Summary
Samenvatting
Participatory ergonomics to prevent low back pain and neck pain at the workplace

Low back pain and neck pain are prevalent among the Dutch working population. These symptoms may lead to unfavourable consequences (i.e. pain and disability) to the individual worker, but are also a financial burden for both society and companies. To prevent low back pain and neck pain various interventions have been conducted at the workplace, however, with mixed results. A potentially effective intervention is participatory ergonomics, an implementation strategy involving both workers and management in order to change the worksite. The Stay@Work study investigated the effectiveness of participatory ergonomics on the prevention on low back pain and neck pain. Moreover, Stay@Work evaluated the cost-effectiveness and the cost-benefits of participatory ergonomics aimed at the prevention of these symptoms. In chapter 1, several questions on participatory ergonomics were addressed by different stakeholders. Answers to these questions are presented in the following section.

Questions asked:

By the ergonomists and the workers: What is the effectiveness of the interventions we often use to prevent low back pain and neck pain?
Chapter 2 presents the results of a systematic review on the effectiveness of physical and organisational ergonomic intervention to prevent low back pain and neck pain among non-sick listed workers. A total of 10 randomised controlled trials (RCTs) met the criteria to be included in this systematic review. The risk of bias assessment resulted in seven low risk of bias RCTs and three high risk of bias RCTs. The quality of evidence was rated using the GRADE system. The results showed low to moderate quality evidence that physical and organisational ergonomic interventions were not more effective than no ergonomic intervention on short and long term low back pain and neck pain incidence/prevalence and on short and long term low back pain intensity. There was low quality evidence that at the short term a physical ergonomic intervention (i.e. curved and flat seat pan chair) was significantly more effective on the reduction of neck pain intensity than no ergonomic intervention. There was low quality evidence that at the long term a physical ergonomic intervention (i.e. arm board support) was significantly more effective on the reduction of neck pain intensity than no ergonomic intervention.

By the researchers: What are important aspects in the design of a participatory ergonomics programme which is aimed at preventing low back pain and neck pain among workers?
Chapter 3 presents the design of a cluster randomised controlled trial to investigate the (cost-)effectiveness of participatory ergonomics compared to the control group (no participatory ergonomics) to prevent low back pain and neck pain among workers. The departments of four companies (a university including its university medical center, a railway transportation company, an airline company, and a steel company) participated in this study. The randomisation procedure was performed at the level of the department. At the intervention departments a working group of maximum of 10 persons was formed consisting of both workers and management. Guided by an ergonomist, the working group performed the steps of participatory ergonomics during a six-hour working group meeting. In the meeting, the working group brainstormed about, evaluated and prioritised risk factors for low back pain and neck pain at the department. In order to reduce the risk factors, the working group brainstormed about, evaluated, and prioritised ergonomics measures. Information about the prioritised risk factors and prioritised ergonomics measures were documented in an implementation plan. The working group was requested to implement the ergonomic measures at their department within three months. To improve implementation, two to three members of each working group were asked to voluntary participate in a special four-hour implementation training to become a Stay@Work ergocoach.

The main outcome measure of the Stay@Work study was the prevalence of low back pain in the past three months and the prevalence of neck pain in the past three months. Secondary outcome measures included: the exposure to work-related physical and psychosocial risk factors, pain intensity and pain duration, sick leave, and work performance. Also, the cost-effectiveness and cost-benefit of participatory ergonomics was investigated. Risk factors exposure was assessed using questionnaires at baseline and after six and 12 months. Data on low back pain and neck pain prevalence, as well as on pain intensity and pain duration, sick leave, work performance, and health care costs were collected at baseline, and after three-, six-, nine-, and 12-months follow-up.

By the employers: Are my workers satisfied with participatory ergonomics?
By the ergonomist: What is the applicability of participatory ergonomics and does participatory ergonomics lead to the implementation of ergonomic measures?
Chapters 4 and 5 present the results on the deliverance of the participatory ergonomics programme. A total of 19 departments were allocated, and 16 working groups were formed. In total, 113 working group (87%) members attended the meeting. The working group members rated the quality of the steps of the participatory ergonomics programme on a 10-pointscale on average between 7.3 and 7.6. Workers at the intervention departments were, however, less satisfied with the use of participatory ergonomics to develop and prioritise ergonomic measures (on average 5.6 on a 10-pointscale). The additional Stay@Work ergocoach implementation training was attended by 40 working group members and the members reported to be satisfied with the quality of the implementation training (on average a 7.7 on a 10-pointscale).
Regarding the implementation of the prioritised ergonomic measures, it was found that after six months working groups implemented a total of 34% ergonomic measures at the intervention departments. According to the workers at the intervention departments, a total of 26% of the prioritised ergonomic measures were implemented. It was found that several factors played a role during implementation. Financial and personnel shortcomings as well as lacking stakeholder involvement (i.e., technicians, occupational health workers, and entrepreneurs) hampered the implementation. Also, the composition of the working group was important. Some working groups lacked the presence of a department manager who was entitled to make decisions, lacked a facilitating working group member for implementation, did not receive time to implement measures or the working group fell apart during the implementation period. Ergonomic measures that were already approved by the management before the working group meeting appeared to facilitate their implementation.

By the ergonomists and the workers: Is participatory ergonomics more effective than the control group (no participatory ergonomics) to reduce the exposure to work-related risk factors for low back pain and neck pain? This question is answered in chapter 6. Data on both the work-related physical and psychosocial risk factors for low back pain and neck pain were collected at baseline and after six-month follow-up. After six months, the exposure to the work-related physical risk factors ‘working in an awkward position’ statistically significantly increased in the intervention group (OR 1.86; 95% CI 1.15 - 3.01) compared to the control group. Regarding the perceived exposure to work-related psychosocial risk factors, the workers in the intervention group slightly (but statistically significantly) improved on ‘decision latitude’ (0.29 points; 95% CI 0.07 - 0.52) and ‘decision authority’ (0.16 points; 95% CI 0.04 – 0.28), in comparison with the control group. No further significant differences between both groups were found for the remaining work-related psychosocial risk factors.

It was concluded that, after six months Participatory ergonomics was in general not effective to reduce workers’ exposure to work-related physical and psychosocial risk factors among a large and heterogeneous group of workers.

By the researchers and by the ergonomist: Is participatory ergonomics more effective than the control group (no participatory ergonomics) to prevent low back pain and neck pain? Although participatory ergonomics overall did not reduce the workers’ exposure to work-related physical and psychosocial risk factors, the intervention may still be effective on low back pain prevalence in the past three months and neck pain prevalence in the past three months. The primary outcome measure was low back pain prevalence in the past three months and neck pain prevalence in the past three months. Additionally, the course of low back pain and neck pain (transitions from no episode to episode and from episode to no episode) was modelled. Secondary outcomes were the level of pain intensity and pain duration in the past three months. Data were collected by questionnaires at baseline, and after three-, six-, nine-, and 12-months follow-up. After 12 months, participatory ergonomics was not more effective to reduce low back pain and neck pain prevalence, and was also not more effective to reduce pain intensity and pain duration. Participatory ergonomics was not effective to prevent low back pain and neck pain. Further, participatory ergonomics was not more effective in the recovery from neck pain. However, the intervention was statistically significantly more effective (OR 1.41; 95% CI 1.01 – 1.96) to recover from low back pain (from an episode of low back pain to no episode of low back pain).

Based on these findings it can be concluded that the current participatory ergonomics programme should not be used to prevent low back pain, but could be used as a method to recover from low back pain. However, more evidence on the findings on recovery obtained from high quality studies is needed.

By the employers and by the ergonomist: Does participatory ergonomics reduce sick leave and improve work performance? Is participatory ergonomics cost-effective and /or cost-beneficial? In chapter 8 the results of the economic evaluation of the Stay@Work study are presented. Effect measures that were considered in the economic evaluation were low back pain prevalence in the past three months and neck pain prevalence in the past three months, self-reported sick leave, and self-reported work performance. In the economic evaluation, only costs that were directly related to low back pain and neck pain were taken into account. All data were collected by questionnaires at baseline, and after three-, six-, nine-, and 12-months follow-up.

Participatory ergonomics was not more effective than the control group to reduce self-reported sick leave or to improve self-reported work performance. The costs of participatory ergonomics were estimated to be €29 per intervention group worker. 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 €64 – €418). These results indicate that from a societal perspective, participatory ergonomics was not cost-effective in comparison with the control group on low back pain and neck pain prevalence, self-reported sick leave, and self-reported work performance. The cost-benefit analysis from a company/employer perspective showed a negative monetary benefit of €78.

In conclusion, participatory ergonomics was neither cost-effective nor cost-beneficial on any of the effect measures in comparison with the control group. Based on these results, the implementation of this participatory ergonomics programme to prevent low back pain and neck pain is not supported.
**General discussion**

In chapter 9 of the thesis, we summarised the main findings obtained from this thesis. Furthermore, we discussed methodological considerations of our study and we compared our research findings with other studies on the effectiveness of participatory ergonomics and ergonomic interventions. Moreover, in our general discussion we expanded on the possibility that results obtained from participatory ergonomics intervention studies are due to a programme and theory failure. Finally, recommendations for research and practice were made.

Main conclusions that can be derived from this thesis are:

1. Compared to the control group, participatory ergonomics is not more effective to reduce worker’s exposure to work-related physical and psychosocial risk factors for low back pain and neck pain.

2. Compared to the control group, participatory ergonomics is not more effective: a) to prevent low back pain and neck pain among workers, b) to reduce the pain intensity and pain duration of low back pain and neck pain, and c) to recover from neck pain. It was found that participatory ergonomics is more effective to recover from low back pain (from an episode of low back pain to no episode of low back pain). However, more evidence to this findings is needed.

3. Participatory ergonomics is neither cost-effective nor cost-beneficial compared to the control group.

Implementation of participatory ergonomics to prevent low back pain and neck pain among workers is not recommended. More evidence obtained from high quality studies is needed to confirm the effectiveness of participatory ergonomics on low back pain recovery.