Participatory ergonomics to prevent low back pain and neck pain at the workplace
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Economic evaluation of a participatory ergonomics programme to prevent low back pain and neck pain

Submitted as:
Driessen MT, Bosmans JE, Proper KI, Anema JR, Bongers PM, van der Beek AJ.
Economic evaluation of a participatory ergonomics programme to prevent low back pain and neck pain.
Abstract

Objective: Low back pain and neck pain are common among the working population and need to be prevented. Hardly any randomised controlled trial has investigated the cost-effectiveness or cost-benefit of participatory ergonomics on the prevention of low back pain and neck pain. This study evaluated the cost-effectiveness and cost-benefit of the Stay@Work participatory ergonomics programme compared to a control group (no participatory ergonomics).

Methods: 37 departments (n = 3047 workers) were randomised into either the intervention (participatory ergonomics) or the control group (no participatory ergonomics). During a meeting, working groups followed the steps of participatory ergonomics, and composed and prioritised ergonomic measures aimed to prevent low back pain and neck pain. Working groups had to implement the ergonomic measures within three months at the department. Effect measures were the prevalence of low back pain and neck pain, self-reported work performance, and all cause sick leave from work in days. Cost data only included those directly related to low back pain and neck pain. Cost-effectiveness analyses and cost-benefit analyses were performed. Multiple imputation was used to impute missing data. Cost-effectiveness was analysed using bootstrapping.

Results: Working groups managed to implement one third of the 66 ergonomic measures at the intervention departments. After 12 months, health care costs and costs of productivity losses were higher in the intervention group than in the control group (mean total cost difference €127 (95% CI €-164 – €418). From a societal perspective, the cost-effectiveness analyses showed that participatory ergonomics was not cost-effective in comparison with control for low back pain and neck pain prevalence, work performance, and sick leave. The cost-benefit analyses from a company perspective showed a negative monetary benefit of €78.

Conclusions: The participatory ergonomics programme evaluated in this study was neither cost-effective nor cost-beneficial on any of the effect measures in comparison with the control group.
Introduction

Non-specific low back pain (LBP) and non-specific neck pain (NP) are prevalent among the working population.1,2 LBP and NP are episodic and marked by periods of remissions and exacerbations of pain and disability.3,4 LBP and NP are a financial burden for companies and society since these symptoms result in extended periods of sick leave from work and greater utilisation of health care services among workers.5,6 Therefore, the prevention of LBP and NP and their unfavourable consequences has become an important goal for workers, employers, policy makers, and health care providers.

To prevent LBP and NP, a variety of preventive strategies has been conducted at the workplace, for example: lumbar supports, advice or education on postures and working methods, physical exercise programs, lifting aids, new chairs, and pause software programmes. Recent literature indicates that, with the exception of physical exercise programmes, none of the strategies proved to be effective to prevent LBP and NP.7,10

Another approach to prevent musculoskeletal disorders (MSD) may be participatory ergonomics.11 Supported by the management, the implementation strategy involves workers to control their own work activities and empowers them to change their own worksite. The systematic review by Rivilis et al. (2008) found some evidence that participatory ergonomics can reduce MSD.11 These results were not confirmed by three large randomised controlled trials (RCT) concluding that participatory ergonomics was not more effective than the group that received no participatory ergonomics in preventing MSD (i.e. LBP and NP).12,14

Irrespective of the effectiveness of an intervention, insight into the costs of an intervention is important to decide whether or not to undertake it. However, little is known about the cost-effectiveness and the cost-benefit of participatory ergonomics when used as a strategy to prevent LBP and NP.15

Therefore, the present study reports on the results of an economic evaluation performed alongside a cluster RCT comparing an intervention group (participatory ergonomics) with a control group (no participatory ergonomics).

Methods

An economic evaluation from the societal and employer’s perspective was conducted alongside a cluster RCT. The RCT was conducted at the departments of four large Dutch companies; a railway transportation company, an airline company, a university including its university medical hospital, and a steel company. The study protocol was approved by the Medical Ethics Committee of the VU University Medical Center. More details on the study design and methods have been described elsewhere.16
Study population
Randomisation took place at the department level, and was performed by an independent research assistant using a computer-generated randomisation programme. Departments were randomly allocated to either the intervention group (participatory ergonomics) or the control group (no participatory ergonomics). All workers within the participating departments were allowed to participate in the study. The high lifetime and 12-months prevalence rates of LBP and NP made it impossible to only include workers who had never experienced an episode of LBP and NP. Also, the departmental focus of the current study made it impossible to refuse workers from participation. Therefore, workers meeting the following criteria at baseline were included in the analyses: 1) aged between 18-65 years; 2) not pregnant; and 3) no cumulative sick leave period longer than four weeks due to LBP or NP in the past three months. The sample size calculation showed that an initial study population of 2076 workers was needed to statistically find a 25% reduction of LBP and NP prevalence, with a power of 80% and a significance level of 0.05.

Control group
Before filling out the baseline questionnaire workers from both the intervention and control departments were requested to watch three short (45 seconds) educative movies about the prevention of LBP and NP. The movies were used as a sham intervention and can be considered as an ineffective strategy to prevent LBP and NP.

Intervention
Intervention departments received the Stay@Work participatory ergonomics programme, which has been described in detail elsewhere. Briefly, under the guidance of a trained ergonomist a working group (consisting of both workers and management) followed the steps of the participatory ergonomics programme during a 6-hour working group meeting. By following these steps, the working group brainstormed about, evaluated, and prioritised a top three risk factors for LBP and NP. Subsequently, the working group brainstormed about, evaluated, and prioritised a top three of ergonomic measures. All information about the prioritised risk factors and ergonomic measures were written down in an implementation plan. The working group had to implement the prioritised ergonomic measures within three months at their department. To enhance the implementation of the measures, two or three working group members from each working group followed a 4-hour implementation training.

All together working groups prioritised 66 ergonomic measures: 32 individual ergonomic measures (i.e. improving awareness regarding ergonomics, worksite visits, and physical activity programmes), 27 physical ergonomic measures (i.e. ergonomic redesign or modification, new equipment, and manual handling aids), and seven organisational ergonomic measures (i.e. pause software installation, job rotation, and restructuring ma-
nagement style). Approximately one third (34%) of the prioritised ergonomic measures were implemented in the intervention departments.\textsuperscript{17}

**Data collection**

**Effects**

Measures of effect were the prevalence of LBP and NP, work performance, and all cause sick leave from work in days. Effect measures were assessed at baseline, three-, six-, nine-, and 12-months follow-up.

Data on self-reported LBP and NP was collected using the Dutch Musculoskeletal Questionnaire (DMQ).\textsuperscript{18} The DMQ separately asked about the presence of LBP in the past three months and the presence of NP in the past three months: “no, never”, “yes, sometimes”, “yes, regularly”, “yes, always”. For the analyses of the effects we dichotomised these variables by combining “no, never” and “yes, sometimes” into “no LBP or NP”, and combining, “yes, regularly” and “yes, always” into “yes, LBP or NP”. Self-reported work performance was measured using a single-item question from the WHO Health Productivity Questionnaire asking workers to report their overall work performance in the past three months on a 11-points numerical rating scale, ranging from 0 “worst performance” to 10 “top performance”.\textsuperscript{19,20} Self-reported sick leave was measured using a single item question asking the workers about their full days of absence from work due to all cause sick leave in the past three months. This question has shown acceptable specificity and sensitivity levels.\textsuperscript{21}

**Health care costs**

Health care costs included the costs of the visits to health care providers, diagnostic examinations, and both prescribed and over-the-counter medication due to LBP and NP. The index year for this study was 2008. Standard costs from the Dutch Manual for Costing were used to value health care utilisation.\textsuperscript{22} Costs of prescribed and over-the-counter medication were obtained from the individual worker. Health care costs were measured using questionnaires with a recall period of three months at baseline and after three-, six-, nine-, and 12-months follow-up. Participants who reported to have no LBP and/or NP complaints in the past three months were considered to have generated no LBP and/or NP related health care costs.

Intervention costs encompassed the costs that were related to the development and conduct of the participatory ergonomics programme, and were determined via a bottom-up calculation. Costs included: study protocol development, ergonomists training costs, and ergonomists costs for guiding the working groups. Costs of the total (work) time invested by the 98 working group members to prepare and to attend the six-hour working group meeting were calculated by multiplying the total amount of hours by an average hourly wage rate.\textsuperscript{17,22} Also incorporated in the intervention costs were the costs of the four-hour implementation training and encompassed: protocol development, ergonomists costs for guiding the training, and costs for the 40 workers who attended the training. Further-
more, costs for room rental, refreshments and training materials (i.e. laptop and beamer) were included.\textsuperscript{21,22}

\textit{Productivity loss}
Productivity loss from paid work was quantified in terms of net cumulative number of work days on all cause sick leave over a period of 12 months. The cumulative number of work days of sick leave was converted into work-hour equivalents based on a Dutch average of 1540 work hours per year.\textsuperscript{23} Using the Friction Cost Approach (FCA), costs of production losses were calculated by multiplying the number of sick leave hours by the estimated price of production loss of a worker per hour of sick leave, based on age and gender. The FCA assumes that costs are limited to the friction period (i.e. the time it takes to find a replacement). A friction period of 154 calendar days and an elasticity of 0.8 was used.\textsuperscript{21,23}

\textit{Statistical analyses}
The economic evaluation was performed according to the intention-to-treat principle. Baseline characteristics of workers in the two groups were compared using descriptive statistics. Due to the considerable amount of missing follow-up data, missing data were imputed using multiple imputation (MI) based on Multivariate Imputation by Chained Equations (MICE).\textsuperscript{24} The MI procedure was performed in SPSS 17.0, in which five complete data sets were generated. By using Rubin’s rules, SPSS enabled to pool effects and costs from the five complete data sets.\textsuperscript{25}

For the cost-effectiveness analysis (CEA), incremental cost-effectiveness ratios (ICERs) were calculated by dividing the differences between groups in costs by those in effects. For the outcomes LBP prevalence and NP prevalence and work performance, the total societal costs (health care, intervention and lost productivity costs) were used. For the outcome all cause sick leave the total health care costs and intervention costs were concerned. The ICER indicates the additional investments needed for the intervention to gain one extra unit of effect compared to the control group.

In the cost-benefit analysis (CBA), a net company benefit was calculated by subtracting the difference in intervention costs between the two groups from the difference in lost productivity costs between the groups (benefits).

The 95\% CI around the mean cost differences and the uncertainty around the ICERs were estimated using bootstrapping with 5000 replications.\textsuperscript{26,27} To graphically illustrate the uncertainty around the ICERs, we plotted the bootstrapped cost-effect pairs in a cost-effectiveness plane. If informative, acceptability curves were calculated to estimate the probability that PE was cost-effective at different values of the ceiling ratio.\textsuperscript{28} All costs, effects, cost-effect and cost-benefit analyses were based on imputed data. MI and data processing was performed in SPSS 17.0, and CEA analyses in R.
Sensitivity analysis
In a first sensitivity analysis, lost productivity costs were estimated using the Human Capital Approach (HCA). In the HCA, total sick leave time is not “capped” as in the FCA nor is elasticity considered.
In a second sensitivity analysis, it was analysed to what extent the use of a different LBP and NP prevalence definition had consequences on the health care and the lost productivity costs. For this purpose workers who reported for LBP and NP in the past three months “no, never” and “yes, sometimes” were considered to have zero health care costs related to LBP and NP.

Post-hoc analysis
The results of our effectiveness study showed that participatory ergonomics compared to no participatory ergonomics (control group) increased the probability in recovering from LBP (OR 1.41; 95% CI 1.01 – 1.96). To gain insight into the cost-effectiveness of participatory ergonomics on recovering from LBP, a post-hoc analysis was performed among workers with LBP at baseline.

Results

Participants
The randomisation procedure allocated 19 departments to the intervention group and 18 departments to the control group. All included 3047 workers (n = 1472 intervention group, and n = 1575 control group, respectively) were approached for the follow-up measurements. No meaningful differences between the two groups were found at baseline (Table 1). The loss to follow-up on the primary outcome measure (the prevalence of LBP and NP) was considerable. After six months, 511 workers (35%) in the intervention group and 464 workers (29%) in the control group did not fill out their questionnaires. After 12 months, 594 workers (40%) in the intervention group and 580 workers (37%) in the control group did not respond on the questionnaire. Complete follow-up data was derived from 1280 workers on the primary outcome measure (LBP and NP) and from 111 workers (8.6%) on the health care costs. At baseline, workers with and workers without complete follow-up did not differ on the primary outcome measure.
Costs
Table 2 shows the mean costs of health care utilisation in both groups during the 12-month follow-up. The costs of PE were €29 per intervention group worker. Total health care costs and productivity loss costs were higher in the intervention group compared to those in the control group, but the cost differences were not statistically significant. Mean total costs in the intervention group were higher than those in the control group, but also this difference was not statistically significant (mean difference €127; 95% CI -164 – 418).

<table>
<thead>
<tr>
<th>Department characteristics</th>
<th>Intervention group (n=19)</th>
<th>Control group (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workload departments [no.]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Light physical</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mix mental/physical</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Heavy physical</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Worker characteristics</th>
<th>Intervention group (n=1472)</th>
<th>Control group (n=1575)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) [mean (SD)]</td>
<td>41.9 (11.1)</td>
<td>42.1 (10.7)</td>
</tr>
<tr>
<td>Men [no. (%)]</td>
<td>861 (59.0)</td>
<td>891 (57.0)*</td>
</tr>
<tr>
<td>Education [no.(%)]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower education</td>
<td>202 (13.8)</td>
<td>126 (8.0)</td>
</tr>
<tr>
<td>Intermediate education</td>
<td>572 (39.1)</td>
<td>579 (36.8)</td>
</tr>
<tr>
<td>Higher education</td>
<td>690 (47.1)</td>
<td>868 (55.2)</td>
</tr>
<tr>
<td>Low back pain [no.(%)]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1067 (72.5)</td>
<td>1160 (73.7)</td>
</tr>
<tr>
<td>Yes</td>
<td>404 (27.5)</td>
<td>415 (26.3)</td>
</tr>
<tr>
<td>Neck pain [no.(%)]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1150 (78.2)</td>
<td>1249 (79.4)</td>
</tr>
<tr>
<td>Yes</td>
<td>319 (21.8)</td>
<td>325 (20.6)</td>
</tr>
<tr>
<td>Work performance on a 0-10 scale [mean (SD)]</td>
<td>7.67 (1.5)</td>
<td>7.74 (1.4)</td>
</tr>
<tr>
<td>All cause sickness absence days [mean (SD)]</td>
<td>2.11 (7.0)</td>
<td>1.78 (6.0)</td>
</tr>
</tbody>
</table>

Abbreviations: no., number; SD, standard deviation.
* p<0.05.
Table 3 shows that no statistically significant differences were found between the intervention group and the control group on LBP prevalence (0.53%; 95% CI -3.13 - 4.19) and NP prevalence (0.26%; 95% CI -2.71 – 3.23) at 12 months. Regarding work performance (0.00 points; 95% CI -0.15 - 0.16) and all cause sick leave (0.48 days; 95% CI -1.45 - 2.42) no statistically significant differences between the intervention and the control group were found.
Cost-effectiveness analyses
In Table 3, the differences in costs and effects and the ICERs are presented. For LBP prevalence an ICER of 23749 was found, meaning that participatory ergonomics was more expensive than the control group to obtain an extra unit of adverse effect. Table 3 shows that ICERs in similar directions were found for the other outcomes, meaning that participatory ergonomics was more expensive than the control group to obtain an extra unit of (adverse) effect. These results indicate that for all outcomes the control group (no participatory ergonomics) dominated the intervention. Figure 1 presents the cost-effectiveness plane for LBP prevalence.

Cost-benefit analyses
The CBA from a company perspective showed that the costs of participatory ergonomics were €29 per worker, while the programme did not result in monetary benefits (€49; 95% CI -306 – 327). This indicates that participatory ergonomics was not cost-beneficial.

Sensitivity analyses
Table 3 shows that costs of lost productivity were higher using the HCA than the FCA. This resulted in larger ICERs than in the main analysis, but the conclusion of the study did not change. Lower mean health care costs were estimated when LBP and NP prevalence were defined as “no” by combining “no, never” with “yes, sometimes”, and as “yes” by combining “yes, regularly” with “yes, always”. Mean total costs decreased for both the intervention group (€1691 (SD 3729)) and the control group (€1591 (SD 3416)). The mean pooled total cost differences were €100 (95% CI -14 – 213) in favour of the control group.

Post-hoc analyses
Among the subgroup of workers with LBP at baseline (n=404 workers) participatory ergonomics did not result in a statistically significant reduction of LBP prevalence (-1.71%; 95% CI -9.43 – 6.00) at 12 months of follow-up. An ICER of -32873 was found, indicating that an extra investment of €32873 is needed to reduce LBP prevalence with an extra percent (table 3).
Table 3. Difference in pooled mean costs, effects (95% Confidence Interval), and incremental cost-effect ratios (ICERs).

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Sample Size</th>
<th>Outcome</th>
<th>∆C (95% CI)</th>
<th>∆E (95% CI)</th>
<th>ICER</th>
<th>Distribution CE plane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention</td>
<td>Control</td>
<td>€</td>
<td>Percent/points/days/€</td>
<td>NE SE SW NW</td>
<td></td>
</tr>
<tr>
<td>Main analysis (FCA)</td>
<td>1472</td>
<td>1575 LBP prevalence</td>
<td>127 (-164 – 418)</td>
<td>0.53% (-3.13 – 4.19)</td>
<td>23749</td>
<td>29.5 6.2 12.8 51.5</td>
</tr>
<tr>
<td></td>
<td>1472</td>
<td>1575 NP prevalence</td>
<td>127 (-164 – 418)</td>
<td>0.26% (-2.71 – 3.23)</td>
<td>45778</td>
<td>34.3 9.1 9.3 47.3</td>
</tr>
<tr>
<td></td>
<td>1472</td>
<td>1575 Work performance</td>
<td>127 (-164 – 418)</td>
<td>0.00% (-0.15 – 0.15)</td>
<td>18962</td>
<td>41.0 10.5 8.0 40.5</td>
</tr>
<tr>
<td></td>
<td>1472</td>
<td>1575 Sick leave days</td>
<td>78 (23 – 133)</td>
<td>0.48% (-1.45 – 2.42)</td>
<td>161</td>
<td>30.0 0.1 0.1 69.8</td>
</tr>
<tr>
<td>Cost benefit (FCA)</td>
<td>1472</td>
<td>1575 LBP prevalence</td>
<td>29</td>
<td>49 (-306 – 327)</td>
<td>27415</td>
<td>48.7 15.2 7.5 28.6</td>
</tr>
<tr>
<td>Sensitivity analysis (HCA)</td>
<td>1472</td>
<td>1575 LBP prevalence</td>
<td>147 (-245 – 538)</td>
<td>0.53% (-3.13 – 4.19)</td>
<td>27415</td>
<td>48.7 15.2 7.5 28.6</td>
</tr>
<tr>
<td></td>
<td>1472</td>
<td>1575 NP prevalence</td>
<td>147 (-245 – 538)</td>
<td>0.26% (-2.71 – 3.23)</td>
<td>64608</td>
<td>33.5 9.8 10.8 46.6</td>
</tr>
<tr>
<td></td>
<td>1472</td>
<td>1575 Work performance</td>
<td>147 (-245 – 538)</td>
<td>0.00% (-0.15 – 0.15)</td>
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</tr>
<tr>
<td>Cost benefit (HCA)</td>
<td>1472</td>
<td>1575 LBP prevalence</td>
<td>29</td>
<td>69 (-315 – 452)</td>
<td>98</td>
<td>63.4 3.8 1.3 31.5</td>
</tr>
<tr>
<td>Post-hoc analysis (FCA)</td>
<td>404</td>
<td>415 LBP prevalence</td>
<td>595 (-163 - 1292)</td>
<td>-1.71% (-9.43 – 6.00)</td>
<td>-32873</td>
<td>63.4 3.8 1.3 31.5</td>
</tr>
</tbody>
</table>

Abbreviations: 95% CI; 95% confidence interval, FCA; friction costs approach, HCA; human capital approach, ICER; incremental cost-effectiveness ratio, ∆C; costs intervention group – costs control group, ∆E; effects intervention group – effects control group.

1 Refers to the northeast quadrant of the CE plane, which indicates that participatory ergonomics is more effective and more costly than the control group.
2 Refers to the southeast quadrant of the CE plane, which indicates that participatory ergonomics is more effective and less costly than the control group.
3 Refers to the southwest quadrant of the CE plane, which indicates that participatory ergonomics is less effective and less costly than the control group.
4 Refers to the northwest quadrant of the CE plane, which indicates that participatory ergonomics is less effective and more costly than the control group.

Figure 1. Cost-effectiveness plane for the difference in low back pain prevalence at 12 months.
Discussion

This study evaluated the cost-effectiveness and cost-benefit of the Stay@Work participatory ergonomics programme versus a control group (no participatory ergonomics) to prevent LBP and NP among workers. No significant differences in effects on health care and lost productivity costs were found in the intervention group in comparison with the control group. This study found that the participatory ergonomics intervention evaluated was neither cost-effective nor cost-beneficial compared to the control group.

Strength and limitations

An important strength of this study is the pragmatic cluster RCT design, which enabled us to study the (cost-)effectiveness and cost-benefit of participatory ergonomics under real world conditions. High number of workers recruited from various working settings participated in the study, which improves the external validity of our study results. Furthermore, this is the first RCT on LBP and NP prevention that has investigated the cost-effectiveness and the cost-benefit of participatory ergonomics.

This study has also some methodological limitations. The first limitation is the low implementation rate. All together, the working groups implemented only 34% of the prioritised ergonomic measures (n = 66) in the intervention departments. Probably, implementing one third of the ergonomic measures is insufficient to obtain an effect on LBP and NP prevention. A second limitation concerns the considerable loss to follow-up on the primary outcome measures (LBP and NP). Drop-out rates after 12 months exceeded the maximum of 30%. Complete follow-up on the primary outcome measures was derived from 1280 workers. However, complete (health care cost) data was available for only 111 workers resulting in no complete cases analysis. Although we imputed missing values using the MICE procedure, the missing data may have affected the internal validity of the study. We checked our data for selective drop-out. Non-responders did not differ from responders on several important prognostic LBP and NP factors (i.e. age, gender, prevalence, pain intensity and duration). We believe that the considerable number of missing values was mainly due to the preventive character of this study. At baseline a substantial group of workers (>70%) did not have LBP and NP, did not consume health care, and thereby probably did not feel the need to fill out health care costs questionnaire.

Self-reported sick leave rates may be underestimated, and the use of company databases may have led to more valid information on this outcome. Furthermore, it is debatable whether a broad concept such as work performance can be captured by one single question. Finally, cost data were collected retrospectively every three months, which may introduce recall bias. However, we do not believe these aspects have influenced our findings because similar procedures were used in both the intervention and the control group.
It is questionable whether the costs of the prioritised ergonomic measures have to be considered as intervention costs. We did not incorporate these costs because we purposed to evaluate the cost-effectiveness and cost-benefit of participatory ergonomics when used as an implementation strategy. Logically, the adding up of these costs would have led to larger cost differences between the two groups.

Comparisons with the literature
The systematic review by Tompa et al. (2010) reported that participatory ergonomics may result in financial returns when implemented as a strategy to prevent MSD. Contradictory, most RCTs do not support the use of participatory ergonomics in preventing MSD such as LBP and NP. Comparing our results on the costs of participatory ergonomics with other RCTs is hampered because these studies did not conduct an economic evaluation. Tsutsumi et al. (2009) showed in a RCT that participatory ergonomics among Japanese workers resulted in a small but statistically significant increase on job performance. However, no information on the cost-effectiveness or cost-benefit was available.

In contrast, economic evaluations have been conducted alongside RCTs that used participatory ergonomics as a return to work intervention for workers who were absent from work due to LBP. One Canadian study found a trend (not statistically significant) towards cost-benefit and cost-effectiveness in favour of PE. In the Dutch setting, participatory ergonomics proved to be cost-effective compared to usual care. The results of Steenstra et al. (2006) showed that an additional €19 resulted in a sick leave reduction of one day. Lambeek et al. (2010) found that the extra investment of €4 in an integrated care programme (including participatory ergonomics) resulted in one day earlier return to work among workers with chronic LBP. Moreover, the cost-benefit analysis revealed that every euro invested in intervention programme would lead to a return on investment of €26.

Implications
Economic evaluations are important for decision makers in health care and for managers in companies, even when interventions are not effective. Evidence on the cost-effectiveness and cost-benefit is important to decide whether or not to undertake an intervention. Researchers, and especially those who conduct RCTs, are recommended to report on the cost-effectiveness and cost-benefit of participatory ergonomics when used in preventing MSD (i.e. LBP and NP). To improve the success of Participatory ergonomics, researchers should take into account, preferably in advance of conducting a Participatory ergonomics programme, the difficulties accompanied with the implementation of ergonomic measures.

Conclusion
The participatory ergonomics programme evaluated in the current study was neither cost-effective nor cost-beneficial compared to the control group in preventing LBP and NP.
Reference list


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