Work-related musculoskeletal disorders (WMSD) are among the most prevalent health problems in the industrial countries and have extensive consequences for individuals and society in terms of work disability and sickness absence. Worldwide, low back pain causes more disability than any other condition. Heavy lifting, working in awkward postures, pushing and pulling and manual material handling – which frequently occur during construction work - are associated with increased risk of developing WMSD. Recent data from the Danish Work Environment & Health questionnaire study show that construction workers have a higher degree of; heavy lifting, pushing and pulling, and work with back rotation or forward bending than the general working population. The number of high-quality intervention studies aiming at reducing the workload in the construction industry is scarce, and the methods for evaluating workload have often been based on self-reports. Technological development has made it possible to obtain technical measurements during full working days by using surface electromyography (sEMG), kinematics (IMU), heart rate and video recordings. However, these measurements have not previously been used simultaneously and in a synchronized manner to detect events of excessive workload during a full day of construction work. While technical measurements are important for achieving good measurements of exposure, making actual changes at the workplaces in the construction industry can be difficult. Participant involvement in interventions has previously shown promising results in certain job groups and may help to fit the intervention to the context, culture, as well as the psychosocial and organizational conditions on the working site. However, whether participatory ergonomics can reduce the physical workload in the construction industry is unknown. The overall aim of this PhD-thesis was to investigate whether a participatory ergonomics intervention with technical measurements consisting of IMU sensors, sEMG, heart rate and video recordings of physical workload can reduce the number of events with excessive physical workload during a working day in the construction industry. A Study protocol that described the purpose and methods planned to be used in the intervention was published (Study I). Two methodological studies (Study II and III) were conducted with the purpose of developing a reliable and accurate method to detect events of excessive physical workload during construction work. In Study II the inter-day reliability of sEMG of the back and neck muscles was tested during standardized lifting situations, which showed moderate to almost perfect reliability (ICC3.k) for 89% and 73% of the lifting situations, for absolute and normalized values, respectively. In Study III the accuracy of detecting high or low-risk lifting during standardized lifting situations were tested and showed accuracy up to 78.1%. Based on the results from Study II and III a cluster randomized controlled trial with technical measurements, i.e. sEMG, IMU sensors, heart rate, and video recordings, obtained simultaneously at baseline, three and six months follow-up, was conducted in the Danish construction industry (Study IV). The sEMG and IMU sensors were used to detect events of excessive physical workload. The video recordings showing excessive physical workload for the construction gang in question were used in a participatory ergonomics intervention involving construction workers and managers. This intervention consisted of three workshops over a three month period. During the workshops several solutions to decrease the physical workload were proposed. The results of the intervention did not show an effect on the number of events of excessive physical workload. However, secondary outcome (questionnaires) showed a decrease in general fatigue after a typical working day from baseline to second follow-up as well as increased influence of own work from baseline to first follow-up, in the intervention group compared with the control group. Altogether, this PhD-thesis demonstrates new reliable methods for detecting events of excessive physical workload during laboratory settings. This thesis demonstrated that it is possible to use the method for event detection in field environment despite a lack of decrease in the number of events with excessive physical workload after the intervention.
To fulfill the requirements for the PhD degree, Mikkel Brandt Petersen has submitted the thesis: Participatory ergonomics intervention with technical measurements in the construction industry: cluster randomized controlled trial - Including development of a new method for measuring physical workload, to the Faculty Council of Medicine at Aalborg University.

The Faculty Council has appointed the following adjudication committee to evaluate the thesis and the associated lecture:

Senior physician Kaj Bo Veiersted  
National Institute of Occupational Health (STAMI)  
Norway

Professor Allard van der Beek  
VU University Medical Center  
Holland

Chairman:  
Associate Professor Ryan Godske Larsen  
Aalborg University  
Denmark

Moderator:  
Professor Pascal Madeleine  
Aalborg University  
Denmark

The PhD lecture is public and will take place on:

Friday 15 June 2018 at 13:00  
Det Nationale Forskningscenter for Arbejdsmiljø  
Lersø Parkallé 105  
2100 København Ø

Program for PhD lecture on

Friday 15 June 2018  
by  
Mikkel Brandt Petersen

Participatory ergonomics intervention with technical measurements in the construction industry: cluster randomized controlled trial - Including development of a new method for measuring physical workload.

Chairman:  
Associate Professor Ryan Godske Larsen

Moderator:  
Professor Pascal Madeleine

13.00  
Opening by the Moderator

13.05  
PhD lecture by Mikkel Brandt Petersen

13.50  
Break

14.00  
Questions and comments from the Committee  
Questions and comments from the audience at the Moderator’s discretion

16.00  
Conclusion of the session by the Moderator

After the session a reception will be arranged