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# Can physical activity during work be designed so it promotes health among industrial workers?

**Submission date**
08/09/2021

**Recruitment status**
No longer recruiting

**Registration date**
10/09/2021

**Overall study status**
Completed

**Last Edited**
06/08/2024

**Condition category**
Musculoskeletal Diseases

[X] Prospectively registered
[X] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

**Plain English summary of protocol**
Background and study aims
Industrial workers generally have poor musculoskeletal health, are physically exerted and fatigued at work, and many are not able to work until statutory retirement age. High physical work demands are considered a main contributing reason to this. Accordingly, in previous studies the dominating approach to prevent pain, physical exertion and fatigue among industrial workers is to reduce their physical work demands.
Despite these efforts, the Danish Work Environment and Health Study showed that a high proportion of industrial workers experience pain several days during the week, and feel fatigued during work. Pain and fatigue are associated with reduced work ability and increased sickness absence risk, thereby constituting a large economic burden for affected companies and society as a whole. Therefore, initiatives that can promote musculoskeletal health and reduce physical exertion and fatigue at work for industrial workers are highly warranted.
Researchers have previously tested the feasibility of redesigning work towards a 'just right' composition of physical behaviour, with the aim of promoting health among a group of industrial workers in Denmark. At the start of the study, the physical behaviors of the industrial workers consisted of about two-thirds of the total time spent standing, and few alternations between sitting, standing and active physical behaviors over the workday. The study showed that it was feasible to redesign work towards a 'just right' physical behavior (i.e., in this case, reduced time standing, increased time sitting and active, and an increased frequency of alternations between sitting, standing and active work). The workers reported lower levels of pain and fatigue after redesigned workdays compared with usual workdays. In order to evaluate if redesigning work towards the 'just right' can effectively promote musculoskeletal health, these intriguing but preliminary results need to be tested on a larger sample in a controlled trial.
Thus, the primary aim of this trial is to evaluate the effectiveness of redesigning work to be 'just right' for promoting musculoskeletal health. Secondary objectives are to determine the changes in the composition of physical behavior during work and the frequency of alternations between sitting, standing and active work tasks; and to determine the extent to which these changes move towards the 'just right'. Additional objectives are to evaluate fatigue, energy and perceived physical exertion at work, the process of redesigning productive work (e.g., dose delivered, dose received and fidelity) and to evaluate cost-effectiveness from an employer's perspective.

Who can participate?
Workers with manual work employed for 20 hours or more weekly in the participating company

What does the study involve?
The participants will be asked to answer questionnaires related to work and health, to participate in health measurements, and to wear a thigh-worn accelerometer for several days at the beginning and end of the study. A local workplace group consisting of representatives from management, work environment, staff, and health and safety will receive three consultations. Workers will receive training and support to use the daily planning tool from the local workplace group during the 12-week intervention period.

What are the possible benefits and risks of participating?
Workers will receive knowledge on their current health and physical behavior during work, and which changes could be beneficial for their health. The workplace will gain knowledge on occupational physical activity and health, and information, tools and experience on how to redesign healthy jobs. Potentially, in the long term, this may result in healthier workers, increased productivity and reduced sickness absence.
Manual work can be associated with harmful health effects, such as musculoskeletal pain, work injuries, and sickness absence. However, because work is redesigned by having the workers revising and reorganizing existing work tasks, participation in this study should not cause any additional health or safety risk compared to usual work. Reorganizing work in this way could, in fact, reduce the risk of musculoskeletal pain, injuries and sickness absence.

Where is the study run from?
The study is run by the National Research Centre for the Working Environment located in Copenhagen, Denmark with supervision from the University of Southern Denmark, Curtin University and the University of Gävle. The intervention and data collection will be conducted at departments at two production sites of a large biotechnological company in Denmark.

When is the study starting and how long is it expected to run for?
January 2020 to July 2023

Who is funding the study?
The Danish Work Environment Research Fund (Denmark)

Who is the main contact?
Andreas Holtermann
aho@nrcwe.dk

# Contact information

### Type(s)
Scientific

### Contact name
Mr Anders Lerche

### ORCID ID
https://orcid.org/0000-0002-3199-6571

### Contact details

Lersø Park Allé 105
Copenhagen
Denmark
2100
+45 (0)20111590
afl@nfa.dk

### Type(s)
Scientific

### Contact name
Mr Andreas Holtermann

### ORCID ID
https://orcid.org/0000-0003-4825-5697

### Contact details
Lersø Park Allé 105
Copenhagen
Denmark
2100
+45 (0)50514946
aho@nfa.dk

## Additional identifiers

## Study information

### Scientific Title
Can productive work be redesigned to change physical behavior so it promotes health among industrial workers? A cluster randomized controlled trial

### Study objectives
This workplace intervention aims to redesign productive work towards physical behaviours that are ‘just right’ to promote workers’ musculoskeletal health based on the Goldilocks Work principle. It is hypothesized that the work redesign intervention will result in significant improvements in musculoskeletal health indicators without compromising work productivity.

### Ethics approval required
Old ethics approval format

### Ethics approval(s)
The National Research Centre for the Working Environment has an institutional agreement with the Danish Data Protection Agency about procedures to treat confidential data (journal number 2015-41-4232), e.g. by securing data at a protected drive with limited access to research personnel and making all individual data anonymous or pseudo-anonymous. The Danish National Committee on Biomedical Research Ethics (The local ethical committee of Frederiksberg and Copenhagen) has evaluated a description of the study and concluded that, according to Danish law as defined in Committee Act § 2 and § 1, the intervention described should not be further reported to the local ethics committee (ref: H-18041423).

## Primary study design
Interventional

## Study design
Cluster randomized controlled trial

## Study type(s)
Quality of life

## Health condition(s) or problem(s) studied
Musculoskeletal health among industrial workers

## Interventions
This study will investigate a 12-week workplace intervention aiming to improve the musculoskeletal health of industrial workers by redesigning their productive work. More specifically, the intervention aims to redesign the workers' physical work behaviors towards being 'just right', i.e. having a 'just right' composition of sitting, standing and active work and 'just right' alternations between these three, so that their musculoskeletal health may be improved. The researchers define the 'just right' composition of a workday as consisting of six blocks organised as 3/6 of sitting, 2/6 of standing and 1/6 of active work, performed in a sequence where physical behavior is alternated roughly every hour.

This 'just right' composition was based on analysis of objective measurements of physical behaviours at work and self-rated health from a large sample of industrial workers, i.e. the DPhacto cohort (doi: 10.1016/j.apergo.2019.01.003). Specifically, among these 561 industrial workers, the researchers observed that those workers with the best self-rated health spent 65% of their work time sitting, 28% standing and 7% active.

The study will be conducted within at least one organisation where workers primarily perform manual labour, selected based on its/their motivation to participate. Two production sites at each participating organisation will be involved to increase participant numbers and diversity of workers with manual labour.

A 'local workplace group' of representatives from management, staff, health and safety (separate department working with work environment across the whole organisation), and work environment (representative among workers with increased responsibilities in work environment) will receive three onsite consultations including; 1) training in using a tool to redesign productive work to be 'just right' for promoting health, 2) support in implementation of the tool in the production, and 3) support in identifying and overcoming main barriers to implementing redesigned work.

A tool to redesign work to be 'just right' was developed based on a feasibility study (doi: 10.3390 /ijerph18094707), performed in a collaborative process with stakeholders within the industry, and the participating company. In this tool, all work tasks within the participating organization will be labelled as either sitting, standing or active behavior, as judged by the most common physical behavior associated with the work task.

The research team will train the local workplace group in using the tool to redesign work, and assign responsibilities for training and supporting workers in this process, while health and safety representatives from the local workplace group will do the actual training and support the workers' use of the tool. Furthermore, the work environment representatives will ask

workers to identify barriers that may challenge implementation, which will then be discussed and addressed by the local workplace group.

To investigate the effectiveness of the intervention, the researchers will use a cluster randomized controlled trial design. Clusters will consist of work teams of 2-7 workers. Clusters will be randomly allocated to either intervention (i.e. using the tool to redesign work) or control (i.e. usual practice). Allocation of work teams will be performed at each production site, in each participating organization. Thus, each production site will have approximately half of their work teams allocated to intervention and the other half to the control condition. Allocation will be performed before baseline measurements for logistical reasons related to the planning and execution of the intervention.

Baseline and follow-up measurements
Participants will participate in a 12-week intervention. Musculoskeletal pain (including the low back), fatigue and energy level will be measured repeatedly over 5 work days during the first week of the intervention (baseline) and during the last week of the intervention (follow-up) by use of questionnaires delivered as text messages. Questionnaires concerning general health, musculoskeletal health, productivity and work environment will be distributed by text message at baseline and follow up. Physical behaviors (i.e. sitting, standing and active) will be assessed by a thigh-worn accelerometer worn for several working days at baseline and at follow up. Alternating between work tasks with different physical behaviors will be assessed from work schedules filled out by the workers. Height, mass, fat percentage, resting blood pressure, and resting heart rate will be collected at the workplace by the researchers at baseline and at follow up. Furthermore, during the intervention, information about dose delivered and dose received will be collected by counting the number of consultations delivered and the number of invited workers participating. Fidelity of using the daily planning tool will be addressed using work schedules filled out by the workers on a daily basis. Workers will be asked weekly between the 1st and 2nd, and again between the 2nd and 3rd consultation about their main challenges when use the tool to plan their work.

For the cost-effectiveness analysis, the researchers will collect information on costs of intervention activities and costs associated with health-related productivity loss. Intervention costs will include; staff and consultant time, consumables and overhead.

## Intervention Type
Behavioural

## Primary outcome(s)
Low back pain intensity is measured with a numeric scale (NRS, 0-10) at baseline (following work for 5 days in week 1) and follow up (following work for 5 days at week 12)

## Key secondary outcome(s)
1. Composition of physical behaviors (i.e., sitting, standing and active) during work measured with accelerometry at baseline (for 5 days in week 1) and follow up (for 5 days in week 12)
2. Accumulated time in long bouts of sitting and standing during work measured with accelerometry at baseline (for 5 days in week 1) and follow up (for 5 days in week 12)
3. Perceived physical exertion at work measured with a numeric scale (0-10) measured at baseline (following work for 5 days at week 1) and follow up (following work for 5 days at week 12)
4. Fatigue and energy levels measured with a numeric scale (0-10) measured at baseline (following work for 5 days at week 1) and follow up (following work for 5 days at week 12)

5. Self-rated productivity at work measured on a numeric scale (0-10) at baseline (week 1) and follow up (week 12)
6. Cost-effectiveness measured by incremental change in cost-effectiveness (ratio of incremental change in cost and change in low back pain intensity) and return on investment (indicated by the return-on-investment ratio) collected during the 12-week intervention
7. Dose delivered, dose received and fidelity measured with records of consultations delivered (conducted in weeks 1, 4 and 7), list of participants (collected at weeks 1, 4 and 7), and work schedules (collected at weeks 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 weeks)

### Completion date
01/07/2023

## Eligibility

### Key inclusion criteria
≥20 hours weekly work at one of the two participating production sites within the organization

### Participant type(s)
Other

### Healthy volunteers allowed
No

### Age group
Adult

### Sex
All

### Total final enrolment
83

### Key exclusion criteria
1. Workers only working night shifts
2. Workers known/expected to leave the company/department within the intervention period
3. Pregnancy

### Date of first enrolment
13/09/2021

### Date of final enrolment
04/07/2022

## Locations

### Countries of recruitment
Denmark

### Study participating centre
**The National Research Centre for the Working Environment**
Lersø Parkallé 105
Copenhagen
Denmark
2100

# Sponsor information

### Organisation
National Research Centre for the Working Environment

### ROR
https://ror.org/03f61zm76

# Funder(s)

### Funder type
Government

### Funder Name
The Danish Work Environment Research Fund, grant number 20185100177

# Results and Publications

### Individual participant data (IPD) sharing plan
The data-sharing plans for the current study are unknown and will be made available at a later date.

### IPD sharing plan summary
Data sharing statement to be made available at a later date

### Study outputs

| Output type | Details | Date created | Date added | Peer reviewed? | Patient-facing? |
|---|---|---|---|---|---|
| Results article | | 24/05/2024 | 06/08/2024 | Yes | No |
| Protocol article | | 23/02/2022 | 05/07/2022 | Yes | No |
| Study website | Study website | 11/11/2025 | 11/11/2025 | No | Yes |