lower productivity scores in the intervention group in the one-year follow-up were reported. However, the observed differences were not statistically significant. And Strijk *et al.* found no impact on productivity during a 12-month intervention (Strijk *et al.*, 2013). Based on these findings, we concluded that there was *no evidence* for the effectiveness of workplace activity programs on self-assessed productivity.

4.4.3 Job satisfaction. One high-quality study and one moderate-quality study investigated the effect of workplace physical activity on job satisfaction (Nurminen *et al.*, 2002; van Dongen *et al.*, 2017). The studies employed different intervention mechanisms and program components. Both studies reported no effect during the study period. On the basis of these findings, *no evidence* was found to indicate an effect of workplace physical activity programs on job satisfaction.

4.4.4 Net benefit and return on investment (ROI). Intervention costs were mainly determined from company data using market prices that had to be paid by the company (Hartfiel *et al.*, 2017; Hengel *et al.*, 2014; Hunter *et al.*, 2019; Proper *et al.*, 2004; van Dongen *et al.*, 2013, 2017). Two studies reported costs without disclosing a valuation method (Audrey *et al.*, 2015; McEachan *et al.*, 2011). Examples of intervention costs reported in the studies were trainer and physical therapist fees, material and equipment costs, and administration costs. To evaluate the benefit for the employer, changes in productivity were translated into monetary value and referred to as indirect costs (Greenberg *et al.*, 2001; van Dongen *et al.*, 2014). Health-related productivity was measured by absenteeism, sometimes in conjunction with presenteeism, self-perceived workability or self-assessed productivity. Cost calculations differed at most by the methodology of accounting for indirect costs. Absenteeism costs were determined with either the human capital approach (Hartfiel *et al.*, 2017; Hengel *et al.*, 2014; Proper *et al.*, 2004; van Dongen *et al.*, 2013, 2017) or the friction cost approach (Hunter *et al.*, 2019; McEachan *et al.*, 2011; von Thiele Schwarz and Hasson, 2012). According to the human capital approach, the gross employee compensation was used as a reference point, i.e. the productivity loss was calculated by multiplying the estimated number of workdays missed by the estimated average daily earnings. One study calculates with integral process costing (Audrey *et al.*, 2015), and 63% of the studies consider uncertainty by conducting a sensitivity analysis (Hartfiel *et al.*, 2017; Hengel *et al.*, 2014; Hunter *et al.*, 2019; McEachan *et al.*, 2011; Proper *et al.*, 2004; van Dongen *et al.*, 2013, 2017).

Three high-quality studies observed a positive effect of worksite physical activity interventions on financial return for the employer compared to four high-quality studies

that did not find an effect. Hengel *et al.* (2014) reported an ROI of 543% due to lower absenteeism costs, implying that the intervention was cost-saving for the employer. The sensitivity analysis showed that the ROI increased even more, to 999%, when presenteeism costs were included (Hengel *et al.*, 2014). The study results of Hartfiel *et al.* (2017) also revealed a positive ROI of 56%. Proper *et al.* (2004) presented mixed results, which can be explained by the lasting effect of the intervention. The ROI was negative (−71%) after the intervention period; however, the intervention costs were amortized in the follow-up measurements (where the ROI went up to 177%), resulting in a positive ROI for the employer. This effect can be explained by the lasting impact of the intervention even after termination, when the employer no longer assumes delivery costs. However, another three high-quality studies revealed contradictory results. van Dongen *et al.* (2017) reported a negative financial efficiency, finding the ROI for the combined perspective for employers and society was significantly negative (−666%). Some authors concluded that high-intensive physical activity interventions might be more costly than beneficial (van Dongen *et al.*, 2013). A previous study by van Dongen *et al.* (2013) also concluded that the intervention was not cost-saving for the employer. Study results of McEachan *et al.* (2011) presented a negative incremental NB, indicating that the intervention was not beneficial for the employer. And Hunter *et al.* (2019) calculated a net-cost savings potential of GBP 65.53 to 734.53 per year, a statistically insignificant amount. Based on the results of the included studies, we concluded that there was *inconclusive evidence* for a positive financial return for the employer.

5. Discussion

Our findings support the existing evidence in worksite health promotion research and narrow down the focus of the research in three aspects (Aldana, 2001; Proper *et al.*, 2004; van Dongen *et al.*, 2012; White *et al.*, 2016). In general, we found heterogeneity in study designs and intervention, as well as differences in levels of scope (multilevel). However, contrary to our assumption of differences in working conditions, we found similarities to Baicker *et al.* (2010), due to the fact that most of our included studies were undertaken in large companies (more than 1,000 employees). Nonetheless, we also found that the working conditions are varying for two reasons: (1) We had approximately 36% of studies related to healthcare services, and only 9% related to some blue-collar sector. As a result, our review focuses more on services rather than blue-collar jobs in comparison to Baicker *et al.* (2010).

Our hypothesis that the difference in working conditions, for instance the strong scheme of continuing payment in case of illness in Europe, is an explanation for differences in financial returns, must be revised. Due to the different evaluation methodology a comparison on the regulatory working-condition was not applicable. Studies conducted in the UK seem to have a slight tendency to report positive cost-benefit. However, this result is negligible when compared with high-quality studies from the Netherlands. This difference could be explained mostly by the different methodologies of the studies and not necessarily by different legislation or work-condition alone, except for the issue of the sector where the studies take place. Unfortunately, a meta-analysis is not applicable, and a pulled analysis was also ruled out due to this heterogeneity in methodology and setting. We opted for a qualitative synthesis using the predefined evaluation criteria (see Quality Assessment for Synthesis of Results).

Overall, we found inconclusive evidence for a positive effect of workplace physical activity interventions on absenteeism and on financial return (ROI) for the employer. But it is also important to note that this evidence may be inconclusive due to poor measurement methods, the low intensity of some interventions and the weak duration times of some studies. None of our included studies referred to the issue of different working conditions, but the difference

between the US and Europe may be explained rather through the evaluation method between both continents. But some crucial recognition was that our review did not find evidence to indicate an effect on self-assessed productivity or job satisfaction. There we follow Verbeek *et al.* and Van Dongen *et al.* (van Dongen *et al.*, 2011; Verbeek *et al.*, 2009). We see that our results are similar to the reviews by Proper *et al.* and Aldana *et al.* reporting no evidence, inconclusive evidence or limited evidence for a positive effect of physical activity programs for the employer (Aldana, 2001; Proper *et al.*, 2004). Proper *et al.* explored the effectiveness of workplace physical activity programs with respect to work-related outcomes (Proper *et al.*, 2002). Similar to our findings, best-evidence reviews like that of White *et al.* reported that physical activity interventions might have positive effects for workers with pre-conditions. But they see complex interventions as preferable for workers with certain health conditions (White *et al.*, 2016).

Second, our findings are more diverse in outcome than the US reviews, which suggest a general positive effect of worksite health promotion programs for the employer, without facing the issue of heterogeneity in the measurement of absenteeism. Finally, we and other authors concluded that no clear answer about their overall profitability could be made (Aldana, 2001; Proper *et al.*, 2002; van Dongen *et al.*, 2011; White *et al.*, 2016). Hence, we suggest that further studies should consider this heterogeneity of working environments and intervention possibilities.

Third, apart from different national healthcare provisions, there are a number of methodological reasons that might explain the variation of findings. With reference to study design, systematic reviews observed that non-randomized studies (quasi-experimental studies, non-experimental studies) tend to report a positive ROI from worksite health promotion programs due to reduced absenteeism, medical costs, or both, whereas randomized control trials do not observe positive effects (van Dongen *et al.*, 2011). We find that the inconclusive or null evidence on the financial return for the employer could be explained by the study design and measurement of absenteeism. Furthermore, some consequences might have occurred after the analytic time frame chosen by the studies. Health benefits are likely to accumulate gradually, leading to a situation where program costs decrease over time while benefits tend to increase over time (Baicker *et al.*, 2010; Hengel *et al.*, 2014; van Dongen *et al.*, 2017). Different valuation methods might also cause variation in results. However, there is no consensus about the best way to measure and value costs associated with the productivity loss (Hengel *et al.*, 2014).

In fact, only two studies showed a significant work-related outcome of the physical activity intervention (Hengel *et al.*, 2014; Nurminen *et al.*, 2002). Low-powered studies have imprecise and uncertain cost estimates and should be interpreted with caution. Moreover, authors raised concerns about attrition bias (Hartfiel *et al.*, 2017; Proper *et al.*, 2004; Strijk *et al.*, 2013). Studies had to deal with a substantial loss to follow up on the outcomes, which decreases the statistical power to an even greater extent. Two studies observed that a few participants were responsible for a large proportion of absenteeism during the study period, possibly overinflating the effect of the intervention (Hartfiel *et al.*, 2017; Hengel *et al.*, 2014). Economies of scale might induce another cost-effect causing variation in results. Compared to this review, US reviews included studies from large employers, where economies of scale facilitate the generation of savings through workplace health promotion programs. This is a clear message for further research in Europe to undertake studies with larger sample sizes.

Finally, publication bias is a common risk in worksite health promotion research. Several reviews raised concern about a possible publication bias, indicating that health promotion researchers and journal editors could strive to demonstrate program effectiveness. Therefore, studies reporting positive results might be more likely to be published (Aldana, 2001; Baicker *et al.*, 2010). Because most of the included studies also had negative results, the publication

bias is not as high. This could particularly apply to primary studies published by service providers with vested interests in the results (White *et al.*, 2016).

5.1 Limitations

The results of this review should be interpreted with caution for several reasons. The present review included primary studies with (quasi)experimental design and different external validities. We see it as a limitation that the gender distribution varied substantially and that fewer studies take socio-economic factors into account. For example, only two of the 11 included studies targeted a specific gender focus, and 4 even reported a substantial disparity in gender distribution. None of the studies takes contextual factors as legal working-conditions into account. This is a lack of evidence that has to be addressed in further empirical studies. We also observed considerable variation concerning the employed intervention format, which was a major concern in terms of comparing the intensity and duration of the programs.

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Appendix 1
Searching string in PubMed/Medline and EMBASE

PubMed/Medline
(Occupational Health[MeSH] OR workplace physical activity OR (Organizational Intervention OR Organisational Intervention OR Healthy People Programs[MeSH]) AND (Workplace OR Workspace OR Employ* OR Occupation* OR business OR corpora* OR enterprise*)) NOT Ergometry[MeSH]) AND (prevention and control[MeSH] OR Exercise [MeSH] OR Physical activity* OR sport* OR physical education and training OR sport intervention OR fitness OR physical exercise OR Motor activity) AND (Cost and Cost Analysis[MeSH] OR Investment[MeSH] OR Return on Investment OR Economic Evaluation OR Economic Impact OR Cost*)

NHS-EED
(Occupational Health[MeSH] OR workplace physical activity) OR (Organizational Intervention OR Organisational Intervention OR Healthy People Programs[MeSH]) AND (Workplace OR Workspace OR Employ* OR Occupation* OR business OR corpora* OR enterprise*) FROM 2000 TO 2018

EMBASE
('white collar worker'/exp OR 'blue collar worker'/exp OR employee OR workers) AND ('occupational health'/exp AND 'health promotion'/exp OR excerise) AND ('health economics'/exp OR 'investment'/exp OR 'cost'/exp OR 'socioeconomics'/exp OR 'return on investment'/exp) AND ('observational study'/exp OR 'randomized controlled trial'/exp OR 'clinical trial'/exp)

Emerald
(Workplace AND (occupational health intervention OR Organi*ational intervention OR program*) AND (physical Exercise OR physical activity OR physical Exercise OR Sport intervention OR physical education OR physical training OR Occupational sport)) AND (Return on Investment OR Economic* OR cost* OR impact OR Effectiveness OR Benefit)

Appendix 2

Table A1. Defined economic outcomes as inclusion criteria

Monetized outcomes	Non-monetized outcomes
absenteeism costs	absenteeism
net-benefit	productivity
presenteeism costs	fluctuation
	work ability
	staff satisfaction
	customer's satisfaction
	motivation and engagement
	work environment
	image
	communications culture
	handling with absenteeism

Appendix 3

Table A2.
Checklist for assessing economic evaluations

Assessed Study:………………………………………………………………

E1	*Was a well-defined question posed in an answerable form?*		Yes (+1)	No (0)
	•	Did the study examine costs and effects of the physical intervention?		
	•	Did the study involve an appropriate time horizon?		
	•	Did the study involve a comparison?		
	•	Was the perspective of the study from businesses, corporations or companies?		
	•	Were the study population well-described (included persons, socio-demographics)		
E2	*Was the comparator described?*		Yes (+1)	No (0)
	•	Was an explanation of alternatives given?		
	•	Were other alternatives mentioned?		
E3	*Was the effectiveness of the programmes established?*		Yes (+1)	No (0)
	•	Was the study randomized?		
	•	Were inferences tested with significances?		
	•	Was the sample size adequate to the given question?		
	•	Were validity, reliability and robustness tested or mentioned in the study? (e.g. through validated instruments or outcomes)		
E4	*Were all important and relevant costs identified?*		Yes (+1)	No (0)
	•	Did the study list direct, indirect and intangible costs?		
	•	Was the range of estimated costs broad enough?		
	•	Were capital costs and operating costs included?		
	•	Were business administrated costs taken into account? (e.g. data from business cost accounting)		
E5	*Were all important and relevant outcomes identified?*		Yes (+1)	No (0)
	•	Did the study separate adequate outcomes from costs?		
	•	Is there any argument for the chosen outcomes?		
	•	Were the outcomes accurately measured?		
	•	Are any relevant outcomes omitted?		
	•	Were the weights of the outcomes explained?		

(*continued*)

Assessed Study:. . . . . .

E6	*Were costs and outcomes valued credibly?* • Were the sources clearly identified? • Where market values absent? • Which costs are measured? (marginal costs, average costs, total costs)	Yes (+1)	No (0)
E7	*Were costs and consequences adjusted for differential timing?* • Was the discount rate accurate for longtime studies? (2–5% per year) • Was any justification given for the used discount rate(s)?	Yes (+1)	No (0)
E8	*Was an incremental analysis of costs and outcomes performed?* • E.g. Was there any justification for using a specific ICER?	Yes (+1)	No (0)
E9	*Was uncertainty in the estimates of costs and consequences characterized?* • Was there a sensitivity analysis performed (one-way, two-way or net-benefit)?	Yes (+1)	No (0)
E10	*Did the presentation and discussion of study results include all issues of concern to users?* • Were the conclusions of the analysis based on some overall index or ratio? • Were results compared with other relevant studies? • Did the study discuss the generalizability of the results? • Did the study discuss limitation of the used analysis?	Yes (+1)	No (0)
Score			

Table A2.

Appendix 4

Table A3. Results of critical appraisal

Study	Evidence-level	Average score
Audrey *et al.* (2015)	Low	1.5/10
Hartfiel *et al.* (2017)	High	8/10
Hengel *et al.* (2014)	High	9/10
McEachan *et al.* (2011)	High	7.5/10
Nurminen *et al.* (2002)	Moderate	5/10
Proper *et al.* (2004)	High	8/10
Strijk *et al.* (2013)	Moderate	5/10
van Dongen *et al.* (2013)	High	8.5/10
van Dongen *et al.* (2017)	High	8.5/10
von Thiele Schwarz and Hasson (2012)	Moderate	5.5/10

Study	Country†	Study design ‡	Sample size (I,C) §	Population characteristics	Randomization	Program focus	Program format	Control group	Program delivery during working hours	Study period	Follow-up in months	Attrition rates for last post-treatment follow-up	Employer-related outcomes	Direction of economic outcome¶
Audrey *et al.* (2015)	GB	RCT	187 (I:100, C: 87)	Predominantly employees in sedentary (desk-based) occupations	Worksite level	Promote physical activity	4 contacts: walk to work intervention	NR	NR	12	9	27% (intervention) 32% (control)	Self-reported Absenteeism Self-reported productivity	Absenteeism: o Productivity: o
Hartfiel *et al.* (2017)	GB	RCT	151 (I: 76, C: 75)	NHS employees	Individual level	Promote physical activity	Self-help education materials weekly contacts: group training	Reduced intervention	No	6	4	54%	Absenteeism	Absenteeism: + ROI: +
Hengel *et al.* (2014)	NL	RCT	293 (I:171, C: 122)	Male construction workers	Department level	Promote physical activity and health literacy	Self-help education materials 4 contacts: individual and group training	No intervention	Yes	12	6	12% (cost measures) 35% (effect measures)	Absenteeism: company registration systems Self-reported Workability: Work ability index Presenteeism: WHO-HPQ	Absenteeism: ++ Productivity: o ROI: ++
Hunter *et al.* (2019)	GB	RCT	863 (I: 457, C: 396	Office workers near Belfast or Lisburn city centers	Worksite level	Promote physical activity and loyalty	App-based financial incentive system to increase physical activity	No intervention	Yes	6	6	26% (intervention: 26%; control: 26%)	Absenteeism and presenteeism were measured with the self-reported WHO-HPQ	Absenteeism: o Productivity: o Net-cost: +
Mc Eachan *et al.* (2011)	GB	RCT	1,274 (I: 606, C: 668)	All employees without predetermined medical indications	Worksite level	Promote physical activity	Self-help education materials weekly contacts: group activities	Reduced intervention	Yes	12	9	37% (intervention) 30% (control)	Self-reported Absenteeism	ROI: - Absenteeism: +

(*continued*)

Table A4.
Study descriptions

Table A4.

Study	Country†	Study design ‡	Sample size (I,C) §	Population characteristics	Randomization	Program focus	Program format	Control group	Program delivery during working hours	Study period	Follow-up in months	Attrition rates for last post-treatment follow-up	Employer-related outcomes	Direction of economic outcome¶
Nurminen *et al.* (2002)	FI	RCT	260 (I: 133, C: 127)	Women workers	Individual level	Promote physical activity	1 contact: individual counseling weekly contacts: group training 2 post-intervention reinforcement group sessions	NR	Yes	15	7	10%	Absenteeism: company administrative records Self-reported workability: Work ability index (including self-reported sick leaves) + modified version of Nordic questionnaire Job satisfaction: modified version of Nordic questionnaire including job satisfaction	Productivity: + Job satisfaction: o
Proper *et al.* (2004)	NL	RCT	299 (I: 131, C: 168)	Civil servants	Department level	Promote physical activity and healthy nutrition	7 contacts: individual counseling	No intervention	Yes	21	12	5% (intervention) 28% (control)	Absenteeism: company administrative records	Absenteeism: + ROI: o/-
Strijk *et al.* (2013)	NL	RCT	730 (I: 367, C: 366)	Older hospital workers (45 years or older)	Individual level	Promote physical activity and healthy nutrition	Self-help education materials 3 contacts: individual counseling weekly contacts: individual and group training free fruit	Reduced intervention (self-help education materials)	No	12	6	32% (effect measures) 47% (cost measures)	Self-reported Absenteeism Self-reported productivity	Absenteeism: o Productivity: o

(*continued*)

Table A4.

Study	Country†	Study design ‡	Sample size (I,C) §	Population characteristics	Randomization	Program focus	Program format	Control group	Program delivery during working hours	Study period	Follow-up in months	Attrition rates for last post-treatment follow-up	Employer-related outcomes	Direction of economic outcome¶
van Dongen *et al.* (2013)	NL	RCT	730 (I:367, C: 363)	Older hospital workers (45 years or older)	Individual level	Promote physical activity and healthy nutrition	Self-help education materials 3 contacts: individual counseling weekly contacts: individual and group training free fruit	Reduced intervention	No	12	6	32% (effect measures) 47% (cost measures)	self-reported absenteeism: Productivity disease Questionnaire PRODISQ Self-reported presenteeism: WHO-HPQ	ROI: - Productivity: o
van Dongen *et al.* (2017)	NL	RCT multiple treatment arms	412 (I: 306, C: 106)	Office employees	Department level	Promote physical activity	Social intervention 3 contacts: group activities physical intervention: physical facilities	No intervention	Yes	12	10.5	20%	Absenteeism: company administrative records Presenteeism: WHO HPQ Job satisfaction: Netherlands Working conditions survey	ROI: – Productivity: o Job satisfaction: o
von Thiele Schwarz and Hasson (2012)	SE	Quasi-experimental multiple treatment arms	233.7 (I: 160.8, C: 81.9)	Dental health employees	N.A.	Promote physical activity	weekly contacts: group training	No intervention	Yes	12	No	NR	Absenteeism: company administrative records Productivity: self-reported absence due to ill-health	Absenteeism: + Productivity: ++

Note(s): † GB: Great Britain, NL: Netherlands, FI: Finland, SE: Sweden; ‡ RCT: Randomized controlled trial; §I: Intervention group, C: Control group; NR: Not reported; ¶ ++: strong positive economic outcome, +: positive economic outcome, o: neutral economic outcome, -: negative economic outcome, –: strong negative outcome

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