

BIRGITTA OJALA

A Cognitive-Behavioural Work-Related Program for Early Rehabilitation

*A controlled study among municipal employees
in Finland*

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ACADEMIC DISSERTATION

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<i>Responsible supervisor or/and Custos</i>	Professor Clas-Håkan Nygård Tampere University Finland	
<i>Supervisor(s)</i>	Professor Clas-Håkan Nygård Tampere University Finland	Professor Seppo Nikkari Tampere University Finland
<i>Pre-examiner(s)</i>	Docent Katariina Hinkka University of Lapland Finland	Professor Kristiina Härköpää University of Lapland Finland
<i>Opponent(s)</i>	Professor Sarianna Sipilä University of Jyväskylä Finland	

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List of Original Publications

The dissertation is based on the following original publications:

- I Ojala B, Nygård C-H, Nikkari S (2016): Outpatient rehabilitation as an intervention to improve employees' physical capacity. *Work*, vol. 55, no. 4, pp. 861–871.
- II Ojala B, Nygård C-H, Huhtala H, Nikkari S (2017): Does perceived work ability improve after a cognitive behavioral intervention program? *Occupational Medicine*, vol. 67, no. 3, pp. 230–232.
- III Ojala B, Nygård C-H, Huhtala H, Nikkari S (2017): Effects of a nine-month occupational intervention on health-related quality of life? *Scandinavian Journal of Public Health*, vol. 45, no. 4, pp. 452–458.
- IV Ojala B, Nygård C-H, Huhtala H, Bohle P, Nikkari S (2019): A Cognitive Behavioural Intervention Programme to Improve Psychological Well-Being? *International Journal of Environmental Research and Public Health*, 16(1), 80; <https://doi.org/10.3390/ijerph16010080>.

Permission to attach the articles to the doctoral dissertation was kindly granted by the publishers of the original articles.

Abbreviations

AHRF	Assessment of health risks with feedback
BBI	Bergen Burnout Inventory
BMI	Body mass index
CBT	Cognitive behavioural therapy
ICF	International Classification of Functioning, Disability and Health
KELA	Social Insurance Institution of Finland
RCT	Randomized controlled trial
SD	Standard deviation
UWES	Utrecht Work Engagement Scale
VO ₂ max	Maximal oxygen intake
VOMR	Vocationally oriented medical rehabilitation
WAI	Work Ability Index
WHPP	Workplace health promotion programme
WHO	World Health Organization

Abstract

Work ability builds on the connection between human physical and psychological resources to the demands of work. Work ability is based on the physical and psychological ability of people including also attitudes and professional's skills. Work ability is the sum of many changing elements; for example, physical resources -tend to deteriorate with age, while professional's skills and experience develop with age. Work ability is strengthened by a meaningful and challenging job in a well-functioning working community. In assessing work ability, consideration is given to the physical and mental capacity of the person, the working capacity of a person in relation to other tasks of his or her own work or working life. This early rehabilitation of the municipal employees' purpose is to maintain and improve employees' work ability and continue to labour force.

The aim of the present study was to compare the causal impact of the programme on an intervention group (n=446), with a control group (n=185) that did not take part in the intervention, with a nine-month follow-up study design. There were eight intervention days during four months in every two weeks and a follow-up meeting was nine months after beginning. The mean age of the subjects was 49.9 years (range 21–64 years). The subjects were recruited from different vocational areas for the intervention programme. The largest participation of women came from health services (37.3%), and of men from construction and transport (70.4%).

The intervention was a new model to be carried out near work and home. Questionnaires on perceived work ability assessed was assessed by the work ability index (WAI), health-related quality of life by RAND 36, burnout assessed by the Bergen Burnout Inventory 15, and work engagement assessed by the Utrecht Work Engagement Scale. Physical capacity was measured by repeated functional tests, and maximal oxygen consumption by a sub-maximal bicycle ergometer test.

Both groups filled in the questionnaires at the beginning of the intervention and at the follow-up after nine months, but only intervention group took part in the physical tests.

This intervention programme was based on cognitive behavioural theory (CBT), which is a goal-oriented and practical approach to problem-solving by changing patterns of thinking or behaviour that helps people to move on in tricky situations and hence change the way they feel. In the intervention, the participants worked with their thoughts, beliefs and attitudes and how they connected to personal behaviour. It has been stated that identifying negative, unhelpful automatic thoughts is the key to understanding clients and overcoming their problems. CBT is based on the theory that it is not events themselves that upset us, but rather the meanings we give to them.

Work ability index increased in intervention group and decreased at the same time in control group. In the control group, a decrease in WAI was seen. The difference in changes between the groups in RAND 36 in psychosocial functioning was statistically significant. All items in BBI15 and UWES have been improved, although there was not statistically significant difference between groups. All age groups improved their VO₂max score during the nine-month intervention.

In conclusion, work ability can be improved by CBT intervention when it is offered in time, and when participants are motivated and can actively take part in support measures in the group rehabilitation programme.

Work ability builds on the connection between human physical and psychological resources and the demands of work. It is based on people's physical and psychological abilities, including their attitudes and professional skills. Work ability is the sum of many changing elements; for example, physical resources tend to deteriorate with age, while professional skills and experience develop with age. Work ability is strengthened when one has a meaningful and challenging job in a well-functioning work community. In the assessment of people's work ability, consideration is given to their physical and mental capacity, and to their working capacity in relation to other tasks in their own work or working life. The purpose of this early rehabilitation programme for municipal employees is to maintain and improve their work ability and prolong their membership of the workforce.

The aim of the present study was to compare the causal impact of the programme on an intervention group (n=446), with a control group (n=185) that did not take part in the intervention, with a nine-month follow-up study design. There were eight intervention days in total – one day every two weeks during a period of four months – and a follow-up meeting nine months after the start of the programme. The mean age of the subjects was 49.9 years (range 21–64 years). The subjects for the intervention programme were recruited from different vocational areas. The largest participation of women came from health services (37.3%), and of men from construction and transport (70.4%).

The intervention was a new model to be carried out near work and home. Questionnaires on perceived work ability were assessed using the work ability index (WAI), health-related quality of life using RAND 36, burnout using the Bergen Burnout Inventory (BBI15), and work engagement using the Utrecht Work Engagement Scale (UWES). Physical capacity

was measured by repeated functional tests, and maximal oxygen consumption ($VO_2\max$) by a sub-maximal bicycle ergometer test.

Both groups filled in questionnaires at the beginning of the intervention and at the follow-up nine months later, but only the intervention group took part in the physical tests.

The intervention programme was based on cognitive behavioural theory (CBT), which is a goal-oriented and practical approach to problem-solving by changing patterns of thinking or behaviour that helps people to move on in tricky situations and hence change the way they feel. In the intervention, the participants worked on their own thoughts, beliefs and attitudes and how they connected to personal behaviour. It has been stated that identifying negative, unhelpful automatic thoughts is the key to understanding clients and overcoming their problems. CBT is based on the theory that it is not events themselves that upset us, but rather the meanings we give to them.

WAI increased in the intervention group and decreased at the same time in the control group. The difference in changes in psychosocial functioning between the groups, measured with RAND 36, was statistically significant. All items in BBI₁₅ and UWES improved, although there was no statistically significant difference between the groups. All age groups improved their $VO_2\max$ score during the nine-month intervention.

In conclusion, CBT intervention can improve work ability if it is offered in a timely manner, and participants are motivated and actively participate in supportive measures on a group rehabilitation programme.

This finding suggest that this early rehabilitation produce benefit by improving work ability to participants.

Tiivistelmä

Tämä tutkimus kohdistuu Tampereen kaupungin työntekijöiden uudenaikaiseen varhaiskuntoutusinterventioon ja sen tuloksiin yhdeksän kuukauden seuranta-aikana. Interventio on toteutettu lähellä kotia ja työtä, tukien elämäntapamuutosten jatkuvuutta ja oppimista omassa arjessa. Työnantaja on mahdollistanut kuntoutuksen kustantamalla kuntoutuspäivien toteuttamisen ja KELA on tukenut osallistumista maksamalla kuntoutusrahaa, korvaamaan menetettyjä palkkakustannuksia kuntoutuspäivien ajalta.

Kuntoutus eli interventio-ohjelma sisälsi kahdeksan kokoontumispäivää. Kuntoutuksen tarkoituksena oli ylläpitää ja edistää osallistujien työkykyä ja mahdollisuuksia toimia ja pysyä työelämässä. Kokoontumispäivät olivat kahden viikon välein ja seuranta toteutui yhdeksän kuukauden kuluttua ohjelman alkamisesta. Osallistujien keski-ikä oli 49,9 vuotta (vaihdellen 21–64 vuoden välillä). Osallistujista 80% oli naisia ja 20% miehiä. Tampereen kaupungin työntekijöistä oli naisia 75 % (2014). Osallistujat edustivat eri ammatti- ja tuotantoaloja. Naisten kohdalla eniten oli edustettuna terveydenhuoltoala (37,3 %) ja miehillä edustetut alat olivat pääosin rakennusala tai kuljetusala (70,4%).

Aineisto kerättiin interventioon osallistuneilta henkilöiltä ja vertailuryhmän jäseniltä ajanjaksona 2011–2014. Molemmat ryhmät vastasivat kaikkiin kyselylomakkeisiin samanaikaisesti intervention alussa sekä lopussa. Vertailuryhmä ei osallistunut seuranta-aikana interventioon. Vertailuryhmään osallistuneet henkilöt olivat samasta ammatillisesta yksiköstä kuin interventio-ryhmä.

Interventio toteutettiin uudella tavalla ja kiinnostuksen kohteena oli vaikuttaako tämä uusi palvelukokonaisuus osallistujien työkykyyn. Tulostavina tutkimuksessa käytettiin vakiintuneita mittareita ja fyysisen suorituskyvyn testejä. Koettua työkykyä mitattiin työkyky indeksikyselyllä (TKI), elämänlaatua mitattiin elämänlaatumittarilla RAND 36, työuupumusta arvioitiin Bergen Burnout 15 -mittarilla ja työn imua Utrecht Work Engagement -pisteillä, UWES-mittarilla.

Fyysistä suorituskykyä mitattiin toiminnallisilla toisto- ja suoritustesteillä ja maksimaalista hapenottoa arvioitiin sub-maksimaalisella ergometritestillä. Fyysisen suoritusky-

vyn testejä ei tehty käytännön syistä vertailuryhmän henkilöille. Fyysisen suorituskyvyn tuloksia verrattiin kuntoutujan omiin aikaisempiin mittaustuloksiin. Lopullinen tutkimusaineisto sisälsi ne vastaajat, joilta oli käytettävissä kattavat vastaukset, 446 kuntoutujaa ja 116 verrokkia. Aineistoa ei ole satunnaistettu, sillä arkityön sujuminen tuli myös varmistaa yhdeksän kuukautta kestäneen palveluprosessin aikana. Tutkimus sisältää aineiston kvasikokeellisen tarkastelun.

Tutkimukseen käsitteet ovat laajoja ja moniulotteisia, kuten työkyky ja kuntoutus. Henkilön työkyky rakentuu muuttuvista fyysisistä ja psyykkisistä voimavaroista, sekä muuttuvan työn vaatimusten välisestä yhteydestä. Työkyky ei ole siis vain yksilöön liittyvä ominaisuus. Terveys ja toimintakyky ovat työkyvyn perusta ja siihen liittyy myös työhön kohdistuvat asenteet ja ammattitaito. Esimerkiksi ihmisen fyysiset voimavarat usein heikenevät iän myötä, kun taas osaamisen ja ammattitaito voivat olla parhaimmassa vaiheessa.

Työkykyä arvioitaessa huomioidaan henkilön fyysinen ja psyykinen toiminta- ja työkyky suhteessa omaan työhönsä tai tarjolla oleviin mahdollisiin muihin tehtäviin. Työkykyä tukee mielekäs ja sopivan haasteellinen työ hyvin toimivassa organisaatiossa. Työhyvinvointi liittyy työhön, johtaminen, työyhteisö ja työolosuhteet ovat keskeisessä roolissa. Toimintaympäristö, lähiyhteisö ja perhe ovat myös merkittävässä roolissa työkyvyn näkökulmasta. Työssä pysymiseen ja työhön paluuseen liittyy monenlaisia esteitä ja mahdollistavia tekijöitä.

Interventioryhmän ohjelma perustui kognitiivisbehavioraaliseen teoriaan (CBT), missä toiminta on tavoiteorientoitunutta ja käytännönläheistä. Malli tarkastelee automaattisia ajattelutapoja ja niiden merkitystä omalle hyvinvoinnille. Ohjelma mahdollistaa omien ajattelutapojen ja käyttäytymismallien tunnistamisen. Mikäli oma ajattelumalli on esteenä muutokselle tai hyvinvoinnille, on ajattelumallia hyvä tarkistaa, ja tarvittaessa muuttaa. Ajattelun ja toiminnan muutos muuttaa myös tilanteeseen liittyviä tunteita. On todettu, että negatiivisten automaattisten ajatusten tunnistaminen, auttaa luopumaan negatiivisista ajatuksista, sekä auttaa löytämään ongelmille ratkaisuja. CBT:n mukaan itse tapahtuma ei aina ole ongelman syynä vaan tapahtumalle antamamme merkitys, mikä muodostuu ajattelumme kautta.

Kuntoutusryhmän tulokset kohenivat kaikilla osa-alueilla toisin kuin vertailuryhmän. Työkykyindeksi kasvoi interventioryhmässä ja väheni samanaikaisesti kontrolliryhmässä. Rand 36:n ryhmien väliset muutokset psykososiaalisessa toiminnassa olivat tilastollisesti merkitseviä. Kaikkien yksittäisten muuttujien arvot BBI 15- ja UWES-mittareissa olivat parantuneet seurantamittauksessa, vaikka ryhmien välillä ei ollut tilastollisesti merkitsevää eroa. UWES-mittarin osalta vastaavaa kehitystä tapahtui myös vertailuryhmässä. Kaikki ikäryhmät paransivat VO₂max-pisteitään seurantajakson aikana. Johtopäätöksenä voidaan todeta, että työkykyä voidaan parantaa CBT-intervention avulla, kun sitä tarjotaan oikea-aikaisesti, osallistujat ovat motivoituneita, ja he osallistuvat sitoutuneesti koko ryhmäprosessiin liittyvään ohjelmaan.

Tämän tutkimuksen tulokset viittaavat siihen, että varhainen kuntoutus tuo hyötyä yksilölle, joka osallistuu varhaiskuntoutukseen. Yksilön saavuttama hyöty voi heijastaa myönteisiä vaikutuksia myös työyhteisöön ja perheelle. Tutkimus sijoittuu sekä työterveys- huollon että kuntoutuksen tutkimusaloille. Tutkimus perustuu deduktiiviseen päättelyyn ja kvantitatiiviseen tutkimusmetodologiaan. Tutkimustuloksista on julkaistu neljä artikkelia kansainvälisissä tieteellisissä julkaisuissa.

1 Introduction

The population in Europe began ageing significantly in the 1990s. The proportion of the population aged 65 years and above is expected to almost double from 17% in 2010 to 30% in 2060 (Börsch-Supan et al. 2013). The importance of sustainable work ability increases with an ageing workforce, and innovative ways to support workers to prolong their working lives are needed to prevent workers from retiring before the official retirement age (Geuskens et al. 2012).

The European Commission reports an increase in labour force participation among people with disabilities. About 16% of men and women at 16–64 years of age in the European Union reportedly have long-standing health problems or disabilities. One third of these persons indicate that they are not restricted in the kind or amount of work they can do, or in their mobility to and from work. Persons who are not restricted in their work or mobility are more likely to be employed than those who are restricted. (Eurostat 2010.)

Studies have found that the earlier interventions and support for work ability are implemented, the more cost-effective they are (Groeneveld et al. 2011; Rasmussen et al. 2016). A six-month individual-based lifestyle intervention has commented on the need for more investment in effective interventions to improve employees' health and work ability (Schofield et al. 2017; Kelly & Jessop 1996). In Finland, vocationally oriented medical rehabilitation (VOMR) has been offered for over 30 years by the Social Insurance Institution of Finland (KELA). VOMR was initially founded in the 1980s for forestry workers and cleaners, expanding later to all occupational groups. It was targeted at employed persons whose work was related to physical performance and whose problems had not yet developed very far. (Saltychev et al. 2014.) The results of VOMR studies were very contradictory, and the rehabilitation proved not to be cost-effective. Consequently, VOMR was terminated in 2015. (Konu et al. 2009; Suoyrjö et al. 2009).

There was a lack of services to support work ability (in its widest sense) at early stages, and a need to show evidence of the effectiveness of such services. This was one reason why the present early intervention was developed, and the study begun. Occupational health

services play a preventive role in healthcare in Finland, and the service providers know the workplaces; this kind of intervention differs from earlier services. Support at the right time, near users' workplaces and everyday lives, may offer the possibility of long-term effects, and is probably the most economic form of action.

The definition of rehabilitation is difficult, and every country has its own history and uses its own definition. In the present study we use early rehabilitation and intervention as synonyms when we describe the content of support. In this study we have tried to find out whether the new model of early rehabilitation close to the workplace changes municipal employees' work ability and health.

2 Literature Review

2.1 Theoretical aspects of the study

The theoretical framework provides the theoretical basis for the process of change in the intervention, although there is no consensus regarding rehabilitation theories, reference frameworks or models. Framework refers to scientifically valid concepts and theories that can be used for planning interventions and rehabilitation (Järvikoski 2013). This study is based on deductive reasoning, and we used only tested and comparable measurements to find out whether the intervention was effective as a new model of service (Evans et al. 1993).

In 1948 the World Health Organization (WHO) defined health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. Without mental health there is no health; WHO defines mental health as “a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community” (World Health Organization 2004).

Overall health, as opposed to the mere treatment of illness, has become a more important focus of international policy, and this challenge health professionals to develop and find innovative ways to offer support. Recovery involves the development of many aspects of one’s life, including attitudes, values, feelings, goals, skills and roles to find a meaningful way of life even when living with illness (Sapani 2015; Kimura et al. 2015; Slade et al. 2008; Slade 2010). Our research is based on a cognitive behavioural work-related programme for early rehabilitation that combines basic principles from behavioural and cognitive psychology (Beck 1991).

The WHO’s International Classification of Functioning, Disability and Health (ICF) is one widely used framework for rehabilitation. In the health field, the ICF is used at individual and population levels to describe and measure health and disability, including in

communities and societies. The ICF combines environmental factors, individual personal factors, and the interactions between them (Stucki 2005; Talo & Rytökoski 2016).

The ICF model is divided into two parts, functional capacity and functional restriction. This study uses the RAND 36 measurement based on this theory. The ICF acts as a framework for identifying most aspects of rehabilitation (Kirchberger et al. 2009).

2.2 Definition of rehabilitation in this study

There is a general lack of clear concepts and conceptual frameworks regarding rehabilitation. The concept of rehabilitation has historically been used to describe a range of different interventions, from improvements to (dis)ability and body function to more comprehensive measures designed to enhance society (Frontera 2012; Frontera 2014; Järvikoski et al. 2016).

Vocational rehabilitation has been defined as a series of dynamic processes consisting of a sequence of services related to the total needs of the client, beginning with the initial case evaluation and ending with successful placement at work. There are many activities that occur concurrently and in overlapping time frames during this process (Chan et al. 1997). Occupational rehabilitation is defined very similarly. The basic purpose of rehabilitation is the restoration of functions; vocational rehabilitation, like occupational or work rehabilitation, covers different kinds of intervention to Rehabilitation is always voluntary, and some individuals may require support with making their rehabilitation choices. In all cases, rehabilitation should help to empower a participant (Härkäpää et al. 2014; Järvikoski 2013).

Well-being is a key focus nowadays, and health services need to reorient to promote it. This requires updated knowledge and skills among health professionals. The new orientation requires more emphasis on the person's own goals and strengths, and an integration into routine clinical practice of interventions to promote well-being. Professionals need to focus on improving social inclusion, which has an impact on well-being (Slade 2010).

2.3 Early intervention

The timing of rehabilitation has been discussed and defined for decades, and early rehabilitation criteria have been formulated for many disease-based rehabilitations, for example after stroke, spinal and other surgery, and various medical diagnoses (Maffei et al. 2017; Milovanovic et al. 2016; Nikamp et al. 2017).

The definition of “early” and “very early” interventions needs consensus to promote mutual understanding (Vargas-Prada et al. 2016). Early rehabilitation has been invoked when an early need for rehabilitation has been identified. Early rehabilitation is initiated when there is a reduction of working capacity based on proactive symptoms, or when

rehabilitation starts after the illness to prevent prolonged disability. (Järvikoski & Lahelma 1981.)

In Finland, early rehabilitation is indicated when a person with a disability anticipates symptoms. The aim is to restore performance to the best possible level by improving the individual's capabilities and eliminating barriers so as prevent permanent working and functional incapacity (Järvikoski & Lahelma 1981). Early rehabilitation is related to the threat of reduced work ability and individual risks; this is the difference between early rehabilitation and primary prevention. Early rehabilitation is supposed to be a collaboration between the workplace and the rehabilitator, but this collaboration has been difficult to build. (Järvikoski 2013.)

The attempt to start rehabilitation earlier was one of the targets of pension law reform in Finland in 2004, although many clients still considered that rehabilitation started too late (Härkäpää et al. 2014). In Finland as elsewhere, the commencement of rehabilitation traditionally requires the occurrence of an illness or injury and a doctor's certificate. Economic, educational and social factors, such as difficulties in one's overall life situation, may also currently be prerequisites for rehabilitation. (Järvikoski 2013.)

In Finland, occupational healthcare and rehabilitation became separated in 1979, when Occupational Health Care Act was implemented. Occupational healthcare was redefined to recognize the need for rehabilitation, and to direct those who had such needs to the rehabilitation service. (Juvonen-Posti et al. 2011.)

Chronic diseases, such as heart disease, stroke, cancer, diabetes and depression, are becoming increasingly prevalent within the ageing workforce (Leijten et al. 2015; Varekamp & van Dijk 2010). Ageing is often accompanied by an increased risk of developing disorders, (chronic) diseases and other health issues, which can lead to functional limitations and disability at work and therefore increase the need for rehabilitation. In our study we recognize the results of relevant measurements and compare them with current recommendations.

2.4 Cognitive behavioural theory and therapy

Cognitive behavioural therapy (CBT) is a certain type of psychosocial intervention that has been widely used to treat people with many kinds of mental health problem (Beck 2011). CBT is a problem-based and action-oriented therapy, and it is used to treat specific problems by identifying individual goals. How a person thinks and behaves plays a role in the development and maintenance of disorders, and this can be reduced by teaching skills and coping mechanisms. (Beck 2011; Field et al. 2015). CBT is based on the idea that how we think (cognition), feel (emotion) and act (behaviour) is always interacting. In particular, our thoughts determine our feelings and behaviour. (Field et al. 2015.)

Cognitive therapy helps people to develop alternative ways of thinking and behaving, as a new coping strategy that aims to help them become aware of unhelpful patterns in cognition,

including in their thoughts, beliefs, attitudes, behaviours and emotional regulation. The goal is to improve well-being by solving current problems, by conceptualizing a person's specific beliefs and patterns of behaviour and looking for an alternative way to produce cognitive change in the patient's thinking and belief system, thereby bringing about lasting emotional and behavioural change. (Beck 2011; Hassett & Gevirtz 2009.)

CBT is an umbrella term for many different therapies that share some common elements, and it consists of several different learning theories. A theory with a holistic view of individuals was developed by Aaron Beck, the founder of cognitive psychotherapy. Beck also recognized a person's inner talk, and he called those thoughts automatic thoughts (Beck 1991). George Kelly's personal construct theory (Kelly & Jessop 1996), Albert Bandura's (Bandura 2017) theory of model learning, abilities and principles of organizational behaviour, Donald Meichenbaum's identification of stress and mental health conditions (Meichenbaum 1997; Meichenbaum 2004), Jerome Frank's comfort, effectiveness and self-awareness (Parloff et al. 1954), and Albert Ellis's rational-emotional behavioural therapy (Ellis 2004) have all influenced CBT.

CBT involves selecting a problem and measuring the results. The CBT process often includes homework before each session. Each step in the homework is based on how successfully the previous task was completed. The effectiveness of CBT is dependent on the therapist and participant's relationship and the participant's commitment to the process. The therapist has to be flexible, and to focus on listening rather than giving advice all the time. (Bender & Messner 2002; Hofmann & Asmundson 2017.) There are many different protocols – with important similarities among them – for implementing CBT (Brewin 1996).

Work-related attitudes such as job satisfaction, expectations of treatment, and plans to apply for compensation are risk factors for chronic disability and should be treated with the cognitive behavioural method. Work-related attitudes are important parts of work ability. For example, social recognition of employees by their colleagues and supervisors regarding their sickness absence is important. In addition to case management, intervention efforts should also emphasize aspects of social recognition and occupational self-esteem. (Elfering 2006.)

A toolkit for cognitive behavioural coaching contains: mutually identified goals, measurable results, sustained change, skill refinement, elimination of maladaptive behaviour, wisdom development, self-awareness development, stress management, honest feedback, skills for developing others, a holistic view of the individual, a systems approach, and the efficacy of techniques (Breitmeyer 2016). In this study, CBT theory was built into the intervention programme. Participants gained knowledge about their individual measurements to help them identify their own goals for the process. Every two weeks, participants learned to make changes in their everyday lives to support their well-being. They gained peer support and professional support for their issues, helping them to gain new perspectives on their own thoughts and new skills for exercise, such as finding their own exercise level.

2.5 Work ability

A definition of work ability helps us to understand the complex, holistic and dynamic aspects of this issue, and also gives us a direction for rehabilitation (Tengland 2011). There is no generally accepted definition of work ability, a relative concept that interacts with many different dimensions (Ilmarinen 2009; Järvikoski 2013; Lederer et al. 2014). Work ability is evaluated in relation to work demands: specific work ability is understood in relation to one's current work or occupation, while overall work ability refers to the ability to perform generally in any available work (Tengland 2011). It is essential to know the work that a person is going to do before one evaluates that person's work ability. Understanding work ability in the broad sense provides a basis for planning the content of the support.

Work ability can be defined according to an equilibrium model as a ratio of individual resources to work-related factors, or as a balance between human resources and the demands of work (Ilmarinen et al. 1997; Tuomi et al. 1991).

Work ability can be described with the model of a house (Ilmarinen & Rantanen 1999). It is built on four mutually supportive storeys (Figure 1). The bottom three storeys are related to human resources: the first to health and functional capacities, the second to knowledge, competence and skills, and the third to values, attitudes and motivation. The fourth storey relates to work content, job creation, and work organization and leadership. The storeys interact with each other by means of stairs; the house's external networks, societal structures, family, and the person's close community relate to the work capacity-building environment outside work. (Ilmarinen 2009.)

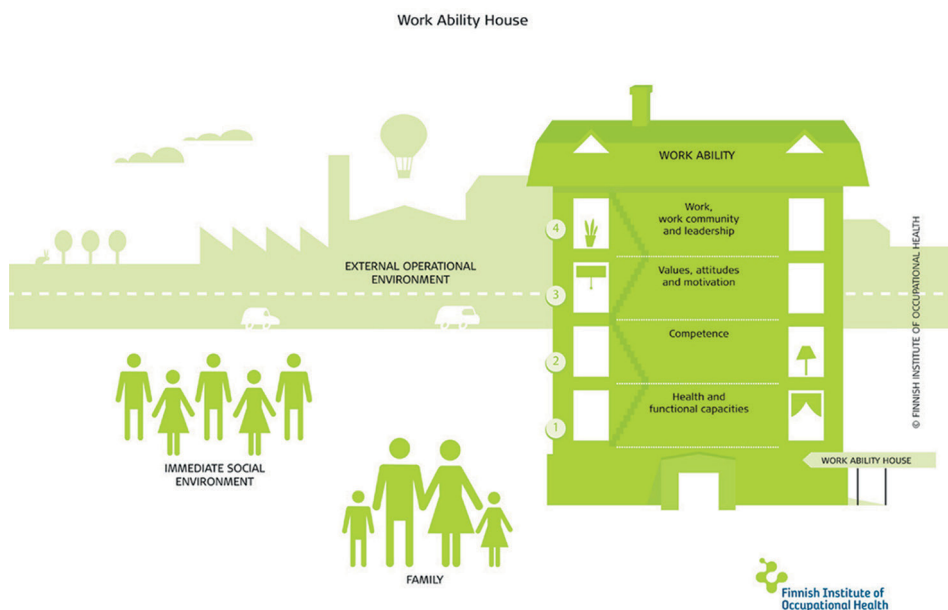


Figure 1. Work ability house (Finnish Institute of Occupational Health)

The factors affecting work ability are continuously changing. Personal resources change, for example, with age, and globalization and modern technology have an impact on work demands. To ensure a decent level of work ability throughout working life, measures need to be taken in all dimensions of work ability. (Ilmarinen 2009; Roelen et al. 2014; van den Berg et al. 2010.)

One's level of current performance reflects where the work is carried out, i.e. the level of performance varies depending on the workplace and the work community (Lederer et al. 2014). Performance may be poor if the work is physically too burdensome, the motivation is poor or there are problems in the work community. This can mean the direct deterioration of the work input of the employee. Performance describes a more general human ability to succeed in the occupation she or he has been trained for and can become slower because of the interaction between the human, the work and the work environment. (Lederer et al. 2014; van den Berg et al. 2010.)

Work ability and work disability can be evaluated through individual research and load factors, and in dynamic and multidimensional aspects. Over the years, the definition of work (dis)ability seems to have become increasingly dynamic, rather than focusing on punctual and static work status (Lederer et al. 2014). The three levels of individual, organization and society are all connected to work ability (Lederer et al. 2014). Poor work ability and the risk of disability and lengthy sickness absence can be predicted by a work ability score (Kinnunen & Nätti 2017). Poor work ability can also predict long-term sickness absence, disability pension and long-term unemployment in the future (Lundin et al. 2016). If a person is unemployed it is difficult to evaluate his or her work ability, because work ability is always connected to a person's work (Gould et al. 2008).

2.6 Theoretical framework of the study

To describe the intervention mechanism, we draw on Chen's (1989) introduction of "action theory" and "conceptual theory" (Figure 2). Action theory explains how a theoretical construction can be changed. Conceptual theory is the link between the construction and the behaviour. (Chen & Rossi 1989.) This study focuses on "action theory" and its associations. An action theory is a systematic plan for arranging staff, resources, settings and support organizations to reach a target group and deliver intervention services. The action model consists of the following elements. It is important to ensure that the implementing organization has the capacity to implement the programme. The implementers' qualifications and competency, commitment, enthusiasm and other attributes can directly affect the quality of service delivery. Programmes may often benefit from, or even require, cooperation or collaboration between their implementing organizations and other organizations.

The intervention protocol is a curriculum or prospectus stating the exact nature, content and activities of an intervention – in other words, the details of its orienting perspective

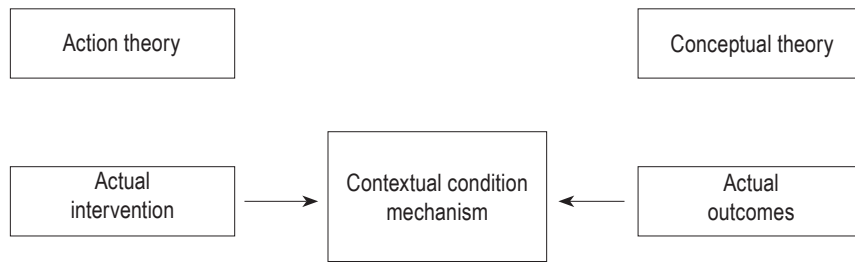


Figure 2. Action theory, conceptual theory and change model (adapted from Chen 1989 and Van Belle et al. 2010)

and its operating procedures. Some programmes have a special need for contextual support, meaning the involvement of a supportive environment in the programme's work. Both microlevel contextual support and macrolevel contextual support can be crucial to a programme's success. Microlevel contextual support comprises the social, psychological and material supports clients need to allow their continued participation in intervention programmes. In addition to microlevel contextual support, programme designers should consider the macrolevel context of a programme, that is, community norms, cultures, and political and economic processes. They should also consider the feasibility of reaching and effectively serving the target group, and the willingness of potential clients to become committed to, cooperative with or at least agreeable to joining the programme. (Chen 1989.)

Theory-driven evaluation traces the mechanisms that link the actual intervention to the actual outcomes. These mechanisms connect the causal pathway that is made up by the interplay between intervention, actors and contextual conditions. This interplay may consist of both linear relations and feedback loops that ultimately lead to change. The evaluation of the change model answers three questions (Van Belle et al. 2010): what kinds of relationship exist between actual intervention and outcome? Which intervening factors might be mediating the effect of the intervention on the outcome variables? Under what contextual conditions will the causal relationship be facilitated or inhibited.

In this study, CBT has an impact as an intervention on all elements of work ability. All the elements in the work ability model are continuously changing, and a person evaluates his or her situation in cycles of thoughts, feelings and behaviour that give value now and in the near future to all the elements. The goals change process and intervention have an impact on physical condition, mental well-being and well-being at work (Figure 3).

There are some things that it is possible to affect by oneself, and other things that are less easy or even quite impossible to change by individual effort. The external operational environment, family and friends, the immediate social environment, work, work community and leadership are issues that are not so easy to change at the individual level. Personal values, attitudes, motivation, competence, health and functional capacity

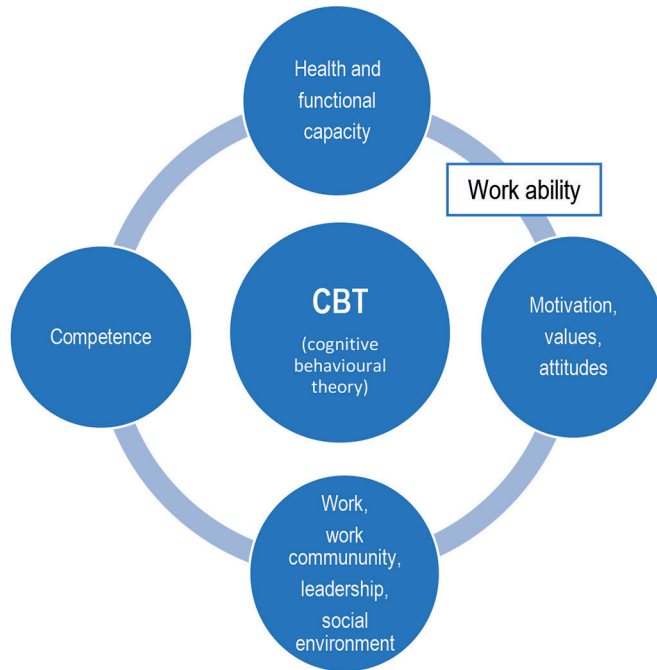


Figure 3. Interactions between CBT and work ability

include elements that person can identify and make changes to through his or her own choices. Measurements for different dimensions of work ability and well-being cover both of these approaches. To understand what you can change and what you cannot, and to achieve positive results, requires reflection and peer support. A broader perspective gives organizations a way to address employee stress more strategically, such as by recognizing the effect on performance of employee involvement, work-life balance, health and safety, and growth and development. (Grawitch et al. 2015.)

The focus of the intervention was mainly individual, on participants and their supervisors. Our intervention group participants were from the same working unit; this helped to strengthen relationships and might also have had some organizational effects such as enhancing the work atmosphere.

Investments in continuing professional education are still advocated, and it is possible to integrate the basic principles of health promotion into a professional development programme and its evaluation, and to find innovative ways to do supportive and preventive work (Tremblay et al. 2013).

2.7 Effects of interventions

Various interventions to promote work ability and health have been carried out in many parts of the world. Most of these are more related to overall health, and only a minority are connected to work. According to the literature, there is a need for new work ability-supportive studies that are well designed and controlled. (Conn et al. 2008; Conn et al. 2009; Conn et al. 2011.)

The literature search for the present study was made using the following sets of keywords: workplace, occupational or health and well-being, health promotion or intervention, programmes; physical activity exercise, stress, mental health. The following databases were used: PubMed, MEDLINE, PsycINFO, Cochrane Library and Google Scholar. The selection of the documents was undertaken in two stages. First-stage documents were selected by title and abstract; second-stage documents, which examined interventions in the workplace and aimed to improve health, physical activity or musculoskeletal health, were read in detail. The focus was on meta-analyses and systematic reviews. Table 1 reports the positive findings of this literature search process.

Table 1. Collection of meta-analyses and systematic reviews, with positive findings of included intervention research

Meta-analyses and systematic reviews	Search time frame	Number of studies	Outcomes of interest	Activity	Evidence found	Studies where evidence was found
Dugdill, Brettle, Hulme, McCluskey & Long 2008	1996-2007	Thirty-three studies from Europe, Australia, New Zealand and Canada	Workplace physical activity interventions	Workplace stair walking	Little evidence of effectiveness of interventions to increase stair walking	Kerr, Eves & Carroll 2001; Marshall, Bauman, Patch, Wilson & Chen 2002; Auweele; Boen, Schapendonk & Dornez 2005; Eves, Webb & Mutrie 2006
				Walking (step counts) in employees	1. Two different types of walking intervention	1. Gilson, Mckenna, Cooke & Brown 2007
					2. Significant decreases in BMI, waist girth and resting heart rate. Three studies find that workplace walking interventions using pedometers can increase daily step counts. Average daily step counts increase	2. Chan, Ryan & Tudor-Locke 2004
				Walking and cycling to work	25% of intervention group regularly actively commute at 12-month follow-up	Mutrie; Carney; Blamey; Whitehaw; Crawford & Aitchison 2002
				Workplace counselling	Strong evidence that workplace counselling influences physical activity behaviour	Talvi, Järvisalo & Knuts 1999; Proper et al. 2003; Aittasalo, Miilunpalo & Suni 2004; Österås & Hammer 2006

Chu, Koh, Moy & Muller-Riemenschneider 2014	1990–2013	Thirty-five articles, most of them randomized controlled trials (RCTs); two comparison trials and two non-RCTs; total 2,025 post-intervention subjects	Whether workplace physical activity interventions improve mental health outcomes	Walking (step counts) in employees	1. Two diverse types of walking intervention 2. Average daily step counts increase. Significant decreases in BMI, waist girth and resting heart rate. Three studies find that workplace walking interventions using pedometers can increase daily step counts An exercise with behaviour intervention significantly improves stress scores	1. Gilson; Mckenna; Cooke & Brown 2007 2. Chan; Ryan & Tudor-Locke 2004 Atlantis, Chow, Kirby & Singh 2004
Meng, Wolff, Mattick, DeJoy, Wilson & Smith 2017	1995–2014	Literature review of 27 peer-reviewed articles in the US	Health interventions for employees with elevated risk of chronic diseases	Physical activity and depression	An exercise and behaviour intervention significantly reduce depression scores 1. At-risk employees might gain benefits and cost savings 2. Multicomponent intervention, effective evaluation strategies with work-related outcome	Atlantis et al. 2004 1. Burton & Connerty 2002; Groeneveld, Proper, van der Beek, Hildebrandt & van Mechelen 2010; Caloyeras, Liu, Exum, Broderick & Matkke 2014 2. Goldgruber & Ahrens 2010

Rongen, Robroek, van Lenthe & Burdorf 2013	Before June 2012	Eighteen studies describing 21 interventions, majority from northern European countries	Workplace health promotion	Workplace health promotion programmes to improve lifestyle, health, work ability and work productivity. Most studies aim to improve physical activity and weight, and a combination of lifestyle factors	Effectiveness depends on study population, intervention content, and methodological quality of study. With at least weekly contact, interventions for white-collar and younger populations become more effective; many components outside the intervention itself may also account for this	Guillaumie, Godin, Vezina-Im 2010; Shaikh, Yaroch, Nebeling, Yen & Resnicow 2008
Poscia, Moscato, La Milia, Milovanovic, Stojanovic, Borghini, Collamati, Ricciardi & Magnavita 2016	2000–2015	Eighteen articles published in English or Italian	Workplace health promotion for older workers	Interventions for ageing (and synonyms), worker (and synonyms), intervention (and synonyms) and health (and synonyms)	Workplace is an ideal setting for implementing health promotion activities. Evidence is rather limited regarding health promotion for the ageing workforce	Pegus, Bazzarre, Brown & Menzin 2002; Aldana, Greenlaw, Diehl, Englert & Jackson 2002; Bloch, Armstrong, Dettling, Hardy, Caterino & Barrie 2006
Goldgruber & Ahrens 2010	2004–2008	Seventeen articles published in English or German	Effectiveness of workplace health promotion and primary prevention interventions	Stress, physical activity and nutrition, organizational development, smoking, and ergonomics and back pain	In stress management, CBT interventions show the greatest effectiveness. Educational interventions might have better effects than rational interventions. Redesign of work, reduction of work demands, improved communication and development of conflict management skills are connected to employees' health	Richardson & Rothstein 2008; LaMontagne, Keegel, Louie, Ostry & Landsbergis 2007

				Ergonomics and back pain	1. Physical discomfort, technical performance of transfers, and frequency of manual lifting 2. Participatory ergonomic interventions 3. Exercise influences sick leave, costs and number of new episodes of lower back pain. Interventions with relational and behavioural elements get the best effects	1. Bos, Krol, van der Star & Groothoff 20062. Rivillis, Van Eerd, Cullen, Cole, Irvin, Tyson & Mahood 2008 3. Tveito, Hysing & Eriksen 2004
				Smoking	Group therapy, individual counselling and nicotine replacement therapy are effective	Moher, Hey & Lancaster 2005
				Teamwork	Improves psychosocial work environment, but has no health effects	Bambra, Egan, Thomas, Petticrew & Whitehead 2007
Odeen, Magnussen, Maeland, Larun, Eriksen & Tveito 2013	2011	Seventeen articles published in English	Workplace interventions to reduce sickness absence	Musculoskeletal, mental and multiple health complaints or general health	Some evidence of decreasing sickness absence; limited evidence for multidisciplinary interventions and CBT. Workplace education and physical exercise do not decrease sickness absence	Lexis, Jansen, Huibers, van Amelsvoort, Berkouwer, Tjin, Ton, van den Brandt & Kant 2011; Loisel, Abenhaim, Durand, Esdaile, Suissa, Gosselin, Simard, Turcotte & Lemaire 1997; Lindström, Ohlund & Eeek 1992

Van Ostrom, Driessen, de Vet, Franche, Schonstein, Loisel, van Mechelen & Anema 2009	2007	Six RCTs with 749 workers	Aim at return to work	Workplace interventions	Some evidence that workplace interventions decrease sickness absence among workers with musculoskeletal disorders, but no effective health improvement outcomes	Verbeek, Van Der Weide & van Dijk 2002; Blonk, Breninkmeijer, Lagerveld & Houtman 2006
Richardson & Rothstein 2008	After 1976	Thirty-six studies of 55 interventions in English	Occupational stress management intervention programmes	Psychological outcome variables	CBT interventions have best outcomes in occupational settings	Lipsey & Wilson, 1994
Awa, Plaumann & Walter 2010	1995–2007	Twenty-five intervention studies	Burnout prevention	Interventions are organization-directed, person-directed, and a combination of both	Burnout prevention is effective overall	Steinhardt, Smith, Jeggars, Faulk & Gloria 2011
Chan & Perry 2012	2000–2011	Three studies from US, Canada and Taiwan	Lifestyle health promotion interventions for nursing workforce to reduce risks of chronic disease	Obesity, activity, smoking, alcohol consumption	1. Decreased overall smoking 2. Significant reductions in fat levels 3. Better fitness tests results	1. Chalmers, Bramadat, Cantin, Murnaghan, Shuttleworth, Scott-Findlay, Tataryn 2001 2. Tucker, Lanningham-Foster, Murphy, Thompson, Weymiller, Lohse & Levine 2011 3. Yuan, Chou, Hwu, Chang, Hsu & Kuo 2009
Kuoppala, Lamminpää & Husman 2008	1970–2005	Forty-six studies	Work health promotion, job well-being, and sickness absence in occupational settings	Activities involving exercise, lifestyle and ergonomics have some effect	Some decreases in sickness absence and increases in mental well-being	Ruotsalainen, Verbeek, Salmi 2006

Workplace counselling seems to improve stress scores, but there is limited evidence that physical activity has an effect on stress. An exercise- and behaviour-based programme reduced depression but had no effect on anxiety disorders. (Chu et al. 2014.) Health promotion interventions in the workplace may be more beneficial if they are implemented among at-risk employees and include group discussions (Meng et al. 2017). Health education with feedback was found to be effective in improving health risks (Soler et al. 2010). Workplace health promotion interventions that aimed to improve smoking cessation, physical activity, healthy nutrition and obesity had small effects on self-perceived health, work absence due to sickness, work productivity or work ability, but there were better results in younger populations and in interventions with weekly contact (Rongen et al. 2013). The links between mental health, exercise and physical activity are well known. Interventions should build in physical and mental components, including work-related and non-work-related aspects. There is some evidence that a comprehensive multidisciplinary intervention and CBT reduced sickness absence, although education and physical exercise do not generally reduce sickness absence in the workplace. (Odeen et al. 2013.) On the other hand, there is moderate evidence to support the use of workplace interventions to reduce sickness absence among workers with musculoskeletal disorders. However, these workplace interventions were not effective in improving the health outcomes of the same group. Only a few studies found that workplace interventions were effective among workers with mental health problems and other health conditions. (van Oostrom et al. 2009.)

Cognitive behavioural programmes had larger effects than other types of occupational intervention for stress management, but if additional treatment components were added the effect was reduced. Relaxation was the most frequently used intervention, and the effects were based mainly on psychological variables rather than physiological or organizational measurements. (Richardson & Rothstein 2008.)

Intervention programmes against burnout are beneficial. Person-directed interventions reduce burnout in the short term, and a combination of person- and organization-directed interventions have longer-lasting positive effects. Institutions should recognize the need for burnout intervention programmes and make them available to employees through better-implemented programmes, including both person- and organization-directed measures. (Awa et al. 2010.) Health promotion lifestyle interventions for working-age nurses aimed for fewer cigarettes smoked, reduced fat mass and improved fitness. Nurse leaders and the whole organization promoted the improvements, driving the recognition of, commitment to and development of the targets. (Chan & Perry 2012.)

Work health promotion should target both the physical and the psychosocial environment at work, to decrease sickness absence and increase work ability and mental well-being. Exercise seems to increase overall well-being and work ability, but education and psychological methods do not seem to affect well-being, sickness absence or disability pensions. Sickness absence seems to be reduced by promoting a healthy lifestyle and ergonomics. Work health promotion is beneficial for employees' well-being and work

ability. Ergonomic improvements are effective. However, education and psychological means alone do not seem to be effective. (Kuoppala et al. 2008.)

In Finland, the concept of rehabilitation is used more widely, including in work-related interventions. Internationally similar interventions have been carried out on a broad scale, although the impact has been partly contradictory. The findings from these studies suggest that there is a need for well-designed interventions to support work ability in a multidimensional way. The present study aims to fill this research gap.

3 Aim of the Study

The aim of the present study was to find out whether a cognitive behavioural intervention had any impact on municipal employees' work ability and health.

More specifically, the study asked whether cognitive behavioural intervention affects physical capacity (Study I), perceived work ability (Study II), health-related quality of life (Study III) and psychosocial well-being (Study IV).

4 Material and Methods

4.1 Study design

This study was a nine-month follow-up designed to study of the intervention on an intervention group, with a control group that did not take part in the intervention.

In autumn 2011–2014 we recruited municipal employees for the study. Participation in the programme was voluntary, and participants were required to commit to the entire programme. The intervention was conducted during paid working hours. The intervention sessions lasted for four months, with one session every two weeks; five months after that came the follow-up tests and group meeting. The study was approved by the ethics committee of the Pirkanmaa Hospital District in Finland.

At the beginning, supervisors were informed about the intervention and the related research. After that they decided whether their unit could take part in the study. Some of the municipal production units agreed to start the course in autumn 2011 or thereafter. Employees were informed about the study and the programme; if they expressed individual interest in the course, and if the inclusion criteria were met, they were invited to an information session. With regard to the inclusion criteria, the supervisors had the best knowledge about an employee's work relationships and other employment-related criteria, and it was they who decided whether the employee could participate.

Research questionnaires were filled in at the beginning of the study. An intervention group – 12 employee in each group – was chosen by volunteer applicants, occupational professionals and supervisors. The remaining volunteers who had taken part in the information session were asked to join a control group. Applications to join a group were affected by the group's duration and often by dates, for example if the group clashed with holiday plans. If there were more than 12 applicants to join a group, they were assigned randomly to a participant or a control group. However, their workstation was taken into account. If there were multiple applicants from the same workstation, they were assigned

either to an intervention group, or to a waiting list or control group, according to their ability to participate in the intervention at all. It was considered important that the participants and the correlative control group should be from the same unit. The intervention group (n=583) took part in the programme, and those on the waiting list formed the control group (n=185) without taking part in the intervention. Both groups were from the same work area and met the criteria for participation. The group's start-up schedule was influenced by personal plans and work needs. The finalization of the groups' composition was not completely randomized, because each participant had to commit to the whole intervention process. The main principles used in the planning and evaluation of the intervention are set out in Table 2.

Table 2. Core principles of health promotion interventions and evaluations (Rootman et al. 2001; Tremblay et al. 2013)

Principle	Intervention	Evaluation
Participation	Involve the stakeholders at all stages of the project	Include stakeholders who display a legitimate interest in the evaluation of the intervention
Capacity-building empowerment	Enable individuals and communities to assume broader control over the personal, socio-economic and environmental factors that affect their health	Enable the stakeholders involved in the evaluation to develop competencies
Holism	Consider the multiple dimensions of health: physical, mental, social and spiritual	Anchor the process in a multitude of disciplines, and rely on a variety of information-gathering techniques
Multidisciplinary	Ensure collaboration by actors from all the disciplines and sectors concerned	
Equity	Seek equity in health and social justice	
Sustainability	Bring about changes that individuals and communities can maintain once the intervention has ended	
Multiple strategies	Rely on a variety of approaches in combination	
Relevance (in relation to the interventions)		Design the process in such a way that it respects the complex nature of the interventions and allows the measurement of their long-term impact

4.2 Participants

A total of 779 municipal employees volunteered and met the inclusion criteria for this study: being employed in the public sector and working as permanent or long-term temporary staff with at least one year of service. Of the 779 participants, 80% were women and 20% were men. The mean age of subjects was 49.9 years (range 21–64 years). There were no statistically significant differences between the intervention group and the control in age, gender, BMI, marital status or years of work experience. No vocational training in intervention group were 7.1% and in control group 5.3%. However, there was a difference in education: the intervention group had less vocational training than the control group. The subjects were recruited from different vocational areas for the intervention programme. The largest participation of women came from health services (37.3%), and of men from construction and transport (70.4%).

Of the 779 total participants, 594 took part in the intervention group and 185 in the control group. Control group members had the opportunity to take part in the intervention after they had answered follow-up questionnaires before the intervention started.

In the intervention group, 446 (75.1%) completed the questionnaires at both baseline and follow-up. There were missing responses in 148 cases. In 28 of these, there was natural movement such as changes of workplace, absence, changes of job, and death. Nineteen cases did not want to take part in the study, and 101 answered incompletely at the baseline or follow-up. In the control group, 116 (62.7%) answered at baseline and follow-up, there was natural movement with six participants, and 63 answered incompletely at baseline or follow-up (cf. Fenton et al. 2014) (Figure 4).

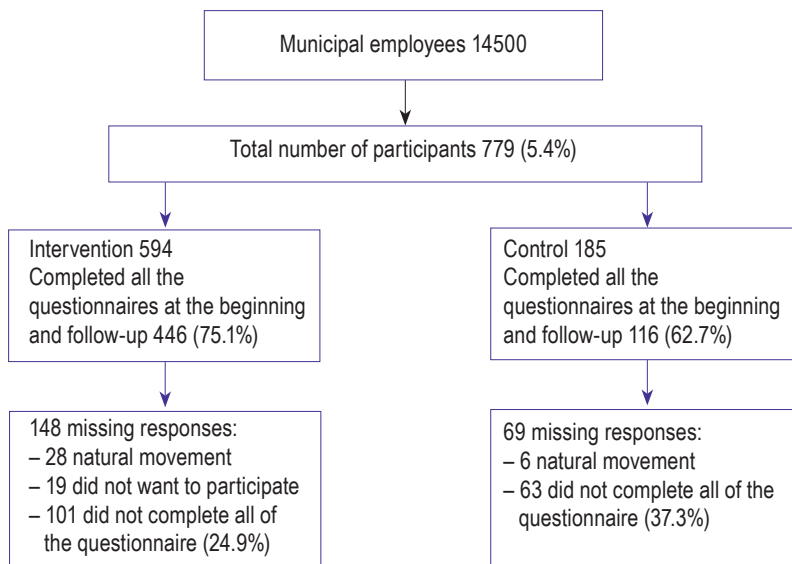


Figure 4. Participants in the study and missing data

4.3 Intervention programme

The intervention contained information to support prevention and well-being at work. The chosen topics are generally considered to be significantly linked to health and well-being at work (Brown et al. 2011; Chase & Conn 2013; Conn et al. 2009; Malik et al. 2014; To et al. 2013). The intervention session programme is outlined in Figure 5.

The multidisciplinary occupational healthcare team, who guided the intervention, were familiar with the workplace, its exposures and specific occupational factors. The team included physiotherapists, a physician, a psychologist and a nurse. The rehabilitation allowance applications were filled out during the intervention day to make sure everybody had completed them properly.

1. Intervention day	Medical examination for 4 persons, and ergometer tests for the same 4 persons. The other 8 group members have a workout session. Each member of the group defines their own aims for the next 2 weeks and across the entire process. Muscular tests in groups as first measurement.
2. Intervention day	Medical examination for 4 persons and ergometer tests for the same 4 persons. The other 8 group members are in gym training. Discussion and theory regarding motivation. Group activities as homework: muscle strength exercises and stretching exercises.
3. Intervention day	Medical examination for 4 persons and ergometer tests for the same 4 persons. The other 8 group members are in gym training. Theory of muscular strength training: weights and repetitions.
4. Intervention day	Theoretical background on aerobic training, and medical lecture on the function of the cardiovascular system. Individual bicycle ergometer test results applied for planning of practical aerobic training: Nordic walking with heart rate monitoring. Limits for basic endurance training and maximum endurance training are set to provide experience of how it feels to practise basic endurance at your own heart rate level.
5. Intervention day	The basis of a healthy diet. Theory and exercises on physical ergonomics. Discussion of work-related issues. Group activities: aerobic exercise.
6. Intervention day	The basis of a healthy diet. Discussion of work-related issues. Group activities: importance of water aerobics and water running – theory and practical training.
7. Intervention day	Theory of the importance of adequate sleep. Group activities: stretching and relaxation theory, and relaxation training.
8. Intervention day	Group activities: dance exercises, balance and coordination training. Supervisors visit the group.

Follow-up group, 9 months from start, 3 hours.

Figure 5. The eight-day intervention programme

A workplace survey had been carried out, and the occupational healthcare team provided ongoing cooperation with supervisors and employees. This specialism in occupational healthcare provided an opportunity for the intervention to look at work and changes in it. Participants were taught to discuss their work and its changes with supervisors, and to be active in work-related discussions with their supervisors. Under the aegis of the group it was important to avoid judgement and persuasion. The participants were instructed to talk about their own needs and opportunities for change, and their own behavioural follow-up in everyday life. The process was supported with the use of participants' test results and the setting of concrete goals, follow-up and feedback. All participants set up their own goals concerning health, work or working ways and exercise areas. Support for occupational healthcare also continued after the intervention.

4.4 Study measures and data collection

The primary measurement tools used in this study were the Work Ability Index (WAI), Health-Related Quality of Life (RAND 36), the Bergen Burnout Inventory (BBI15) and the Utrecht Work Engagement Scale (UWES). The intervention and control groups who answered these questionnaires were from the same work unit. Only the intervention group participated in the physical capacity tests, and these results were compared with the participants' own results before and after the intervention. All measurements were taken at baseline in the information session; the intervention group completed the measurements at the follow-up test meeting, and the same measurements were taken for the control group at the same time.

The questionnaires were distributed to study participants in autumn 2011 and autumn 2014. The participants could fill in the questionnaires during their working hours. Each question, including personal information such as name and social security number, was numbered. The questionnaires were saved in folders, and the folders were archived according to healthcare requirements. The data was stored in password-protected Excel files (Fenton et al. 2014), with personal information removed, for statistical tests.

4.4.1 Background variables

All study participants (Studies I–IV) gave responses to questions about basic information: age, gender, basic education, vocational training (workplace training, vocational school, lower polytechnic, higher university of applied sciences, lower university, higher university, degree, doctorate, none), marital status, smoking status, estimated physical activity, medication, occupation, number of years worked in that occupation, whether the work is essentially mental or physical, and number of current illnesses diagnosed by a doctor. Basic information such as weight, height and waist measurements taken at the physical

test meeting are reported in Study I. Responses to stress, depression and anxiety-screening questions are reported in Study IV.

4.4.2 Physical capacity (Study I)

Functional tests include the results of standing-on-one-foot tests, back/side bend flexibility tests, squatting tests, dynamic sit-up test (Fenton et al. 2014)s, grip strength tests and right upper extremity tests. Functional tests were done at first time by physiotherapists group advice and at follow up participants was tested individually by physiotherapists.

Maximal oxygen intake (VO_{2max}) was estimated by sub-maximal cardiovascular endurance tests with a bicycle ergometer (Ergoline® 100K-ERG 161105, Bitz, Germany; accuracy under directive DIN VDE 0750-0238). The test results were analysed with a commercial software program (Aino Health Management, Fit Ware Pro®, Helsinki, Finland). Maximal oxygen consumption was compared with reference values based on age and gender. Physiotherapists who had good experience of physical testing performed the functional and VO_{2max} tests, with written guidance.

4.4.3 Work Ability Index (Study II)

The Work Ability Index (WAI) was used to estimate perceived work ability.

The WAI score could range from seven to 49 (poor to excellent). The total WAI score comprised the sum of seven items (Ilmarinen 2001; Tuomi et al. 1997):

1. Current work ability in relation to lifetime best, scale zero to 10, one question
2. Work ability in relation to demands of the job, scale two to 10 (weighted according to the nature of the work), two questions
3. Number of current diseases diagnosed by a physician, scale one to seven (at least five diseases = one point, one disease = five points, no disease = seven points), list of 51 diseases
4. Estimation of work impairment caused by disease, scale one to six, one question
5. Self-reported sickness absence during the past 12 months, scale one to five, one question
6. Personal prognosis of work ability after two years, scale one to four or seven, one question
7. Mental resources, scale one to four, three questions

4.4.4 Health-related quality of life (Study III)

The RAND 36 survey on health-related quality of life is the best-known health-generic indicator of quality of life (Hays et al. 1993).

The RAND 36 score can range from zero to 100 and is a percentage of total possible scores achieved. The higher the score, the better the result.

This 36-item survey encompasses eight concepts: physical functioning, bodily pain, role limitations due to physical health problems, role limitations due to personal or emotional problems, emotional well-being, social functioning, energy and fatigue, and general health perceptions. It also includes a single item that provides an indication of perceived changes in health (Van der Zee et al. 1996). Missing data is not considered when calculating the scale scores.

The total RAND 36 score comprises the sum of the eight scale scores (Hays et al. 1993):

1. Physical functioning, items three to 12
2. Role limitations due to physical health, items 13 to 16
3. Role limitations due to emotional problems, items 17 to 19
4. Energy and fatigue, items 23, 27, 29 and 31
5. Emotional well-being, items 24 to 26, 28 and 30
6. Social functioning, items 20 and 32
7. Pain, items 21 and 22
8. General health, items one and 33 to 36

The Swedish RAND 36's reliability and responsiveness have recently been tested (Orwelius et al. 2017). Pekkonen et al. (2008) found associations between work ability, health-related quality of life, physical activity and fitness among middle-aged men in rehabilitation context. The health-related quality of life RAND 36 is based on the WHO's ICF model.

4.4.5 Bergen Burnout Inventory (Study IV)

The Bergen Burnout Inventory (BBI15) is a short measure for burnout (Feldt et al. 2014). The percentiles for age and gender are presented in the manual: zero to 74 indicates no burnout, 75 to 84 indicates slight burnout, 85 to 94 indicates moderate burnout, and 95 to 100 indicates serious burnout. In this study we consider only the total sum of BBI15 and its subdimensions.

4.4.6 Work engagement scale (Study IV)

The Utrecht Work Engagement Scale (UWES-9) was developed by Schaufeli and Bakker in the Netherlands (Schaufeli et al. 2002; Schaufeli et al. 2006; Schaufeli et al. 2009). The UWES method was developed primarily for research purposes. The nine-item UWES-

9 has been found to have good construct validity and has been recommended in future research, although work engagement seems to be a highly stable indicator of occupational well-being environment (Seppälä et al. 2009; Salanova & Schaufeli 2008). UWES-9's three scale scores have good internal consistency and test-retest reliability. The UWES score mean can range from zero to six (poor to excellent), and it is possible to compare average values with obtained reference data.

There are no limit values for work engagement. The Finnish manual has set norms that are based on a total of more than 16,000 Finnish employees. The manual presents standard values, averages and distribution data on the generality of work engagement in several occupational categories (Hakanen 2009a).

4.4.7 Statistical analyses

The functional and aerobic test results and background statistics are analysed by frequency. Paired t-tests measure the differences between before and after the intervention when observations have been obtained in pairs (Fenton et al. 2014). The difference between the paired values is assumed to be normally distributed. Results are presented as mean and standard deviation (SD); p-values less than 0.05 are considered significant. Wilcoxon signed-ranks tests have been used if the parametric test is not suitable and distribution is skewed. Categorical dependent variables with two categories (yes or no) are reported and analysed with the McNemar test. Gender and age-based formulae were made by syntax to perform correlations tests on VO₂max before and after the intervention in order to estimate the results of the intervention, with special attention to those who increased their VO₂max results during the intervention. Data is analysed with SPSS 20 software (SPSS Inc., Chicago, Illinois, USA).

Studies II–IV report well-known measurements, and this data is analysed according to guidelines for WAI, RAND 36, BBI₁₅ and UWES-9. Differences between the groups at baseline and follow-up are tested with the Mann-Whitney U test or chi-square test for categorical variables. Baseline is compared with the nine-month follow-up within the groups by the Wilcoxon signed-ranks test. Changes between intervention and control groups are tested by analysing variance for repeated measurements. P-values of less than 0.05 are considered statistically significant and not any Bonferroni adjustment has been used. Data is analysed using SPSS 23.0 software (SPSS Inc., Chicago, Illinois, USA).

5 Results

5.1 Physical capacity (Study I)

Physical capacity was tested for about 60% of a total of 588 participants. The largest participation for women came from health services (28.1%) and for men from construction work (25.2%). Across the nine months of the rehabilitation programme, the tested employees' physical capacity clearly improved by the follow-up (Table 3). A statistically significant improvement was seen in all but three tests.

A total of 429 subjects participated in the sub-maximal cycle test at the baseline, and 360 at the follow-up. The majority of these, 305 persons, increased their VO₂max result from the initial result (Figure 6).

The estimated VO₂max increased significantly on average from the first test (VO₂max = 31.0 ± 6.0 millilitres per kilo per minute) to the nine-month follow-up (VO₂max = 31.6 ± 6.4 millilitres per kilo per minute) (p < 0.001). A total of 245 participants could not take part in the follow-up sub-maximal cycle test. Their main reasons for absence were: their physician ruled out the test for health reasons, they had elevated blood pressure and/or cardiac symptoms, they did not attend the follow-up test, or the tests were interrupted for health reasons (Table 4).

There were no statistically significant differences in background characteristics (age, gender, current smoking status, plasma total cholesterol level, BMI, physical exercise of 30 minutes per week) among the study subjects who were included in the physical testing and those who were excluded from the physical testing.

For women, the health-conscious oxygen uptake level is 28 millilitres per kilo per minute (Kodama et al. 2009). At the baseline 231 women were below this threshold, and at the follow-up 111 (p = 0.004, paired t-test).

For men, the health-conscious VO₂max level is 32 millilitres per kilo per minute. At the baseline 37 men were below this threshold, and at the follow-up 24 (p=0.000, paired t-test). These values are estimated from Kodama et al.'s MET values (Kodama et al. 2009).

Table 3. Test results on the physical parameters of the reference divided by the sexes at baseline and follow-up for the nine-month rehabilitation programme

Female		Baseline	Follow-up	
	N	Mean (SD)	Mean (SD)	p*
Standing on one foot (seconds)	306	50 (17)	52 (16)	.009
Back/side bend flexibility (centimetres)	294	18 (3)	19 (3)	<0.001
Grip strength (kilos)	305	34 (6)	34 (6)	.111
Squatting (repetitions)	292	19 (5)	21 (11)	.004
	N	Median (Q1-Q3)	Median (Q1-Q3)	p*
Dynamic sit-up (repetitions)	293	15 (8-22)	16 (16-25)	<0.000
Right upper extremity (repetitions)	293	25 (20-32)	25 (19-32)	.690
Left upper extremity (repetitions)	290	21 (16-30)	22 (17-29)	.009
Male		Baseline	Follow-up	
	N	Mean (SD)	Mean (SD)	p*
Standing on one foot (seconds)	71	52 (16)	56 (12)	.016
Back/side bend flexibility (centimetres)	72	19 (4)	20 (4)	<0.001
Grip strength (kilos)	73	55 (10)	56 (10)	.198
Squatting (repetitions)	70	22 (5)	24 (4)	.001
	(Fenton et al. 2014)	(Fenton et al. 2014)	(Fenton et al. 2014)	(Fenton et al. 2014)
Dynamic sit-up (repetitions)	69	20 (16-50)	25 (20-31)	.001
Right upper extremity (repetitions)	70	20 (15-25)	21 (17-27)	.004
Left upper extremity (repetitions)	70	19 (15-24)	20 (15-26)	.005

Table 4. Total number of subjects not participating in physical tests and the main reasons for absence

Reasons for missing physical tests	N=245	%
The physician denied the test for health reasons	64	26.1
Elevated blood pressure and/or cardiac symptoms	45	18.4
Acute or chronic disease	27	11
Did not attend the follow-up test	27	11
Sent for further examination e.g. clinical exercise test	24	9.8
Musculoskeletal pain	16	6.54
Tests were interrupted by health safety reasons	15	6.1
Suspended the rehabilitation not by healthy reasons	15	6.1
Tested by different method (fire department)	12	5

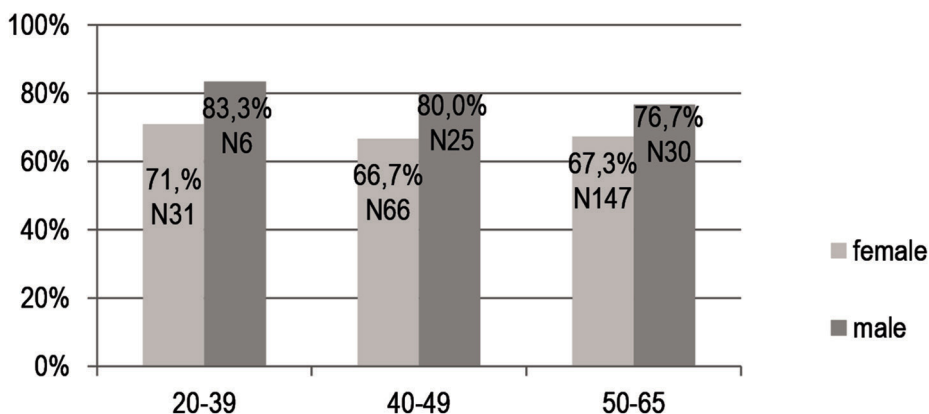


Figure 6. Percentages and numbers of women and men in different age groups who improved their VO₂max score during the nine-month intervention

5.2 Perceived work ability (Study II)

Baseline and follow-up values for work ability-related factors and the total WAI for the intervention and control groups are shown in Table 5. At the beginning, there was a significant difference between the two groups in total WAI, where the intervention group had statistically lower WAI (36.98) compared to the control group (37.79)

The work ability-related factors that contributed the most to the increase in WAI in the intervention group were work ability relative to lifetime best, work ability in terms of the demands of work, and psychological well-being. In the control group, a decreased item in WAI was belief in one's own work ability after two years (Table 6). Both groups were in WAI category of "good" (37–43 points) at the follow-up. The change in direction in total WAI scores at baseline and follow-up is shown in Figure 7.

Table 5. WAI and its sub-scores at baseline and follow-up, and within-group and between-group changes in intervention and control groups after nine months compared with baseline

	Intervention group n=389, control group n=110	Mean at baseline	SD	Mean at follow-up	SD	Change from baseline	P-value	Difference in changes between groups
Work Ability Index (WAI)								
WAI (7-49)	Intervention	36.9	5.3	38.2	5.7	1.2	<.001	<.001
	Control	37.6	5.8	36.7	6.7	-0.6	.046	
Work ability relative to lifetime best (1-10)	Intervention	7.7	1.3	8.0	1.4	0.3	<.001	.003
	Control	7.9	1.1	7.7	1.6	-0.2	.168	
Work ability in terms of the demands of work (2-10)	Intervention	7.5	1.3	7.9	1.3	0.4	<.001	.024
	Control	7.5	1.3	7.6	1.4	0.1	.459	
Diagnosed diseases (1-7: 1 = at least 5 diseases, 5 = 1 disease, 7 = none)	Intervention	3.6	2.0	3.7	2.0	0.1	.482	.976
	Control	3.8	1.9	3.9	2.0	0.1	.367	
Work impairment (1-6)	Intervention	4.8	1.0	4.9	1.0	0.2	.003	.015
	Control	4.7	1.0	4.6	1.1	-0.1	.192	
Sickness absence (1-5: 1 = >100 days, 4 = max. 9 days, 5 = none)	Intervention	3.7	0.9	3.8	0.9	0.1	.004	<.001
	Control	3.9	0.9	3.6	1.0	-0.2	.006	
Belief in own work ability after 2 years (1-7)	Intervention	6.4	1.3	6.5	1.3	0.1	.035	<.001
	Control	6.6	1.1	6.0	1.6	-0.6	.001	
Psychological well-being (total of 3 questions, 1-4)	Intervention	3.2	0.7	3.3	0.7	0.1	.004	.054
	Control	3.2	0.8	3.2	0.8	0.1	.558	

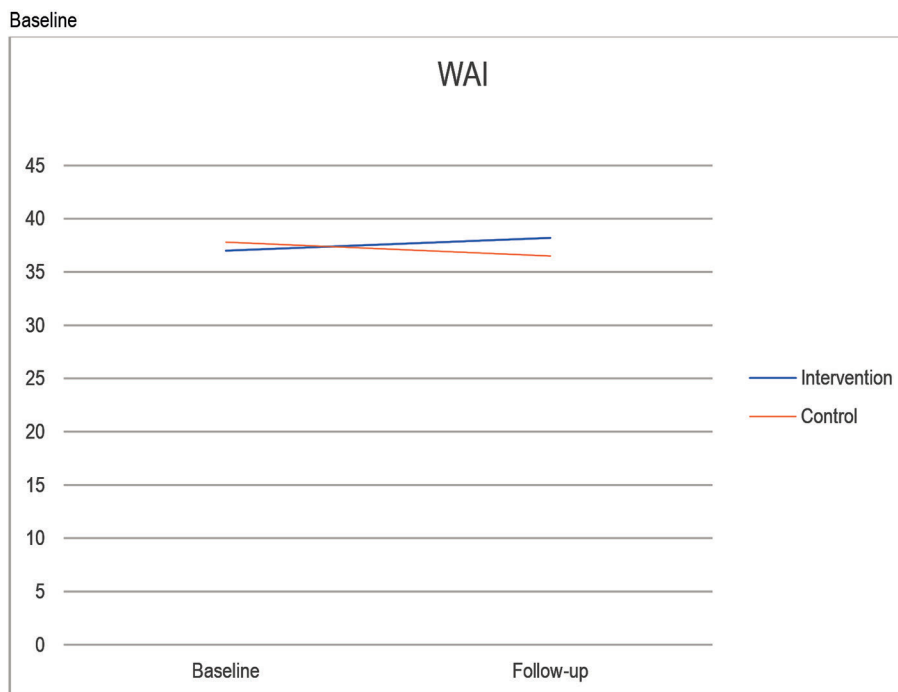


Figure 7. Total WAI at baseline and follow-up in the intervention and control groups

5.3 Health-related quality of life (Study III)

The total RAND 36 values in the intervention group were 76.1 (SD 14.4) at baseline and 80.0 (SD 14.2) at follow-up ($p < 0.001$). The values for the control group were 74.8 (SD 16.6) at baseline and 75.4 (SD 18.4) at follow-up ($p = 0.592$) (Figure 7). The difference in changes between groups was significant ($p = 0.015$). The change in direction in total RAND 36 scores at baseline and follow-up is shown in Figure 8, physical functioning in Figure 9 and psychosocial functioning in Figure 10.

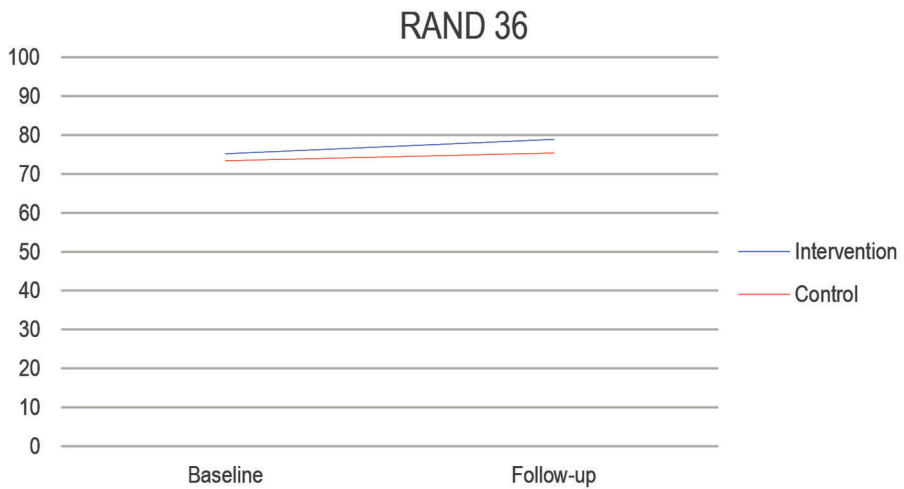


Figure 8. Intervention and control groups at baseline and post-intervention, RAND 36 totals. The physical functioning in the intervention group was 75.2 at baseline 78.9 at follow-up ($p < 0.001$); in the control group it was 73.4 at baseline and 75.4 at follow-up ($p = 0.205$) (Figure 8). The difference in changes between the groups was not statistically significant ($p = 0.290$) (Table 5)

Table 6. Physical functioning and its sub-scores at baseline and follow-up, and within-group and between-group changes in intervention and control groups after nine months, compared with baseline

RAND 36: physical functioning		Intervention group n=388, control group n=110		Baseline		Follow-up		Change from baseline	P-value	Difference in changes in between groups
		Mean	SD	Mean	SD	Mean	SD			
Physical functioning (4 items)	Intervention	75.2	17	78.9	17	3.7			<.001	.290
	Control	73.4	20	75.4	19	2			.205	
Physical functioning (10 items)	Intervention	86.6	14	88.9	13	2.3			<.001	.108
	Control	86.9	13	87.7	13	0.8			.318	
Role functioning/physical (4 items)	Intervention	79.5	30	83	30	3.5			.045	.937
	Control	71.4	39	75.7	34	4.3			.272	
Bodily pain (2 items)	Intervention	68.9	23	72.7	23	3.9			.001	.040
	Control	68.1	24	69.8	23	1.7			.439	
General health perceptions (5 items)	Intervention	65.9	18	71	18	5.1			<.001	.027
	Control	67.3	19	68.3	20	1			.469	

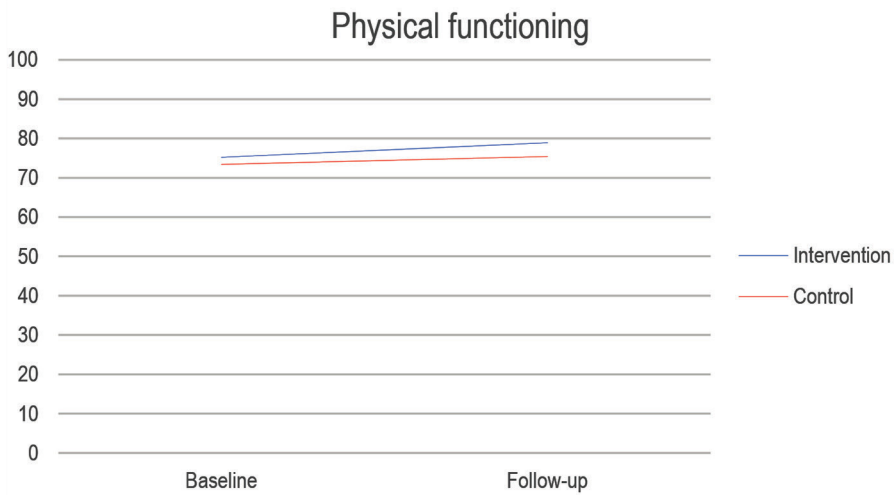


Figure 9. Intervention and control groups at baseline and post-intervention, physical functioning

Psychosocial functioning in the intervention group was 76.9 at baseline and 81.1 at the follow-up ($p < 0.001$); in the control group it was 76.2 at baseline and 75.5 at follow-up ($p = 0.679$) (Figure 9). During the intervention the intervention group made a statistically significant change in the condition of psychosocial functioning that was not found in the controls, and the difference in changes between the groups was statistically significant ($p = 0.002$) (Table 7).

Table 7. Psychosocial functioning and its sub-scores at baseline and follow-up, and within-group and between-group changes in intervention and control groups after nine months, compared with baseline

RAND 36: psychosocial functioning		Intervention group n=388, control group n=110		Baseline		Follow-up		Change from baseline	P-value	Difference in changes between groups
				Mean	SD	Mean	SD			
Psychosocial functioning (EWB+RE+SF+EF)	Intervention			76.9	17	81.1	16	4.2	<.001	.002
	Control			76.2	18	75.5	23	-0.64	.679	
Emotional well-being (EWB) (5 items)	Intervention			76.7	16	79.3	15	2.6	.001	.053
	Control			77.2	15	75.6	19	-1.68	.219	
Role functioning/emotional (RE) (3 items)	Intervention			85.1	28	89.4	25	4.3	.003	.224
	Control			80.9	31	82.1	34	1.2	.668	
Social functioning (SF) (2 items)	Intervention			82.1	21	86.6	19	4.6	<.001	.032
	Control			81.9	21	81	24	-0.91	.612	
Energy and fatigue (EF) (4 items)	Intervention			63.9	18	69.1	18	5.2	<.001	.053
	Control			64.6	20	63.4	22	-1.68	.219	

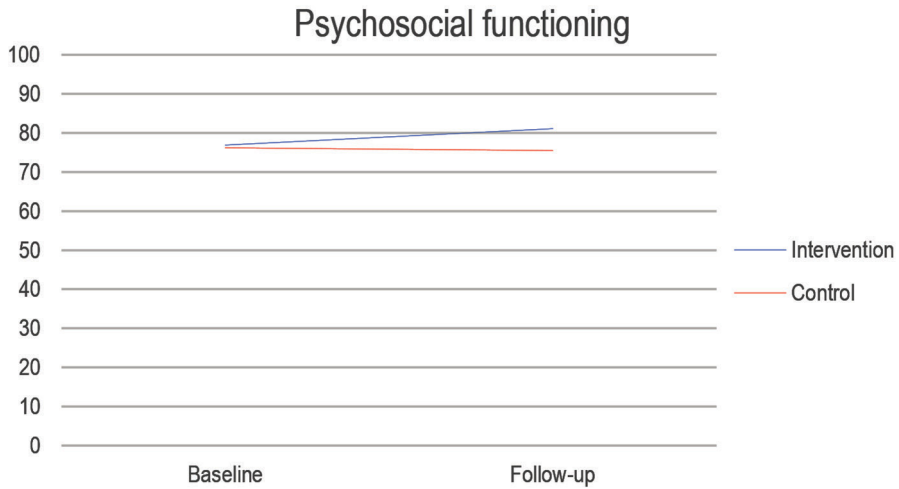


Figure 10. Intervention and control groups at baseline and post-intervention, psychosocial functioning

5.4 Psychosocial well-being (Study IV)

Total BBI₁₅ values for the intervention group were 36.9 (SD 11.8) at baseline and 33.9 (SD 12.3) at follow-up. The change from baseline was -3.0 ($p < 0.001$). Values for the control group were 37.6 (SD 12.2) at baseline and 37.5 (SD 14.4) at follow-up (Figure 10). The change from baseline was 0.1 ($p = 0.912$). The difference in changes between groups was statistically significant ($p = 0.023$) (Table 6).

In the intervention group, the total BBI₁₅ score ($p < 0.01$) and each of the three subdimensions of burnout (exhaustion, cynicism and sense of inadequacy) decreased at follow-up. There was no corresponding decrease in BBI₁₅ scores for the control group. The difference in changes between groups in BBI₁₅ sub-scores was statistically significant for exhaustion, but not for cynicism or sense of inadequacy (Table 8). The direction of the change of the total BBI₁₅ score is shown in Figure 11.

Table 8. Intervention and control groups at baseline and follow-up on BBI15 totals and items

BBI15	Intervention group n=425, control group n=109	Baseline		Follow-up		Change from baseline	P-value	Difference in changes between groups
		Mean	SD	Mean	SD			
Total BBI15	Intervention	36.9	11.8	33.9	12.3	-3	<.001	.023
	Control	37.6	12.2	37.5	14.4	0.1	.912	
Exhaustion (5 items)	Intervention	13.2	4.8	12.1	5.2	-1.1	<.001	<.001
	Control	12.9	4.6	13.1	5.3	0.2	.477	
Cynicism (5 items)	Intervention	10.6	4	10	4	-0.6	<.001	.927
	Control	11.2	4.2	11	5.1	0.2	.622	
Sense of inadequacy (5 items)	Intervention	13.1	4.8	11.8	4.9	-1.3	<.001	.016
	Control	13.6	4.9	13.4	5.5	0.2	0.68	

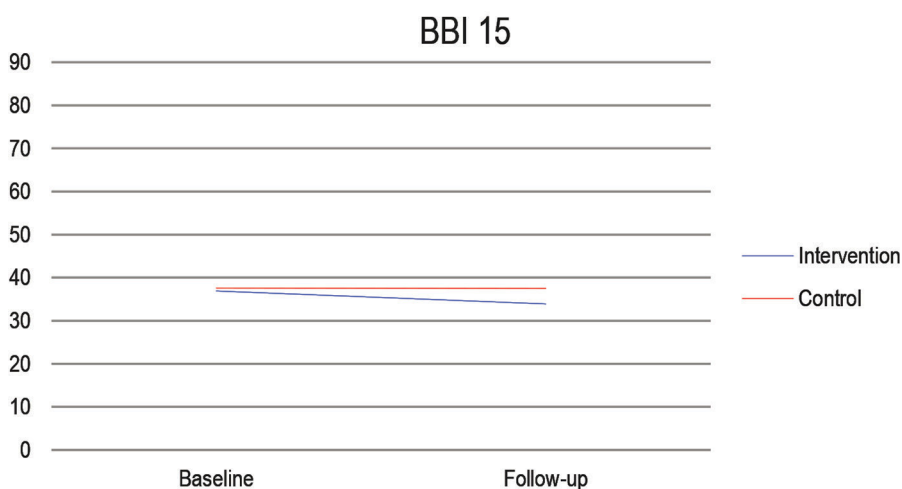


Figure 11. Intervention and control groups at baseline and post-intervention, BBI15

Total UWES-9 values for the intervention group were 4.3 (SD 1.1) at baseline and 4.5 (SD 1.1) at follow-up ($p < 0.001$). Values for the control group were 4.2 (SD 1.0) at baseline and 4.4 (SD 1.1) at follow-up ($p = 0.142$) (Table 11).

There was no difference in changes between the groups ($p = 0.711$) all through the change p-value was significant in the intervention group ($n = 446$) comparing to controls ($n = 116$). The total UWES-9 score and all three of its dimensions of work engagement improved in

the intervention group ($p < 0.001$). There was also a similar improvement in total UWES and two of its dimensions (vigour and absorption) compared with the control group. It can be possible that questionnaire can achieve some positive change. However, there were no statistically significant differences in the changes from baseline to follow-up between the groups because of the size of the groups (Table 9). The direction of change of the total UWES-9 scores is shown in Figure 12.

Table 9. Intervention and control groups at baseline and follow-up on UWES totals and items

UWES-9	Intervention group n=446, control group n=116	Baseline		Follow-up		Change from baseline	P-value	Difference in changes between groups
		Mean	SD	Mean	SD			
Total UWES-9	Intervention	4.3	1.1	4.5	1.1	0.2	<.001	.711
	Control	4.2	1	4.4	1.1	0.2	.142	
Vigour (3 items)	Intervention	4.3	1	4.5	1	0.2	<.001	.555
	Control	4.2	1	4.4	1	0.2	.154	
Dedication (3 items)	Intervention	4.4	1.1	4.6	1.1	0.2	<.001	.919
	Control	4.4	1.1	4.5	1.1	0.1	.054	
Absorption (3 items)	Intervention	4.1	1.1	4.3	1.1	0.2	<.001	.659
	Control	4.1	1	4.3	1.1	0.2	.232	

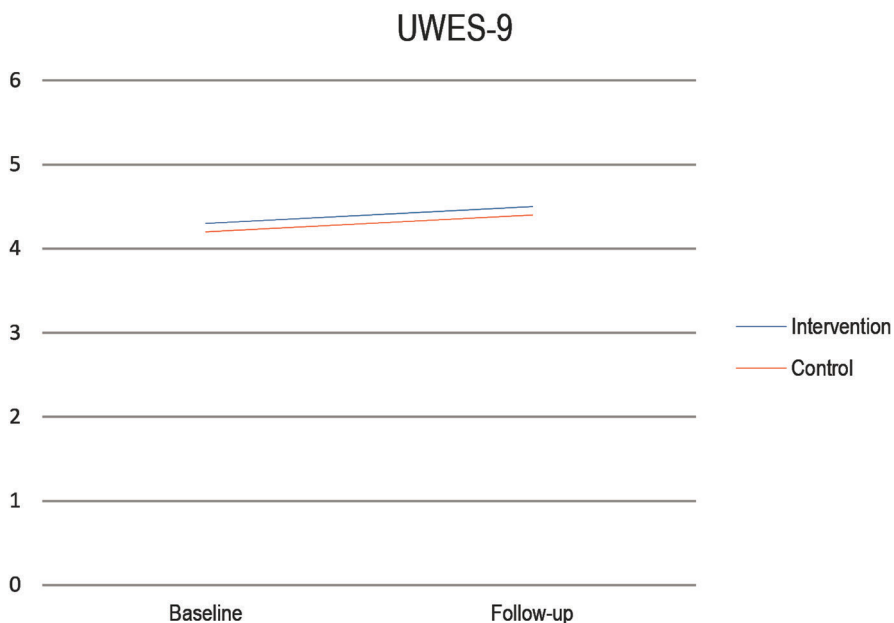


Figure 12. Intervention and control groups at baseline and follow-up, UWES-9

6 Discussion

The aim of this study was to investigate how the new model of early rehabilitation intervention impacts on participants' work ability and well-being.

The current rehabilitation system in Finland ended in 2015 with VOMR, organized by KELA. Our intervention is an option. It has a low threshold and does not require a medical certificate or overnight stay. The service is carried out close to work and home, and it is possible to continue the new habits that have been learned after the intervention. This might help to continue the lifechange.

The question of how to maintain work ability is being discussed in many companies. Increasing work rates and changes in work have raised new challenges. Employees and employers need to work together to find solutions to work-related challenges. Health-related phenomena are often the first symptoms of weakening work ability. In these situations, it is good to recognize the need for wider work ability support. An initial response and an understanding of the changes occurring at work are an effective way to maintain work ability. This will support remaining work ability, reduce risk factors for health, and develop work.

An early intervention can be workable means of maintaining work ability and well-being. Our goal was that by participation into this intervention employees would feel that their lives and work were meaningful and would have tools to help them cope. Supervisors were invited to hear what had been achieved during the intervention. The rehabilitation was supported by KELA's rehabilitation allowance; other costs of the rehabilitation were paid by the employer. Long sickness absence and early retirement have characterized the municipal sector. To prevent these, we need to find innovative ways to support work ability and coping at work. Changes in the labour market require adaptation from employees and new capabilities such as skills and knowledge acquisition. An increased workload can lead to a cycle of illness, and stress-related diseases have increased (Mäntyniemi et al. 2012). Employees with low work ability have a risk of long-term sickness absence and early retirement. It is important that early actions are targeted at at-risk employees to improve

their health and promote their work ability. The commonest causes of decreased work ability are well known, and the aim is to develop services to prevent these phenomena. Work and work ability are changing. Sophisticated estimations have been made for future work and related competences, identifying skills, knowledge and abilities (Bakhshi 2017). The Finnish rehabilitation has also find out updated content in part of the early services for working-age population. This intervention offers the option to learn skills to take care of and promote of one's own work ability and well-being which one can also use in later life.

6.1 Interpretation of the results

6.1.1 Physical capacity (Study I)

In our study, at the nine-month follow-up to the rehabilitation programme, the physical capacity of the intervention group had clearly improved. For example, the mean female value on the back/side bend flexibility test was 18 centimetres, close to the gender and age average. The mean male value was 18.9, also close to the gender and age average. Dynamic balance is an important measure of postural stability that provides valuable information about the balance of injured populations (Pohjonen 2001). Poor results in back-bending are related to back dysfunction, and are a risk factor for impaired work ability due to physically burdensome homecare work (Pohjonen 2001; Suni et al. 1998; Tuomi et al. 1997). Mean grip strength values of 33.9 kilos and 55 kilos were also average for both genders. According to a systematic review, low grip strength is associated with a greater likelihood of premature mortality, the development of disability, and an increased risk of complications or prolonged stay after hospitalization or surgery (Bohannon 2008). The female mean value for squatting (repeat) of 18.8 and the male mean of 21.6 were close to the average. Dynamic sit-up (repeat) result means were also strongly average for both genders. Poor results among housekeepers on a 30-second abdominal muscle test increased the risk of poor WAI in a five-year follow-up (Pohjonen 2001). Mean right upper extremity scores of 25 repetitions for women and 20 for men were strongly average. Left upper extremity scores were weaker, as is often the case with the non-dominant extremity. Shoulder strength and exercises can be a principal factor in the performance of reaching and pulling tasks (Daly et al. 2013).

Scores on the sub-maximal cycle test increased significantly from the first test in all age groups, and both genders increased their VO₂max result from the initial result (53% for both females and males). The test results were compared with the individual's previous results. The intervention group included participants whose VO₂max was already at a satisfactory level at the baseline; there was remarkable improvement in some individual results.

Cardiorespiratory fitness is a quantitative predictor of all-cause mortality and cardiovascular events in healthy men and women, according to Kodama et al. (2009). Maximal oxygen intake values are evaluated according to age and gender, although

different tasks and hobbies requires different VO₂max values. Higher all-cause mortality and cardiovascular events among healthy women are associated with estimated VO₂max scores below 28 millilitres per kilo per minute. At the beginning of the intervention, 50% of women were below this threshold; at the end of the intervention it was 24%. For men, a healthy VO₂max result is 32 millilitres per kilo per minute. At the beginning of the rehabilitation programme, 32% of the men were below this threshold; at the end of the intervention it was 21%. (Kodama et al. 2009).

The promotion of health-related physical activity has become a valuable tool for promoting public health and maintaining work ability and functional capabilities. Aerobic exercise and fitness benefits cardiovascular and metabolic health. The enhancement of motor and musculoskeletal fitness maintains functional capability, may prevent falls and reduce the risk of osteoporotic fractures among the elderly, and decreases the burden of back-related disability among the working-age population (Griffiths et al. 2014; Hamberg-van Reenen et al. 2006; Husu & Suni 2012; Kettunen et al. 2014; Sörensen et al. 2008; Suni et al. 1998) and One meta-analysis concluded that some workplace physical activity interventions can improve both health and important workplace outcomes (Conn et al. 2009). Physical capacity has been found to be associated with low back, neck or shoulder pain in the working population (Hamberg-van Reenen et al. 2006).

One review of interventions to increase physical activity, which included behavioural strategies over cognitive strategies, found that face-to-face interventions were rather better than interventions by telephone or mail, as was targeting individuals instead of communities (Brown et al. 2011; Conn et al. 2011).

6.1.2 Work ability (Study II)

The total WAI score increased significantly in the intervention group, while in the control group it decreased during the same follow-up period. This might indicate that this was the right time to start the intervention, because there was a decrease in WAI in the control group. The total WAI score of 36.9 was moderate (37–40 points) (Ilmarinen et al. 1997) at baseline in the intervention group and good at 38.2 at follow-up; in the control group it was good (37.3) at baseline and moderate (36.7) at follow-up.

The subjective assessment of current work ability compared with lifetime best and total WAI moved in the same direction, and this was also found in another study (El Fassi et al. 2013). Decreases in WAI score may predict sickness absence for mental for other illnesses (Ohta et al. 2017). This suggests that highly intensive measures such as rehabilitation are also necessary for those with excellent WAI scores. Work ability should be maintained through preventive measures such as recreational sports. (Schwarze et al. 2016.) It might be good to consider early rehabilitation when the WAI score is merely moderate. The intervention group had statistically lower WAI scores compared with the control group at baseline (Figure 7). At follow-up the intervention group's WAI scores increased significantly, while

in the control group there was an insignificant trend towards decrease. The change in total WAI was statistically significant between the intervention and control groups.

6.1.3 Health-related quality of life (Study III)

Our study reported positive outcomes of a cognitive behavioural intervention programme to improve employees' health-related quality of life. There was a statistically significant increase in RAND 36 and, and this was not found in the control group. Some dimensions of RAND 36 decreased in the control group, such as physical functioning, energy and fatigue, emotional well-being and social functioning. The same phenomenon was also found with the Work Ability Index. The change between groups was statistically significant for the psychosocial functioning index value, which decreased in the control group.

Finnish population values have been reported by age and gender. After the intervention, our intervention group had increased their RAND 36 results over average Finnish values, except on scores for bodily pain (Aalto et al. 1999). The quality of life among our intervention group compared with the average values of the working-age Finnish population (Aalto et al. 1999) was lower at baseline and follow-up for all items except emotional well-being and role functioning/emotional. Role functioning/physical increased in the follow-up.

Pekkonen (2010) has examined if the RAND-36 is usability measurement in defining the problem profile and monitoring the effectiveness in the working age rehabilitation in Finnish population. The moderate strong correlation between the RAND-36 and the WAI showed that they partially measured the same phenomenon. Pekkonen (2010) also reported RAND 36 results for an early rehabilitation programme, a symptom group, a physically orientated group, a psychosocial group, a multiple-problem group and an early rehabilitation group. The early rehabilitation participants were very much like our intervention group, as presented in the last column of Table 8. When we compare the magnitude of change in the early rehabilitation intervention with our own early rehabilitation, we find that all items increased more in our intervention, but physical functioning was very similar (Table 10). (Pekkonen 2010). RAND 36 has a stronger connection to well-being than to work ability and does not separate disease from an individual's personal characteristics or social context (Sörensen et al. 2008).

Table 10. Health-related quality of life values at follow-up subtracted from baseline value, differences in change tested by t-test (Pekkonen 2010)

Different rehabilitation groups	Symptoms	Physical	Psychosocial	Multiple problems	Early rehab.	Our study, intervention group
General health perceptions	6.79*	5.08*	1.46	10.42*	3.53*	4.2*
Bodily pain	6.23*	17.83*	2.93	7.75*	1.92	3.8*
Physical functioning	4.64*	12.07*	3.73*	3.99	2.33*	2.3*
Role functioning/ physical	14.91*	33.33*	2.44	16.81*	-3.57*	3.5*
Emotional well-being	3.37*	6.43	12.22*	16.14*	0.12	2.6*
Social functioning	2.25	5.42	16.16*	30.08*	-0.62	4.5*
Role functioning/ emotional	3.91	31.11*	45.53*	36.72*	-3.79*	4.3*
Energy and fatigue	7.27*	7.33*	17.07*	22.6*	1.57	5.2*

* Paired samples test <0.05.

6.1.4 Psychosocial well-being (Study IV)

The principal finding of this part of the study was a statistically significant improvement in several measures of psychosocial well-being (BBI₁₅ and UWES-9) for participants who completed the cognitive behavioural intervention programme.

Burnout is connected to job demands, a lack of job resources, and health problems. When intervention leads to positive changes in participants' physical condition or work environment, participants have been shown to be able to modify their self-perceptions, resulting in psychological and behavioural changes such as increased self-approval, self-mercy, and recognition of their inner needs and limits. (Gilbody et al. 2007.)

Research suggests that job resources influence future work engagement, which in turn may predict organizational commitment, whereas job demands predict burnout over time, which in turn predicts future depression. On the other hand, home demands and home resources do not influence the motivational or health impairment process over time. These results indicate that work characteristics play a significant role in health and well-being. (Hakanen et al. 2008.)

The practical point of intervention is to be aware of the differences in profiles among employees, and to adjust their work and leisure-time demands. In this regard it is important to create interventions to support work cultures for diverse ways of working, because there is no single optimal way to manage boundaries between work and leisure. Person-oriented

interventions that are tailored to support these different profiles are needed. (Kinnunen et al. 2015; Mäkikangas & Kinnunen 2016.)

All three dimensions of work engagement (UWES-9) improved in the intervention group: vigour, dedication and absorption. In the control group, there were corresponding improvements in two dimensions and in the total UWES-9. There were no differences in the changes from baseline to follow-up between the intervention and control groups.

According to the Finnish Institute of Occupational Health's reference data (n=16,335), the mean total value for UWES-9 is 4.26 (1.36), and the values for its separate dimensions are as follows: vigour 4.38 (1.37), dedication 4.37 (1.49) and absorption 4.03 (1.58) (Hakanen 2009b). Our intervention group values at follow-up were one to three points higher than these reference values, both in total UWES-9 scores and in all and the dimensions. The three dimensions were at average level at the beginning of the programme. Absorption increased in both the intervention and control groups to higher than average level, and dedication changed in the same direction. It may be that the questionnaire itself acted as an intervention for both the intervention and control groups.

6.1.5 Reflections of the causes of change

An encouraging atmosphere during the intervention process is essential. The baseline and follow-up health measurements, and an understanding of the results of these measurements, motivate the participants. Our intervention was carried out close to home and work, enabling new practices in everyday life to be continued after the intervention. The participants described how each day of intervention allowed recovery from work stress and enabled work-related coping. The intervention groups' small sizes supported interaction and made it possible for all participants to participate actively. This kind of interaction requires that instructors can engage the group in its goals and for a prolonged period of work. Confidence in both the instructor and the whole group made it possible to have very intimate and personal conversations in the groups. Participation during paid working hours enabled attendance for all occupational groups when it would and have and been difficult to achieve this outside working hours.

Employees gain the perspective and time they need to concentrate on analysing their own work and its priorities. Work is a remarkable part of work ability, and the ability to talk about your own work content and work ability with your supervisor makes it possible for the supervisor to plan your work and pay as much attention as possible to your individual needs. Improving ergonomics and adopting a healthy lifestyle at a level appropriate to oneself is also essential. Multidisciplinary skills were available to support participants in working towards their goals. Peer support can be defined as support for others who have had similar life experiences, and it can be combined with the traditional professional-centred approach (Pfeiffer et al. 2011). One study concluded that early workplace dialogue

in addition to structured physiotherapy significantly improved work ability at one-year follow-up (Sennehed et al. 2018).

The key point in getting support may be understanding (Riessman 1990). Peer support is present in nearly all health support groups where participants share their life situations and try to find a way to handle them together, offering each other practical advice that professionals do not have (Riessman 1990). Guided peer support has been found to increase patients' social network size (Anderson et al. 2015). Peer support improves self-management and helps people adapt to new situations (Gillard et al. 2012; Lloyd-Evans et al. 2014). In demanding situations, it gives one hope to find out that somebody else has been there before and found a solution to similar issues; people who have had the same kinds of experience can offer practical alternatives for coping. A number of peer-provided services have been implemented and legitimized during past decades (Solomon 2004; Riessman 1990).

6.2 Strengths and limitations of the study

A strength of this study was a good and sufficient number of participants for quantitative analysis. Participants in the intervention were committed to the entire process. The measurements we used have been found to be reliable and valid for measuring work ability and well-being with their various components. All the sub-studies were directed at the same population and gave a wide view of changes and participants' responses to questionnaires. Only the responses that had no missing data were used in our analyses. The group that was dropped from the analysis did not differ significantly in background variables compared with those who responded. The research team did not change during the study.

The strength was also that multidisciplinary professionals already know the participants work and work organisation and it was easier to have a deeper discussion of these issues.

A limitation of the study was that we did not succeed with the total randomization of the participants, because there were issues that needed to be considered such as the timetable of the entire process, holidays, individuals' work situations, and the need to achieve a sufficient number of participants in the intervention group and – there were not the same numbers of participants in the control group. However, the control groups were from the same work units, and participants were chosen as randomly as possible from that environment. Question-based research may suffer from bias if the participants feel satisfied with the service and therefore respond positively when they answer the second time. Physical test results might improve partly because of motor learning during test performance. Physical tests were implemented during the first three days for the intervention group, and the follow-up period for the physical test results was 7.5–9 months. Medical tests before the physical test were conducted according to the standards of American sports medicine, and these requirements are quite strict. This might explain the number of untested participants. The UWES-9 results also improved in positive direction, but it was nearly significant only in one variable ($p < 0.054$) in the control group the same change was statistically significant

in the larger group, although the change between the groups had not any difference. This kind of long-lasting service includes many changing variables, which makes it difficult to define the causes of the results. The follow-up of the intervention was short and the study did not clarify the clinical significance of the positive changes.

Supervisors played a key role in grouping. A third measurement point would have enabled broader statistical analysis. In this study we had a respectable amount of data to ensure its adequacy for possible dropouts. Dropout is a prevalent complication in the analysis of data from follow-up studies, but in this study, there were no differences between those who responded compared with those who did not in terms of age, gender, years of work, or work unit.

7 Conclusions

The novel early rehabilitation and programme improved work ability and well-being. The programme seems to be a worthwhile service to improve and prolong working life. Early rehabilitation allows participants to play an active role while they still have the resources to make changes in their own lives. Overall the results of this study permit the conclusion that this kind of service is working to support work ability in today's working environment in municipal sector. It is important to act preventively when the participants have the resources to be in active role. Peer support also has remarkable value for finding solutions in different life situations.

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10 Original Publications

PUBLICATION

I

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Outpatient rehabilitation as an intervention to improve employees' physical capacity

Birgitta Ojala^{a,b,*}, Clas-Håkan Nygård^a and Seppo T. Nikkari^{b,c}

^a*School of Health Sciences, University of Tampere, Finland*

^b*Tullinkulma Occupational Health Unit, Tampere, Finland*

^c*School of Medicine and FIMLAB Laboratories, University of Tampere, Tampere, Finland*

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Abstract.

BACKGROUND: The aging of the workforce poses new challenges for maintaining work ability. Because of limited information on the effectiveness of vocational rehabilitation performed in traditional inpatient programs, extended interest in outpatient rehabilitation has risen in the past few years.

OBJECTIVE: We examined the effects of a new outpatient rehabilitation program where every participant defined their own goals to improve work ability by the aid of a goal-oriented multi-professional team. This report will focus on the employees' physical capacity during a nine-month program.

METHODS: A total of 605 municipal employees from different production areas of the City of Tampere took part in the outpatient rehabilitation program, implemented by the occupational health unit. Groups of 12 employees participated in eight one-day sessions at intervals of two to three weeks; the final follow-up was 9 months from the beginning. Submaximal aerobic capacity was tested by a calibrated cycle ergometer with a commercial program (Aino Fitware pro, Helsinki, Finland). Musculoskeletal tests assessed muscle strength, balance and mobility.

RESULTS: During the 9-month follow-up of the rehabilitation program, the employees' physical capacity was improved. The follow-up test scores from a total of 329 employees were significantly higher in the submaximal aerobic capacity test ($p < 0.001$). Other tests were also improved, such as standing on one foot ($p = 0.001$), back side bending flexibility test ($p < 0.001$), dynamic sit up ($p = 0.001$), upper extremity right ($p < 0.001$), and knee bending ($p = 0.029$). About 40% of the participants did not have an adequate health situation to take part in physical capacity tests; however they took part in the intervention.

CONCLUSIONS: The new outpatient rehabilitation program organized by the occupational health unit had a positive influence on employees' physical capacity during a nine-month follow up.

Keywords: Health promotion, work ability, cognitive behavioral theory based training (CBTr)

1. Background

Europe's workforce is rapidly aging. An aging workforce with a low education level, poor health, and a lack of physical activity is more likely to exit

from work to early retirement [1, 2]. Robroek et al. suggested integrating occupational health promotion activities with activities aimed to increase physical fitness to maintain a productive workforce [3]. Occupational health and safety professionals consider physical exercise as an important tool to reach that goal [4–7]. Robson et al have made a systematic review of the effectiveness of Occupational Health and Safety (OHS) training programs and they found

*Address for correspondence: Birgitta Ojala, University of Tampere School of Health Sciences FI-33100 University of Tampere, Finland. Tel.: +358 405000392; E-mail: Birgitta.Ojala@tullinkulma.fi.

43 strong evidence for the effectiveness of training on
44 workers' behaviors, but insufficient evidence of its
45 effectiveness on health [8].

46 Gram et al. performed a health promotion pro-
47 gram with 20 minutes of exercise three times a week
48 among construction workers, which got good results
49 by decreasing the risk of cardio metabolic disorders
50 and improving aerobic capacity. However, the pro-
51 gram did not decrease musculoskeletal disorders or
52 other negative work- related factors [4].

53 Lower aerobic capacity has been found to be one
54 reason to be significantly related to sick leaves [6,
55 7, 9, 10]. The occupational health services could in
56 principle prevent sick leave by promotion of activities
57 aimed at improving physical capacity, thus increasing
58 work ability [1, 11–15].

59 Suoyrjö et al. have studied Finnish vocationally
60 oriented preventive institutional interventions and
61 found that they temporarily reduce the risk of work
62 disability [15]. On the other hand, Saltychev et al.
63 found that institutional rehabilitation had little effect
64 on health risk behaviors, such as alcohol consump-
65 tion, poor physical activity, or prevalence of obesity
66 [16], and early rehabilitation was more often granted
67 to employees with only a few risk factors [17].
68 They suggest that preventive measures to reduce
69 the risk of disability pension through rehabilitation
70 should be targeted rather to high-risk employees
71 [18]. Saltychev et al. also tested a multidisciplinary
72 preventive program of physical training and psycho-
73 logical education to adopt a healthier lifestyle, and
74 to achieve greater aerobic capacity, muscle strength
75 and endurance, as well as better self-management of
76 stress. After the intervention, they did not find any
77 beneficial effects on perceived health. The program
78 was similar to a primary prevention program widely
79 used in Finland to reduce early retirement on health
80 issues [19, 20].

81 Ohue et al. (2011) have researched a cognitive
82 model and their results suggest that changing irra-
83 tional beliefs to rational beliefs might prevent stress
84 and burnout in nurses and could decrease the num-
85 ber of nurses who leave their position [21]. Stress,
86 burn out and loss of position might be prevented by
87 changing the way one thinks, by changing irrational
88 beliefs to rational beliefs, facilitating positive auto-
89 matic thoughts and abandoning negative automatic
90 thoughts [21]. This new way of rehabilitation used
91 in the present study was built to a cognitive behav-
92 ioral theory based training (CBTr). Holtermann et al
93 (2010) describes a framework for health-promoting
94 interventions for four job groups by CBTr [22]. The

95 overall aim of the study was to improve the safety
96 margin between individual resources i.e. physical
97 capacities, and cognitive and behavioral skills and
98 physical work demands, and thereby reduce physical
99 deterioration in a long-term perspective by interven-
100 tions tailored for each job-group [22].

101 Our new concept for rehabilitation includes
102 interdisciplinary, goal-oriented rehabilitation and
103 teamwork by the rehabilitation staff as usual, but not
104 disconnected from participants' everyday life. Work
105 ability has been seen as the balance between work
106 and individual resources; when work and individual
107 resources fit well together, work ability is good [23].

108 Traditionally, to qualify for inpatient rehabili-
109 tation, you must have a medical certificate with
110 information about your illness and why your need
111 this kind of rehabilitation. The practice in Finland
112 is that first the insurance company (in Finland the
113 Finnish Social Insurance Institution) accepts a person
114 for inpatient rehabilitation; this has been followed by
115 a rehabilitation examination at a rehabilitation center.
116 The new concept of selection outpatient rehabilitation
117 is faster, and the representative of the employer has
118 an important role in the selection. The employer will
119 pay the costs of the rehabilitation but gets reimburse-
120 ment of the salary cost if the program is implemented
121 during working hours, as this program was.

122 The rehabilitation program was designed together
123 with the occupational health service and the
124 employer's representative, to meet the needs of the
125 workplace and also to meet the planned expenses of
126 the rehabilitation. The aim of the present study was
127 to determine if a 9-month outpatient intervention pro-
128 gram will increase the physical capacity of municipal
129 employees.

130 2. Materials and methods

131 The ethics committee of Tampere University
132 Hospital approved the study protocol, and written
133 informed consent was obtained from all study partici-
134 pants. The selection of the participants for the rehabil-
135 itation was made by the occupational health service,
136 which had the knowledge of current and previous
137 diseases. The participation in the program was vol-
138 untary. The basic screening of the subjects was done
139 by a multidisciplinary occupational team including a
140 physician, a nurse, a physiotherapist and a psycholo-
141 gist. The employer, however, made the final decision
142 whether it was possible for the person to be on
143 leave from work during the outpatient rehabilitation

144 days. A questionnaire given to the subjects before
 145 the physical tests included questions of health in
 146 general, including diseases, current and past smok-
 147 ing and physical exercise (times per week). Some
 148 basic laboratory measurements were done before the
 149 physician's appointment. These included serum total
 150 cholesterol (mmoles/liter). Height (cm) and weight
 151 (kg) were recorded from which the body mass index
 152 was calculated [24]. This intervention was an early
 153 rehabilitation and the inclusion to the program was
 154 based on the participants' own experience of their
 155 working capacity. The participation had to also meet
 156 the conditions set by the HR unit of the City of Tam-
 157 pere relating to steady employment relationship.

158 2.1. Study sample and the intervention

159 The participants in the study were employed by the
 160 city of Tampere, Finland which has 14,500 employ-
 161 ees, of whom in all 605 (4.2%) were enrolled in the
 162 outpatient rehabilitation program (Fig. 1). Out of the
 163 605 there were 17 (1.2%) subjects; who did not give
 164 consent to use their data in the study. Of the remain-
 165 ing 588 participants, 467 were women (79%) and 121
 166 were men (21%). The mean age of subjects was 49.2
 167 years (range 21–64 years).

168 12 persons in each of the 49 groups in the reha-
 169 bilitation program met eight times at intervals of two
 170 weeks. Each gathering lasted for one day (8 hours).
 171 In addition there was a follow-up after 9 months,
 172 which was a three hour group meeting (Fig. 2). In
 173 this session the group reflected on how they had pur-
 174 sued their goals and how to go on after the total
 175 intervention. The groups were formed from employ-
 176 ees who had slightly decreased work ability, which
 177 was based on the opinion of the employee, super-
 178 visor, and professional experience of occupational
 179 health. Each session was tailored for the needs of
 180 each group. An interdisciplinary, goal-oriented multi-
 181 professional team directed the groups. Goals were
 182 set together with the participants and every partici-
 183 pant defined their own goals to improve work ability.
 184 The intervention days were chosen from the calend-
 185 ar together with the employer so as to interfere as
 186 little as possible with work flow. They consisted of
 187 different educational components such as physical
 188 training; social interaction, problem-solving skills at
 189 work and skills to talk about the work in everyday
 190 life; as well as individual goal setting. Each rehabili-
 191 tation day included physical exercises in the program,
 192 including aerobic training, strength and endurance,
 193 mobility, balance and coordination training. Teaching

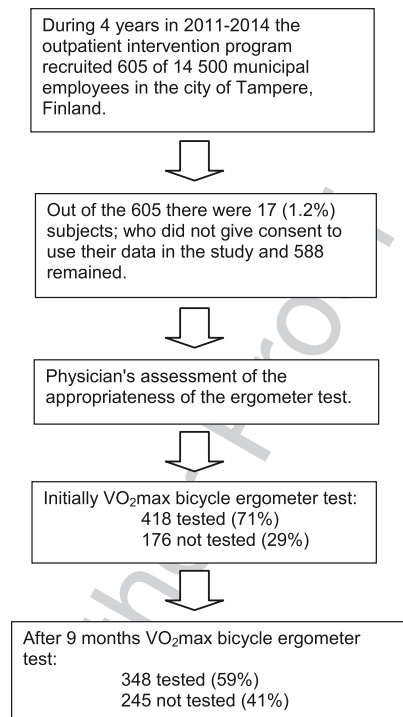


Fig. 1. Subject recruitment for the study and total number of subjects not participating in physical tests.

194 subjects that were handled included nutrition (4 h),
 195 assets and coping, ergonomics and musculoskeletal
 196 diseases (4 h), intoxicants (2 h), sleep and relaxation
 197 practice (4 h), memory and brain health (2 h), exercise
 198 (10 h) and the everyday flow of work (4 h). Regarding
 199 physical capacity the learning process also included
 200 the theory of the different sub-elements of the motor
 201 areas, such as aerobic fitness, muscle strength, mobil-
 202 ity, balance and coordination. It was considered as
 203 important that the learned items were transferred into
 204 everyday health related activity as soon as possible,
 205 in order to obtain a long-term effect [25].

206 The physical capacity was evaluated at the first
 207 three rehabilitation days. Prior to the physical tests
 208 conducted by occupational physiotherapists a physi-
 209 cian examined the subjects.

210 2.2. Test protocols

211 The maximal oxygen intake ($VO_2\max$) was esti-
 212 mated by a sub-maximal cardiovascular endurance
 213 tests with a bicycle ergometer (Ergoline® 100K-
 214 ERG 161105, Bitz, Germany (accuracy under the

<p>1. Rehabilitation day Medical examination for 4 persons and ergometer tests for the same 4 persons. Other 8 group members had a work out session. Each member of the group defined their own aims for the next two weeks and the whole process. Muscular tests in groups as first measurement.</p> <p>2. Rehabilitation day Medical examination for 4 persons and ergometer tests for the same 4 persons. Other 8 group members were at gym training. Discussion and theory of motivation. Group activities as homework muscle strength exercises and stretching exercises.</p> <p>3. Rehabilitation day Medical examination for 4 persons and ergometer tests for the same 4 persons. Other 8 group members were at gym training. Theory of muscular strength training: weight and repetition.</p> <p>4. Rehabilitation day Theoretical background of aerobic training and medical lecture on the function of the cardiovascular system. Individual bicycle ergometer test results were applied for planning of practical aerobic training Nordic walking with heart rate monitoring. The limits for basic endurance training and maximum endurance training was set in order to get experience how it feels to practice basic endurance in your own heart rate level.</p> <p>5. Rehabilitation day The basis of a healthy diet. Theory and exercises on physical ergonomics. Group activities, aerobic exercise.</p> <p>6. Rehabilitation day The basis of a healthy diet. Group activities, importance of water aerobics and water running in theory and practical training.</p> <p>7. Rehabilitation day Adequate sleep importance in theory. Group activities, stretching and relaxation in theory, and relaxation training.</p> <p>8. Rehabilitation day Group activities, a dance exercise, balance and coordination training. Supervisors visit the group.</p> <p>Follow up group 3 hours 9 months from beginning</p>

Fig. 2. Design of the outpatient rehabilitation days (8.00 a.m.–16.00 p.m.).

215 directive DINVDE 0750-0238). The test result was
 216 analyzed with a commercial software program (Aino
 217 Health Management, FitWare pro[®], Helsinki, Fin-
 218 land). ACSM (2009a, 83) guidelines for low-risk tests
 219 suspension criteria were followed during testing [26].

220 Maximal oxygen consumption was compared with
 221 the reference values based on age and gender [27,
 222 28]. Physical test results were compared with age
 223 and gender standardized reference values. Muscu-
 224 loskeletal tests assessed muscle strength, endurance
 225 and mobility. Standing on one foot balance – test
 226 result is maximally 60 seconds [29], back side bend
 227 flexibility test is measured in centimeters [29], grip
 228 maximum isometric strength of the hand and forearm
 229 muscles were measured by calibrated Jamar-Saehan
 230 – dynamometer in kilograms [30]. Dynamic sit up

231 – repeated performance [31], upper extremity – test
 232 woman 5 kg and man 10 kg maximally 50 repetitions
 233 [32] and squatting test [33] were tested in stand-
 234 ing position repeated performance during 30 s. The
 235 submaximal VO₂max tests and the musculoskele-
 236 tal tests were done before and after intervention.
 237 First VO₂max tests were carried out individually dur-
 238 ing the first three days of rehabilitation and second
 239 VO₂max tests were done before the follow up meet-
 240 ing. Muscle tests were carried out during the first day
 241 in-group and before the follow up individually.

2.3. Statistical analyses

242
 243 Statistical analyses were run by SPSS (Statistical
 244 Package for Social Sciences), version 20.0, (IBM,

New York, NY, USA) software. Background characteristics of the study subjects who were included and those who were excluded from the physical testing were analyzed. Comparisons of physical functional test results before and after the nine-month rehabilitation program were divided by gender. Group differences were tested by Paired *t*-test if normally distributed and by Wilcoxon signed ranks tests if the parametric test was not suitable. For categorical variables the Mc Nemar test was applied. *P* values of less than 0.05 were considered significant.

Gender and age based formulas were done by syntax when analyzing VO₂max before and after intervention.

3. Results

Of a total of 588 participants, about 60% were tested for physical capacity. Subject recruitment from different vocational areas for the outpatient program is shown in Table 1. The largest participation for women came from health service (28.1%) and for men from construction work (25.2%). Inclusion criteria were that the unit's management bought the course and the participants enrolled in the course, showing their interest. If the unit had an interest of more participants than planned for the size of the group, occupational health professionals and managers chose the participants. The exclusion criteria for physical capacity testing are shown in Table 2. The most common reasons for not testing were denial of testing by the physician, due to physical symptoms revealed at the examination, or elevated blood pressure and / or reported cardiac symptoms. Background characteristics for the subjects who were included and excluded from physical testing are shown in Table 3. The excluded subjects had significantly higher BMI, lower physical exercise activity and they were older than those who were included. The gender distribution was very similar.

During the nine-month follow-up of the rehabilitation program, the tested employees' physical capacity clearly improved (Table 4). Improvement was seen in standing on one foot (women $p=0.009$, men $p=0.016$), backside bend flexibility (women and men $p<0.001$), squatting (women $p=0.004$ and men $p=0.001$), dynamic sit up (women $p<0.000$ and men $p=0.001$), upper extremity right (women $p=0.69$ and men $p<0.004$), and upper extremity left (women $p=0.009$ and men $p=0.005$). Effect size by *r* squared was medium for back side bending (0.23)

Table 1
Main vocations for the participating women and men

	Women %	Men %
Health service	28.1	0
Social service	18.0	0
Education	14.5	7.8
Other services	13.9	19.1
Public administration	6.3	11.3
Construction		25.2
Transport		7.8
Other	19.3	28.7
Total	100.0	100.0

and squatting-test (0.09), other variables had small effect.

A total of 329 subjects participated in the submaximal cycle test. Detailed results of VO₂max results for each age group by gender are presented in Table 5. Table 6 shows aerobic capacity in baseline (VO₂max, ml/kg/min) stratified by gender and age based values, where the average fitness level is highlighted in gray.

Scores for submaximal cycle test increased significantly from the first test (VO₂max = 30.98 ± 5.98 mL/(kg·min)) to the second test after nine months (VO₂ max = 31.6 ± 6.4 ml/(kg·min)) ($p<0.001$). All age groups and both genders increased their VO₂max result from the initial result (Fig. 1). During the intervention, there was no significant change in BMI (data not shown).

4. Discussion

In the present study, all age groups and both genders increased their VO₂max result from the initial result. All physical tests except grip strength improved significantly during the intervention. On the other hand, the results of grip strength were already moderately good at the first measurement. Although the majority of participants of the present study benefited from the intervention in terms of physical fitness, it may be that those who were in worst shape benefited the most, since improving an inadequate VO₂max might have even lifesaving benefits [34]. Low cardiorespiratory fitness is associated with higher all-cause mortality and cardiovascular events among healthy men and women [46]. On one hand, also testing process safety examination is important to plan properly. Surprisingly, when these precautions were followed, 40% did not pass the medical examination. We consider it extremely important that these subjects were found to take part in the

Table 2
Total number of subjects not participating in physical tests and the main reasons for absence

Reasons for missing physical tests	not participating (N)	%
Tested by different method (fire department)	12	5
Tests were interrupted by health safety reasons	15	6.1
Suspended the rehabilitation not by healthy reasons	15	6.1
Musculoskeletal pain	16	6.5
Sent for further examination e.g. clinical exercise test	24	9.8
Acute or chronic disease	27	11
Did not attend the follow-up test	27	11
Elevated blood pressure and/or cardiac symptoms	45	18.4
The physician denied the test for health reasons	64	26.1
Total	245	100

Table 3
Background characteristics of the study subjects who were included and those who were excluded from physical testing

Vo2max test	Included			Excluded			P
	N	Mean	SD	N	Mean	SD	
Age	372	48.6	8	206	50.3	7.2	<0.01
Gender (% male)	371	21		206	20		0.41
Current smoking (%)	269	20		119	20		0.32
Plasma total cholesterol (mmol/l)	184	5.0	1.0	74	5.2	1.2	0.21
BMI (kg/m ²)	346	26.5	5.1	151	28.9	5.9	<0.01
Physical exercise >30 min/week	288	3.4	1.1	134	3.2	1.1	<0.05

Table 4
Comparison of physical function test results divided by gender before and after the nine-month rehabilitation program

		1st test		2nd test		P
		Mean	SD	Mean	SD	
Paired <i>t</i> -test						
Standing on one foot (s)	Female N306	50	16.7	52	15.8	0.009
	Male N71	51.6	15.6	55.7	12	0.016
Back side bend flexibility test (cm)	Female N294	18	3.4	19	3.4	<0.001
	Male N72	18.9	3.8	19.7	4	<0.001
Grip strength (kg)	Female N305	33.9	5.6	33.6	5.5	0.111
	Male N73	55	9.5	55.8	9.7	0.198
Squatting (repeat)	Female N292	18.8	4.8	20.6	11.4	0.004
	Male N70	21.6	5.4	23.6	4.1	0.001
Wilcoxon signed ranks test						
Dynamic sit up (repeat)	Female N293	15	8–12	16	16–25	<0.001
	Male N69	20	16–30	25	20–31	0.001
Upper extremity right (repeat)	Female N293	25	20–32	25	19–32	0.690
	Male N70	20	15–25	21	17–27	0.004
Upper extremity left (repeat)	Female N290	21	16–30	22	17–29	0.009
	Male N70	19	15–24	20	15–26	0.005

intervention, and they most likely also received health benefits.

Understanding the importance of your test results in practice, including the importance of monitored heart rate, allows for better planning for training. This kind of learning is likely to contribute to improvement in aerobic fitness. In addition, participants described that the group caused positive pressure and increased motivation. In the group, progress of individual plans were reviewed at each session, which is known to be a motivation factor [35].

Aerobic test is the form of examination which provides much more information on the subject than the level of the aerobic condition, for example of abnormal reaction of blood pressure and heart rate to normal exertion. BMI change in this study did not explain the changes in aerobic fitness, and weight loss was not statistically significant at group level. This means that the improvement of aerobic fitness was most likely due to increased physical activity. The intervention was carried out in participants' own community, which made lifestyle changes and

Table 5
VO₂max results by age groups in the first and second tests

Female age			VO ₂ max 1st	VO ₂ max 2nd	Male age			VO ₂ max 1st	VO ₂ max 2nd
20–29	Mean		29.3	31.0	20–29	Mean		32.0	
	SD		8.1	9.2		SD			
	N		6	5		N		1	
30–34	Mean		31.4	31.3	30–34	Mean		36.5	39.0
	SD		7.5	4.9		SD		10.6	12.7
	N		14	12		N		2	2
35–39	Mean		30.0	32.0	35–39	Mean		39.6	40.2
	SD		6.2	7.0		SD		5.4	5.8
	N		26	20		N		5	5
40–44	Mean		30.2	29.6	40–44	Mean		32.6	33.6
	SD		7.2	8.1		SD		5.9	7.1
	N		38	32		N		13	12
45–49	Mean		32.0	33.0	45–49	Mean		33.9	35.1
	SD		6.3	6.4		SD		4.8	6.2
	N		67	55		N		19	19
50–54	Mean		29.8	30.1	50–54	Mean		34.5	35.7
	SD		5.2	5.5		SD		5.3	5.0
	N		91	76		N		23	20
55–59	Mean		28.5	29.8	55–59	Mean		32.6	34.3
	SD		5.0	5.3		SD		5.1	5.7
	N		75	61		N		13	9
60–64	Mean		26.2	27.1	60–64	Mean		32.8	34.0
	SD		5.0	5.9		SD		4.1	4.2
	N		20	18		N		5	2
Total	Mean		29.9	30.6	Total	Mean		34.0	35.3
	N		337	279		N		81	69

learning in everyday life easier. This also poses a limitation to how one might extrapolate our findings to different populations, since the study sample represented municipal employees with the same ethnical background.

Low cardiorespiratory capacity was very common among young female home care workers, which is in line with earlier observations [36]. Physical tests are used in some tasks for the recruitment criteria to predict work ability, although there are studies which do not support for the use of muscle performance tests in work-related fitness evaluations [37]. It is apparent that work ability is multidimensional and not only dependent on physical fitness.

Overall the financial costs of rehabilitation worldwide are large. Many different rehabilitation programs of unclear efficacy are currently in use. It is clearly a challenge to identify the individual health risks of employees and target the measures to be taken accurately. Because of limited information on the effectiveness of traditional programs, extended interest in outpatient rehabilitation has risen in the past few years. Concept requirements for rehabilitation include interdisciplinary, goal-oriented rehabilitation and teamwork of rehabilitation staff.

Vocational rehabilitation is aimed at people entering or already in working life and whose work

capacity has deteriorated or is at risk of deteriorating over the next few years. Although the study subjects showed, by the examination of the occupational health personnel and employer, only slight deterioration of work ability, about 40% of them were physically in such condition that they were not qualified by medical standards for physical testing. A big reason for this were cardiovascular problems, mainly elevated blood pressure. In Finland, it is estimated that over 48% of 25–64 year old adults have a mean systolic pressure of 140 mmHg or above, which is among the highest in Europe [38]. Thus, the intervention may not have been timely to those subjects who were not physically tested because of higher rates of health conditions, higher BMI and older age.

Social Insurance Institution (KELA) arrange institutional rehabilitation and follow-up of tests performed there is done by occupational health care. However, there exist a multitude of various tests, testing tools and testers, and reliable follow-ups to determine effectiveness of interventions have proven difficult in practice. The strength of the present intervention was that we used tests that were done in same way and in same place, which we believe increased the reliability of our findings.

Physical fitness is an important part of work ability and it might correlate with work ability index

Table 6
 Aerobic capacity in baseline (VO₂max. ml/kg/min) stratified by gender and age based values. Reference values for fitness are highlighted in gray [49]

		Female							
Condition category		1	2	3	4	5	6	7	Total
Age 20–29	ml	<27	27–30	32–35	37–40	42–44	47–49	>49	
	n	3	1	0	1	0	0	0	5
Age 30–34	ml	<25	25–29	30–33	34–37	38–42	43–46	>46	Total
	n	2	3	3	0	1	1	0	10
Age 35–39	ml	<24	24–27	28–31	32–35	36–40	41–44	>44	
	n	3	1	6	4	3	0	1	18
Age 40–44	ml	<22	22–25	26–29	30–33	34–37	38–41	>41	
	n	4	11	1	7	6	1	2	32
Age 45–49	ml	<21	21–23	24–27	28–31	32–35	36–38	>38	
	n	1	4	5	7	16	5	9	47
Age 50–54	ml	<19	19–22	23–25	26–29	30–32	33–36	>36	
	n	0	4	4	22	18	8	13	69
Age 55–59	ml	<18	18–20	21–23	24–27	28–30	31–33	>33	
	n	0	4	4	22	18	8	13	69
Age 60–64	ml	<16	16–18	19–21	22–24	25–27	28–30	>30	
	n	0	1	4	7	5	3	6	26
		Male							
Age 30–34	ml	<29	29–34	35–40	41–45	46–51	52–56	>56	Total
	n	0	1	0	1	0	0	0	2
Age 35–39	ml	<28	28–32	33–38	39–43	44–48	49–54	>54	
	n	0	1	1	1	1	0	0	4
Age 40–44	ml	<26	26–31	32–35	36–41	42–46	47–51	>51	
	n	0	4	2	4	1	0	0	11
Age 45–49	ml	<25	25–29	30–34	35–39	40–43	44–48	>48	
	n	1	3	5	5	1	0	0	15
Age 50–54	ml	<24	24–27	28–32	33–36	37–41	42–46	>46	
	n	0	2	5	7	5	1	0	20
Age 55–59	ml	<22	22–26	27–30	31–34	35–39	40–43	>43	
	n	0	1	4	3	0	3	1	12
Age 60–64	ml	<21	21–24	25–28	29–32	33–36	37–40	>40	
	n	0	0	0	2	1	1	0	4

[39–42]. Increased physical capacity as a result of the outpatient intervention may have positive consequences on work ability [39–41]. The physical condition of participants of this study was on average poor at baseline and thus their work ability was at risk even though they comprised an early rehabilitation group. Regular physical activity can reduce also age-associated decline in functional capacity [7]. It is commonly known that behind the decrease in functional capacity is a progressive decline in the function of the cardiovascular system with increasing age. This can inhibit fulfilling job tasks and may eventually lead to an increase in work-related fatigue [36, 37].

The tentative conclusion of this study is that the nine-month outpatient rehabilitation intervention benefits physical capacity. Although every rehabilitation day included physical exercise, the main focus of this program was not in improving physical

performance. We also consider that work ability is not dependent only on the physical fitness of the employee, since work itself and working conditions play an important role (43–45). This intervention also attempted to effect work and working environment in the way that supervisors were involved in the inclusion of employees and invited to the last session [43–45]. Knowing the importance of commitment and interest is considered valuable in work rehabilitation [46].

Kuoppala et al. have made a systematic review studying multiple workplace factors and interventions that may affect workers' health and well-being. Potentially effective activities were encouraging exercise, lifestyle, and ergonomics. Education and psychological interventions applied alone do not seem effective [6]. Low muscle strength is related to an increased risk for several chronic

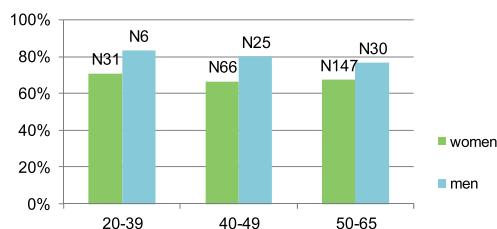


Fig. 3. Scores for the submaximal cycle test after rehabilitation. The percentages and numbers show how many women and men in the different age groups improved their VO_2 max performance during the intervention.

diseases and leg strength correlates positively to VO_2 -max and physical function. Increased muscle strength improves daily function and quality of life [6].

The goal of employment, and the broad integrated approach of the present intervention by cognitive-behavioral process may motivate participants and the group to go on to a better direction in work, as well as self-care and leisure, as reflected by an improved physical ability. The learning process was involved in sub-regions of motor condition such as aerobic fitness, muscle strength, mobility, balance and agility. We do not yet know whether the increase in physical fitness achieved by the current program has affected work ability of the employees in question, in terms of e.g. reduced sick leave or increased performance. These preliminary findings warrant further investigation. The next steps in analyzing this population are to see whether the intervention has effects on parameters addressing work ability.

4.1. Limitations of the study

The subjects represent a relatively small population in Finland. Data on physical tests to analyze a possible health benefit of the intervention was not available for those with a medical contraindication for such testing, although they received the whole intervention. It cannot thus be concluded whether they received a benefit or not. Functional muscle tests were made first in-group and then individually, which may have affected the test results. One more limitation is that we cannot rule out that motor learning may have partly contributed to increased performance in follow-up of balance and musculoskeletal tests. Moreover, we did not have a control group for the physical tests, since appropriate funding for this was not available and it would have involved absence from work for the control employees involved.

4.2. Public health implications

Musculoskeletal disorders are still the main reason to work absenteeism, and exercise is an important means to prevent these problems [47]. Our results implicate that recommending an exercise part in work ability interventions is an effective instrument to promote physical activity. This may prevent musculoskeletal symptoms. It has also been shown previously that exercise alleviates mental health problems [48]. Good physical condition is important in maintaining work ability, and also as important for everyday life.

5. Conclusion

The present results suggest that a cognitive behavioral intervention as an early rehabilitation program is effective in increasing employees' physical capacity.

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Conflict of interest

None to report.

Authors' contributions

All authors have been involved in the development of the study design. BO was responsible for the data collection and for writing the manuscript. STN and C-H.N participated in the general planning and coordination of the study and read and corrected draft versions of the manuscript and HH contributed as a statistician and commented the manuscript.

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PUBLICATION

II

Does perceived work ability improve after a cognitive behavioral intervention program?

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Does perceived work ability improve after a cognitive behavioral intervention program?

Birgitta Ojala, MSc 1,2 Clas-Håkan Nygård, PhD 1, Heini Huhtala, MSc1, Seppo T Nikkari, MD, PhD 2,3

1 University of Tampere, School of Health Sciences, FI-33014 University of Tampere, Finland

2 Tullinkulma Occupational Health Unit, FI-33100, Tampere, Finland

3 University of Tampere, School of Medicine and FIMLAB laboratories, FI-33014 Tampere, Finland

Corresponding author:

Birgitta Ojala. University of Tampere, School of Health Sciences, FI-33100 University of Tampere, Finland. Tel. +358405000392. Email: Ojala.Birgitta.M@student.uta.fi

The submitted manuscript does not contain information about medical device(s) or drug(s). No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Abstract

Background. Long sickness absence leaves and early retirement have characterized the municipal sector. To prevent those we need to find new ways to support work ability and coping at work. Changes in the workplace require adaptation from employees and new capabilities like skills and knowledge abilities. An increased work load can lead to a cycle of illness. It is important that early actions are targeted to employees at risk to improve health, promote work ability and prevent long-term sick leave and early retirement.

Aims. The aim of this study was to evaluate the effects of a cognitive behavioral intervention as an early rehabilitation program to improve employees' work ability.

Methods. The study was a 9 month investigation designed to estimate the causal impact of the intervention on an intervention group, with a control group that did not take part in the intervention. The groups were measured for work ability with the work ability index (WAI). Data were obtained by a self-report at baseline and at nine months follow-up. Differences were analyzed within group and between groups.

Results. Participants in the 9-month outpatient intervention group showed significant increase in several WAI areas, resulting in an overall increase in total WAI ($p < 0.001$). There was a significant decrease in WAI in the control group ($p < 0.05$).

Conclusion. The results suggest that a cognitive behavioral intervention as an early rehabilitation program is effective in increasing employees' work ability, as measured by WAI.

Keywords

Work ability, intervention, occupational health

Introduction

Work ability is important in an aging Europe work force. New ways to support workers to prolong their working career are needed to prevent early retirement. There are very few studies on the effectiveness of interventions that could support work ability and its diverse dimensions.

Work ability is considered to measure both well-being and health status. A job demands -control model postulates that work-related strain is highest in work with high demands and low autonomy [1]. In the present study, work ability was assessed by the Work Ability Index (WAI) ® [2].

In Finland some interventions have not worked as expected. With eight years follow-up more than 3000 people took part in a vocationally oriented medical rehabilitation (VOMR) study. Participation in VOMR did not have any beneficial effects on perceived health [3].

Disease management also needs to focus on interventions that can positively affect behavioral performance [4-5]. This report describes a new kind of intervention where session days included exercise and theoretical background in aerobic and muscle strength training, work related matters, and motivation. It was considered important that the learned and handled issues and items were adapted into everyday life and work. A follow up group session after nine months from beginning included review of the participants' current situation and how goals were achieved. A prospective study was done to evaluate the effects of this cognitive behavioral intervention on the perceived work ability of employees in the public sector, as measured by WAI.

Methods

The study was designed to estimate the causal impact of a rehabilitation program on 12-person intervention groups (n=389), with a control group (n=100) that did not take part in the intervention. Selection of the participants was by occupational health with knowledge of current and previous diseases and employer on basis of work demands, who together made the final decision whether it was considered profitable in terms of work capability for the person to be on leave from work during the outpatient rehabilitation days. The intervention lasted for four months, one day every two weeks (8 times) and a 9-month follow up. The ethics committee of Tampere University Hospital approved the study protocol, and written informed consent was obtained from all study participants.

Every three-hour session was directed by an interdisciplinary group. Goals were set together with the participants. A WAI questionnaire was conducted before the intervention and after nine months to both intervention and control groups, measuring changes in work ability and health areas [2,6-7]. It includes 20 short self-report measures

Difference between the groups were tested by Mann-Whitney U test, Chi-square test, Wilcoxon Signed Ranks test, and analysis of variance for repeated measurements. Data analysis was done by using SPSS 23.0.

Results

The intervention group was similar to controls in age, gender, BMI, marital status, years of professional experience, and in education (data not shown). Baseline and follow-up values in WAI for the intervention and control groups are shown in Table 1. The WAI increased significantly in the intervention group from 36.93 to 38.15 after 9 months ($p < 0.001$), while in the control group it decreased from 37.57 to 36.66 ($p < 0.05$).

WAI factors that increased most in follow-up in the intervention group were Work ability relative to lifetime best, Work ability in terms of the demands of work and Psychological wellbeing. The change in total WAI was statistically significant between intervention and control groups by analysis of variance for repeated measures ($p < 0.001$).

Discussion

We observed a significant improvement in perceived work ability in the 9-month early rehabilitation cognitive behavioral intervention group. There was a statistically significant increase in WAI in the intervention group that was not seen in the control group.

At the beginning of the study, there was a significant difference between the intervention and control groups in total WAI, where the intervention group had statistically lower WAI. This may be due to the fact that intervention and control groups were selected according to the participants' own interests and the situation in working life. However, both groups were in the WAI category of "good".

We do not have information on what was the cause of the subsequent trend for decrease of WAI in the control group, but it may have some connection to working life, since it is unlikely that it would occur e.g. only with increasing age because both groups were of similar age. It is known that WAI declines with age at the age of 50es, about 0.5- 1 points/ year; in women slightly less than in men [2].

The present outpatient rehabilitation with limited number of sessions aimed to encourage employees' ability to solve their own problems, which has previously been considered an important aspect of occupational wellbeing [8]. In fact, the present intervention managed to significantly increase psychological wellbeing as recorded by WAI. Learning a constructive coping pattern, creating communication and learning are key factors in promoting health and work ability [8]. The present findings of an increased WAI in the intervention group may be considered as important. However, one must bear in mind that supervisors' and co-workers' attitudes, beliefs and basic knowledge about how to be supportive are as important, since supervisor support is a significant predictor of work ability [9].

Grossmeier et al. note that "Health is a predictor of productivity, and the benefits of improved health on improved productivity are cumulative over time" [10]. Health-related productivity loss may increase interests in investing in work ability interventions such as the cognitive behavioral intervention described in the present study. In this context, we could say that this intervention as a good investment for the employer.

In conclusion, participants in the 9-month outpatient intervention group showed significant increase in WAI. This would suggest that a cognitive behavioral intervention as an early rehabilitation program is effective in increasing employees' work ability.

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Table 1. Changes in Work ability index-related factors. Within-group changes in intervention and control groups after nine months (2) compared with baseline (1). This table introduces only those answers where all items had been filled at the beginning and at the end.

Work ability index=WAI Work ability index 1.and 2.	Intervention group N=389		Control group N=100		Difference in changes between groups				
	Mean	SD	Change from baseline	P-value a		Change from baseline	P-value b		
Work ability relative to lifetime best? (1-10)									
1.	7.72	1.28	0.29	***<0.001	7.87	1.13	-0.17	0.168	**0.003
2.	8.01	1.37			7.70	1.59			
Work ability in terms of the demands of work? (2-10)									
1.	7.53	1.26	0.37	***<0.001	7.51	1.31	0.08	0.459	*0.024
2.	7.90	1.26			7.59	1.40			
Diagnosed diseases (1-7) 1=not less than 5 disease, 5= one disease, 7= not any									
1.	3.62	1.99	0.06	0.482	3.78	1.88	0.14	0.367	0.976
2.	3.68	1.99			3.92	1.85			
Work impairment (1-6)									
1.	4.78	0.95	0.15	**0.003	4.73	1.03	-0.12	0.192	**0.015
2.	4.93	1.00			4.61	1.13			
Sickness absence (1-5) 1=>100 days, 4= max 9 days, 5=not any									
1.	3.67	0.94	0.13	**0.004	3.86	0.92	-0.23	**0.006	***<0.001
2.	3.80	0.94			3.63	0.96			

Belief of work ability after 2 years (1-7)									
1.	6.40	1.26	0.13	*0.035	6.58	1.05	-0.57	**0.001	**<0.001
2.	6.53	1.29			6.01	1.60			
Psychological well-being. A total of 3 questions (1-4)									
1.	3.21	0.73	0.10	**0.004	3.24	0.77	*0.05	0.558	*0.054
2.	3.31	0.71			3.20	0.82			
Work ability index (WAI) (7-49)									
1.	36.93	5.25	1.22	***<0.001	37.57	5.84	-0.63	**0.046	***<0.001
2.	38.15	5.68			36.66	6.72			
a Paired Samples T Test					b Mann Whitney U test				

*p<0.05, **p<0.01 and ***p<0.001.

PUBLICATION III

Effects of a nine-month occupational intervention on health-related quality of life?

Ojala B, Nygård C-H, Huhtala H, Nikkari S

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ORIGINAL ARTICLE

Effects of a nine-month occupational intervention on health-related quality of life

BIRGITTA OJALA^{1,2}, CLAS-HÅKAN NYGÅRD¹, HEINI HUHTALA¹
& SEPPO T. NIKKARI^{2,3}

¹Faculty of Social Sciences, University of Tampere, Finland, ²Tullinkulma Occupational Health Unit, Tampere, Finland, and ³Faculty of Medicine and Life Sciences and FIMLAB Laboratories, University of Tampere, Finland

Abstract

The aim of this study was to evaluate the effectiveness of vocationally outpatient oriented rehabilitation on an intervention group, compared with a control group that did not take part in the intervention. The groups were compared for health-related quality of life (HRQoL) by the quantitative indicator RAND 36. Data were obtained by a self-report at baseline and at nine months follow-up. Differences between base-line and follow-up were analyzed within group and between the groups. The study population consisted of 751 municipal employees aged between 26 and 64 years; an intervention with 463 women and 115 men ($n = 578$), and a control group with 138 women and 35 men ($n = 173$). In this study we focused on those who had answered to all questions in RAND 36, thus 581 remained. Of these, 388 were in the intervention group (mean age 49.0 years) and 110 in the control group (mean age 48.4 years). Intervention was based on cognitive behavioral therapy. Participants in the 9-month outpatient intervention group showed statistically significant increase in all eight RAND 36 areas. Most improvement was seen in the psychosocial functioning index ($p = 0.002$). Although there were no statistically significant changes in RAND 36 components in the control group, difference in changes between groups were seen in energy and fatigue ($p < 0.001$), social functioning ($p = 0.032$) and general health perceptions 0.027 in favor of the intervention group. The results suggest that a cognitive behavioral intervention as an early rehabilitation program is effective in increasing employees' quality of life, as measured by RAND 36.

Key Words: Occupational health, vocational rehabilitation, quality of life, employee

Introduction

Health-related quality of life (HRQoL) is a broad term that contains an individual's ability to function according to perceived well-being in social, mental, and physical areas of life. It is a wider definer of well-being than work ability. On the other hand, it is conceivable that all life areas also affect the ability to work, and general well-being cannot be separated from well-being at work [1]. In fact, employees with the poorest mental health are known to have strong intention to retire early [2].

An aging workforce in Europe and the new competence requirements are challenging working capacity. When physical and mental demands at work are

higher than one's own capacity, it is difficult to stay at work [3]. The growing cost of disability increases the interest of employers to support employees' well-being. Outpatient intervention seems to change organizational culture into positive direction and this can be the key to create effective stress interventions: worker autonomy, job design, social support and covert messages sent to employees about how they are viewed by the corporation [4–6]. Workplace health promotion programs are reported to improve lifestyle, work-related outcomes and have a positive effect on overall health and well-being, mental health, nutrition and physical activity [7]. We created a new

Correspondence: Birgitta Ojala, Faculty of Social Sciences, University of Tampere, FI-33100 Tampere, Finland. E-mail: Ojala.Birgitta.M@student.uta.fi

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model of outpatient rehabilitation to support employee's well-being and were interested in if it had positive effects on municipal employees HRQoL. As the assessment instrument, we decided to use RAND 36, since it has been shown to be sensitive to change in estimating the benefits of rehabilitation [8].

Many personal and health behavior factors are associated with lower HRQoL, such as older age, medical comorbidities, depression and smoking, low physical activity, unhealthy food, overweight and poor sleep quality. Medical conditions that decrease HRQoL include cardiovascular disease, type 2 diabetes, osteoporosis, depression, hypertension and some cancers that increase sedentary lifestyle [8–11]. Surprisingly, excessive alcohol use does not associate with HRQoL [12].

It has previously been shown that a six-week employee wellness program based on the principles of cognitive behavior therapy combined with weekly aerobic exercise class was beneficial in improving the perceived HRQoL and changing health-related behaviors of clothing manufacturing employees [13]. However, that study was conducted relatively short term, and it could not be concluded that the intervention was more effective than a single health promotion talk to the control group, as no significant changes were noted between the two groups at six week post intervention.

The aim of the present study was to evaluate the effect of a cognitive behavioral intervention program. The study was conducted using early outpatient rehabilitation method with a nine month follow-up. RAND 36 was used to indicate HRQoL.

Study design

The study was designed to estimate the causal impact to the intervention group that was compared with a control group that did not take part in the intervention. Complete randomization of groups was not possible because the employers made the final decision who participated and who did not. The employers confirmed the group of persons who were able to attend the full process, not just one or two sessions of the rehabilitation days. The participation to the program was voluntary and was conducted during paid working hours. The total duration of the intervention was nine months.

One-day group meetings took place every two weeks during the first four months and a follow-up after five months from the last group meeting. Every participant of the intervention had a basic health screening by an occupational physician and an occupational physiotherapist who were familiar with the employees' workplace. Participants who completed

the RAND 36 questionnaires both at the startup of the intervention well as the follow-up were the only ones included in this part of the study.

The ethics committee of Tampere University Hospital approved the study protocol and written informed consent was obtained from all study participants.

Material and methods

Subjects

The outpatient intervention was arranged between the years 2011 and 2014. In all, 751 subjects were recruited from approximately 14,500 municipal employees in the city of Tampere, Finland. The intervention and control groups were formed from employees who had slightly decreased work ability according to their own evaluation and occupational health professionals. The multi-disciplinary team who directed the intervention had a good knowledge of the participants' work place and its special aspects in connection to health issues. Inclusion criteria of the employer's human resources unit for participation were defined as being a permanent employee or as a long-term substitute for at least one year of service.

The number of groups selected to the intervention totaled forty-nine. Each group comprised between eight to thirteen persons who each attended one day group session eight times at intervals of about two weeks. At the beginning and after four months individual screenings were undertaken by occupational physiotherapists, who also asked the participants to fill in the questionnaires at occupational healthcare.

The intervention was concluded after nine months with a three-hour follow-up group session. An interdisciplinary, goal-oriented multi-professional team supervised the groups. At the start goals were set together with the attendees and everyone defined their own goals to improve their individual work ability.

The total number of participants was 751, but in this study we focused on those who had answered to all questions in RAND 36, thus 581 remained. Of those 460 were in the intervention target group (mean age 49.0, range 26–64 years) and 121 in the control group (mean age 48.4, range 28–63 years).

In the intervention group 81.4% of the subjects were female and in the control group 84.5%. Professional experience was 19.2 years in the intervention group and 18.2 years in the control group. In all 53.4% subjects in the intervention group were married and 64.5% in the control group. Education in a University of Applied Science/second degree education was reported by 10.3% in the intervention group and 14.8% in the control group; a University

degree was held by 18.3% in the intervention group and by 16% in the control group. The percentages for vocational school were 64.3% in the intervention group and 63.9% in the control group. No vocational training was reported by 7.1% of the subjects in the intervention group and 5.5% in the control group.

Study design

Description of intervention:

Day 1. Health examination for 4 persons and ergometer tests for the same 4 persons from each group. Other 8 group members had a work out session. Each member of the group defined their own targets for the next two weeks and for the whole process. Muscular strength tests were conducted in each group as well.

Day 2. Health examination for 4 persons and ergometer tests for the same 4 persons from each group. Other 8 group members participated gym training. Lectures about work related matters, motivation and discussion of the subjects. Group activities, like muscle strength exercises, stretching exercises, and planning of homework were performed.

3. Health examination for 4 persons and ergometer tests for the same 4 persons from each group. Other 8 group members were at gym training. Understanding the differences and goals of muscular strength training. How to define weight and number of repetitions.

4. Theoretical background in aerobic training and a lecture on the function of the cardiovascular system. Feed-back of the individual ergometer test results, which were then applied for planning of practical aerobic training in Nordic walking with heart rate monitoring. Every participant used heart rate monitoring during exercise and they learned to recognize the feeling of heart rate levels during the exercise. The limits for basic endurance training and maximum endurance training were set in order to get experience of how it feels to practice basic endurance at your own optimum heart rate level.

5. Lecture on the basis of a healthy diet. Theory and exercises on physical ergonomics. Group activities, aerobic exercise.

6. Lecture on the basis of a healthy diet. Group activities, importance of water aerobics and water running in theory and practical training.

7. Lecture on the importance of adequate sleep. Group activities, stretching and relaxation in theory and practice.

8. Group activities, dance exercise to improve balance and coordination. Employer's supervisors attended the final group session and they took part in the discussion about issues in the workplace that were connected to well-being at work.

9. The follow-up group session after nine months from beginning included review of the participants' current situation and how goals were achieved.

According to the cognitive behavioral model, the intervention days consisted of different educational components (Table I). It was considered important that the learned and handled issues and items were adapted into everyday life and work as soon as possible in order to obtain permanent effect.

Measurement

RAND 36. HRQoL survey is based on the international classification of functioning, disability and health (ICF) [1]. The RAND 36 is increasingly used in clinical rehabilitation and medicine research [14–16]. Most of the questions of RAND 36 are classified according to ICF codes as function and performance of the body [11,12,14].

RAND 36 reference values are available for Finnish population [9,10]. The validity of RAND 36 measures has proved to be very consistent on the basis of both cluster and confirmatory factor analysis in working-age rehabilitation clients [17,18]. RAND 36 has a long history in health measurement. As outlined above, RAND 36 is also considered to be a measurement of functional capacity [9,14–20]. This is important in order to plan more suitable work for those who have some limitations for continuing in their current task [21–23].

The Finnish version of the RAND 36-item Health Survey 1.0 was used [5,14]. The questionnaire was given to the subjects before the start of intervention and after nine months, just before the follow-up day. Both intervention and control groups filled the form at the same time.

RAND 36 questionnaire has 36 items, which include eight health concepts that represent dimensions of HRQoL. More specifically, physical functioning (PF) includes a variety of daily activities. Role functioning/physical (RP) involves role limitations due to physical health problems. Role functioning/emotional (RE) are role limitations due to emotional problems. Energy/fatigue (EF) includes questions on how one has felt in the past 4 weeks, from vigor to tired. Emotional well-being (EWB) includes questions on how one has felt in the past 4 weeks from anxiety to happiness. Social functioning (SF) asks

Table I. Issues included in the intervention.

Intervention included:	Hours
Physical exercises:	
aerobic training	
strength	
endurance	
mobility	
balance	
coordination training	
water exercise	14 h
Nutrition	4 h
Assets and coping	4 h
Ergonomics	2 h
Musculoskeletal diseases	2 h
Intoxicants and memory	2 h
Sleep	2 h
Relaxation practice	2 h
Motivation	2 h
Individual goal setting	2 h
Work ability, well-being	2 h
Problem-solving skills	2 h
Everyday work and modification	4 h
Social interaction	2 h
Results of the physical tests	2 h

how much of the time physical or emotional difficulties have disrupted normal social activities during the past 4 weeks. Bodily pain (BP) involves intensity of pain, and how much it has disturbed your activities during the last four weeks. General health perceptions (GHP) involve general health. Each dimension has a score between 0 and 100, where a higher score means better health [1,7].

RAND 36 was divided dichotomously to a physical capacity index $(GHP + BP + PF + RP)/4$ and a functional capacity index $(EWB + RE + SF + EF)/4$. One score value, the mean of all items of RAND 36, was also used to reflect overall quality of life.

Statistical analyses

Differences between the groups at baseline were compared with nine months follow-up by the paired samples t-test. Change between intervention and control groups was tested by Mann-Whitney U test; *p*-values of less than 0.05 were considered statistically significant. Data analysis was done by using SPSS 23.0 software.

Results

The intervention and control groups did not differ in age (*p* = 0.903), gender (*p* = 0.454), marital status (*p* = 0.535), years of professional experience (*p* = 0.557), and vocational training (*p* = 0.410). In subject recruitment the largest participation of females

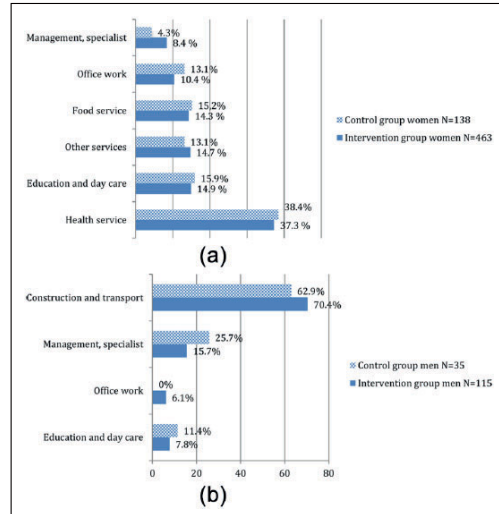


Figure 1. Vocational areas in (a) women and (b) men.

came from health service (37.3%) and for male from construction and logistics (70.4%) (Figure 1).

Comparing baseline mean values of all eight different RAND 36 single-scale scores to nine months follow-up, there were statistically significant differences (*p* < 0.05) in all items in the intervention group (Table II). Difference in changes between groups were seen in energy and fatigue (*p* < 0.001) and social functioning (*p* = 0.032) in favor of the intervention group.

In the intervention group the total RAND 36 mean value was 76.1 at the baseline and 80.0 after the nine months follow-up (*p* < 0.001) and in the control group 74.8 at the baseline and 75.4 after the follow-up (*p* = 0.592). Total RAND 36 increased more in subjects in the intervention group (*p* < 0.001) compared to controls (*p* = 0.012) (Table III).

Physical capacity index at the baseline was 75.2 and at the follow-up 78.9 (*p* < 0.001 in the intervention group) and in the control group 73.4 at the baseline and at the follow-up 75.4 (*p* = 0.205), respectively. The psychosocial functioning index at the baseline was 76.9 and at the follow-up 81.1 (*p* < 0.001) in the intervention group and 76.2 at the baseline and at the follow-up 75.5 (*p* = 0.679) in the control group. The condition of psychosocial functioning increased more in subjects in the intervention group compared to controls (*p* = 0.002) (Table III).

Discussion

We report positive effects of a cognitive behavioral intervention as an early rehabilitation program to

Table II. Changes in RAND 36-related factors. Within-group changes in intervention and control groups after nine months (2) compared with baseline (1). This table introduces only those answers where all items had been filled in the beginning and in the end.

RAND 36 RAND 36 1. and 2.	Intervention (N = 388)				Control (N = 110)				Difference in changes between groups ^b
	Mean	SD	Change from baseline	p-value ^a	Mean	SD	Change from baseline	p-value ^a	
Physical functioning PF (10 items)									
1.	86.55	13.96	2.32	<0.001	86.86	13.42	0.82	0.318	0.108
2.	88.87	12.72			87.68	12.84			
Role functioning/physical RP (4 items)									
1.	79.51	30.16	3.48	0.045	71.36	38.88	4.32	0.272	0.937
2.	82.99	29.70			75.68	34.44			
Role functioning/emotional RE (3 items)									
1.	85.05	28.05	4.30	0.003	80.91	31.43	1.21	0.668	0.224
2.	89.35	25.04			82.12	33.69			
Energy and fatigue EF (4 items)									
1.	63.89	18.24	5.21	<0.001	64.55	19.72	-1.19	0.497	<0.001
2.	69.10	17.71			63.36	22.32			
Emotional well-being EWB (5 items)									
1.	76.70	15.66	2.58	0.001	77.24	15.12	-1.68	0.219	0.053
2.	79.28	15.01			75.56	19.28			
Social functioning SF (2 items)									
1.	82.06	20.49	4.57	<0.001	81.93	20.78	-0.91	0.612	0.032
2.	86.63	18.56			81.02	23.99			
Bodily pain BP (2 items)									
1.	68.86	22.54	3.85	<0.001	68.07	23.45	1.73	0.439	0.040
2.	72.71	23.20			69.80	22.95			
General health perceptions GHP (5 items)									
1.	65.93	18.22	5.05	<0.001	67.32	18.98	1.00	0.469	0.027
2.	70.98	18.03			68.32	20.88			

^aPaired samples t-test.

^bMann-Whitney U test.

Table III. Total RAND 36, the condition of physical capacity, and the condition of psychosocial functioning at the beginning and follow-up.

	Intervention (N = 388)				Control (N = 110)				Difference in changes between groups
	Mean	SD	Change	p-value	Mean	SD	Change	p-value	
Total RAND 36 1.	76.07	14.44	3.92	<0.001	74.78	16.59	0.66	0.592	0.012
Total RAND 36 2.	79.99	14.18			75.44	18.37			
The condition of physical capacity 1.	75.21	16.97	3.68	<0.001	73.40	19.81	1.97	0.205	0.254
The condition of physical capacity 2.	78.89	16.90			75.37	19.14			
The condition of psychosocial functioning 1.	76.92	16.97	4.17	<0.001	76.16	18.38	-0.64	0.679	0.002
The condition of psychosocial functioning 2.	81.09	15.85			75.52	22.58			

RAND 36 includes all items. The condition of physical capacity includes GHP + BP + PF + RP. The condition of psychosocial functioning includes EWB + RE + SF + EF.

improve employees' HRQoL. There was a statistically significant increase in RAND 36 index in the intervention group that was not seen in the control group. All RAND 36 dimensions increased statistically significantly in the intervention group. Although there were no statistically significant changes in RAND 36 components in the control group, differences in changes between groups were seen in energy and fatigue and social functioning in favor of the intervention group.

Our findings confirm the results of a previous study that showed benefits of a cognitive behavior therapy six-week program, combined with weekly aerobic exercise, in improving the perceived HRQoL [4]. However, we were also able to show a beneficial difference compared to a control group with a nine months follow-up.

Primary prevention interventions can help the employees to move in a healthier direction, even small changes in the behavior may have impact on

general health and improve employee productivity [4,8,15,17]. For future programs it may be profitable to adapt a more salutogenic approach as a theory to conduct health promotion since subjects may have a better resistance to disease when life is felt to be comprehensible, manageable, or meaningful, since people feel coherence and continuity in life. It has been shown that when participants were able to develop their personalities, coping strategies and reassess their life situation at their own speed and rhythm in group activities, they improved their health status, quality of life, and function [5]. We have also used many of these ideas in our intervention.

Total RAND 36 result was clearly different between the groups in favor of the intervention. However, when RAND 36 answers were divided dichotomously to a physical capacity index and a psychosocial capacity index the changes the physical capacity did not reach statistical significance between the groups. In fact, it is possible that RAND 36 is insensitive to detect a change when baseline scores for physical capacity are relatively good as in the present study. This may be due to a ceiling effect, when results that are already good are tried to be improved. There were few participants who had major limitations in the physical functional areas surveyed by RAND 36 such as heavy lifting, carrying, climbing stairs, body bending, walking 2 km, 500 m, or 100 m, bathing or dressing. Thus, the physical capacity was the only RAND 36 index, where there was no statistically significant change. This is somewhat in contrast to earlier studies, since increased time spent on physical exercise has been shown to correlate with improvement in both physical and mental components summary of RAND 36 [6,10,13,15,24–28]. However, compared to reference values from the Finnish population by age and gender, the men and women in the intervention group had higher levels of RAND 36 values [8], which may indicate that RAND 36 questions are not the right instrument to measure physical capacity in this study.

There is a need to extend working careers and occupational health intervention programs may prevent early retirement [29]. Intervention programs may also advance the development of working conditions and environment and rehabilitation of the employees. Interventions which influence psychosocial work factors such as perceived changes in leadership, social climate, organizational commitment, and job strain can improve employees' health and also organizational outcomes in the long run [1,7,25,26]. Working life needs more research on quality of life indicators, particularly how impact of rehabilitation interventions support the working capacity of the labor market.

Limitations and strengths of the study

Strengths of the study were that we had a remarkable group of municipal employees with suitable controls, and those who participated in the intervention group were very committed, with only a few who dropped out. A limitation is that the subjects represent a relatively small population. However, the city of Tampere is one of the largest municipal employers in Finland. Although we had a control group for the intervention, it was not randomized because of workplace demands for intervention. Intervention and control groups were selected according to the participant's own interests and the situation in working life. This selection may have produced some differences between the groups at baseline. Moreover, not all participants filled in the whole RAND 36 questionnaire and we analyzed only those who had all the items filled.

Conclusion

In conclusion, participants in a 9-month outpatient intervention group indicated a significant increase in for health-related quality of life (HRQoL) as measured by the quantitative indicator RAND 36. Future research should be targeted to find out exactly what kind of support the participants need to adapt change of their behavior.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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PUBLICATION IV

A Cognitive Behavioural Intervention Programme to Improve Psychological Well-Being?

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Article

A Cognitive Behavioural Intervention Programme to Improve Psychological Well-Being

Birgitta Ojala ^{1,2,*}, Clas-Håkan Nygård ¹, Heini Huhtala ¹, Philip Bohle ³ and Seppo T. Nikkari ^{2,4}

¹ Faculty of Social Science, Health Unit, University of Tampere, 33014 Tampere, Finland; Clas-Hakan.Nygaard@staff.uta.fi (C.-H.N.); Heini.Huhtala@staff.uta.fi (H.H.)

² Tullinkulma Occupational Health Unit, 33100 Tampere, Finland; Seppo.Nikkari@staff.uta.fi

³ Tasmanian School of Business and Economics, University of Tasmania, Private Bag 84 Hobart, 7001 Tasmania, Australia; philip.bohle@sydney.edu.au

⁴ Faculty of Medicine and Health Technology, Tampere University, 33100 Tampere, Finland

* Correspondence: ojala.birgitta@gmail.com; Tel.: +358-40-5000-392

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Abstract: Psychosocial risk factors have increased in today's work environment, and they threaten work ability. Good workplace atmosphere, psychosocial support, the ability to cope with stress, and skills and knowledge are all connected to more successful coping. Faster changes in the work environment and an increased workload can lead to a chain of fatigue and illness. The aim of this study was to evaluate a cognitive behavioural intervention as an early rehabilitation strategy to improve employees' well-being, in intervention group N446 and in control group N116. The well-being measures used were the Bergen Burnout Inventory (BBI 15), Utrecht Work Engagement Scale (UWES), and depression and stress screening questions. Data were obtained by a self-report survey at baseline and at a nine-month follow-up. Differences were analysed within and between groups. The results suggest that cognitive behavioural intervention as an early rehabilitation programme will increase employees' well-being measured by BBI 15, UWES, and depression and stress screening questions. In the intervention group, the total BBI 15 score ($p < 0.01$) and each of the three subdimensions of burnout (exhaustion, cynicism, and sense of inadequacy) decreased at follow-up. Mental health issues are the commonest reasons for sick leave and early retirement. We need ways to prevent these issues.

Keywords: stress; occupational health; intervention; burnout; well-being

1. Introduction

Work is changing, and so are work-related occupational hazards [1]. Work-related psychosocial factors are considered a new type of occupational hazard. They include work characteristics and demands, overload and mental stress, workers' opportunities to influence work tasks and procedures, their use of knowledge and skills, and difficulty and hurry at work [1,2].

These factors increasingly influence workers' capacity to cope at work. A prolonged discrepancy between employees' capacities and work demands may produce burnout, which consists of three main symptoms: Exhaustion, cynicism, and reduced professional efficiency. Burnout is typically associated with absenteeism, sick leave, job turnover or physical health issues [3–5]. Approximately 5% of the Finnish population suffer from depression annually, and there is a reciprocal relationship between burnout and depression symptoms [6,7].

Participatory interventions that focus on the individual as well as on the organisational level have been shown to be effective in treating burnout [8]. Successful intervention programmes against

burnout can be enhanced with refresher courses [9]. It is also important to recognise different burnout patterns and to focus activities effectively [10–12].

Employee engagement can be built at work through meaningful experiences and by enabling workers to understand why they are doing the work. In the health sector, people usually describe their work as meaningful and valuable. Everybody ascribes meanings to their work—for example, to the nature of the work role, and to the relationships that they build with others—and these have implications for their experiences of work. Employees are usually fully engaged in contexts where a source of meaningfulness is present. Agreeable identities with clear roles, important work relationships, challenging work, supportive leadership, and the pursuit of rewards all increase engagement. Employees' engagement can thus be improved by supervisors, leaders, human resources staff, and other co-workers. Under these conditions, workers do their best, are loyal to their employer, and are willing to be flexible if the work so requires [13]. It has been shown that the quality of nurses' work improves with such engagement [14].

Job strain may precipitate clinical depression among employees, according to a review of six studies with a total of 27,461 participants and 914 incident cases of clinical depression [11]. In some organisations, best practices for managing workplace stress have included context-specific interventions, combined organisational and individual interventions, a participative approach, and a change in culture [15]. When office employees were allocated to social and physical environmental intervention groups, social–environmental intervention showed an improvement in task performance, whereas physical environmental intervention showed an improvement in absorption [15]. Workplace-based, high-intensity psychological interventions may improve work disability outcomes for workers with common mental health conditions [16,17]. However, in a meta-analysis of effects of occupational stress management intervention programmes, cognitive behavioural therapy (CBT) interventions consistently produce larger effects than other types of intervention [18].

The CBT model of intervention encourages individuals to act by themselves to achieve their own goals by supporting them to take actions towards those goals [18]. CBT has been found to be effective in improving work-related stress, depression, anxiety, chronic pain, chronic fatigue syndrome, and insomnia. It has also been found to increase work engagement within a working population [19].

Burnout reflects a negative relationship of hostility and alienation between the person and his/her job, the positive opposite of which is engagement, a relationship of reconciliation, and acceptance [20]. We conducted a prospective study to evaluate the effects of a CBT intervention to improve employees' well-being, as measured by outcome of questionnaires on psychosocial variables from positive and negative directions.

2. Material and Methods

2.1. Participants

In 2011–2014, our outpatient intervention study recruited a total of 779 municipal employees. Participants were volunteers who met the inclusion criteria for the study: Being employed in the public sector and working as permanent or long-term temporary staff with at least one year of service. The study was a nine-month follow-up designed to study the causal impact of the intervention on an intervention group, with a control group that did not take part in the intervention. Of the 779 total participants, 594 took part in the intervention group and 185 in the control group. Control group members had the opportunity to take part in the intervention after they had answered follow-up questionnaires before the intervention started. The intervention sessions lasted for four months, with one session every two weeks; five months after that came the follow-up tests and group meetings. The intervention was conducted during paid working hours, and participants were required to commit to the entire programme.

Of the 779 participants, 80% were women and 20% were men. The mean age of subjects was 49.9 years (range 21–64 years). There were no statistically significant differences between the intervention group and the control group in age, gender, body mass index, marital status or years of work experience (Table 1). However, there was a difference in education: The intervention group had less

vocational training than the control group. The subjects were recruited from different vocational areas for the intervention programme. The largest participation of women came from health services (37.3%), and of men from construction and transport (70.4%) (Table 2).

In the intervention group, 446 (75.1%) completed the questionnaires at both baseline and follow-up. There were missing responses in 148 cases. In 28 of these, there was natural movement, such as changes of workplace, absence, changes of job, and death. Nineteen cases did not want to take part in the study, and 101 answered incompletely at the baseline or follow-up. In the control group, 116 (62.7%) answered at baseline and follow-up, there was natural movement with six participants, and 63 answered incompletely at baseline or follow-up (Figure 1).

Table 1. Background characteristics of study population.

	<i>N</i>	Intervention	<i>N</i>	Control	<i>p</i>
Age (years)	578	49.2 (7.8)	173	48.1	0.205
Gender, female (%)	463	80.1	138	79.8	1
Married (%)	578	56.6	173	61.5	1
Years of professional experience	547	19.2 (10.1)	165	18.2 (10.6)	0.702
Education					
No vocational training (%)	38	7.1	9	5.3	
Vocational school (%)	344	64.3	108	63.9	
University of applied science (%)	55	10.3	25	14.8	0.61
University degree (%)	98	18.3	27	16	
Total	535	100	169	100	

Table 2. Main occupations of study population.

	Intervention				Control			
	Female	%	Male	%	Female	%	Male	%
	<i>N</i>		<i>N</i>		<i>N</i>		<i>N</i>	
Health service	173	37.3	0	0	53	38.4	0	0
Construction and transport	0	0	81	70.4	0	0	22	62.9
Education and day care	69	14.9	9	7.8	22	15.9	4	11.4
Other services	68	14.7	0	0	18	13.1	0	0
Food services	66	14.3	0	0	21	15.2	0	0
Office work	48	10.4	7	6.1	18	13.1	0	0
Management specialist	39	8.4	18	15.7	6	4.3	9	25.7
Total	463	100	115	100	138	100	35	100

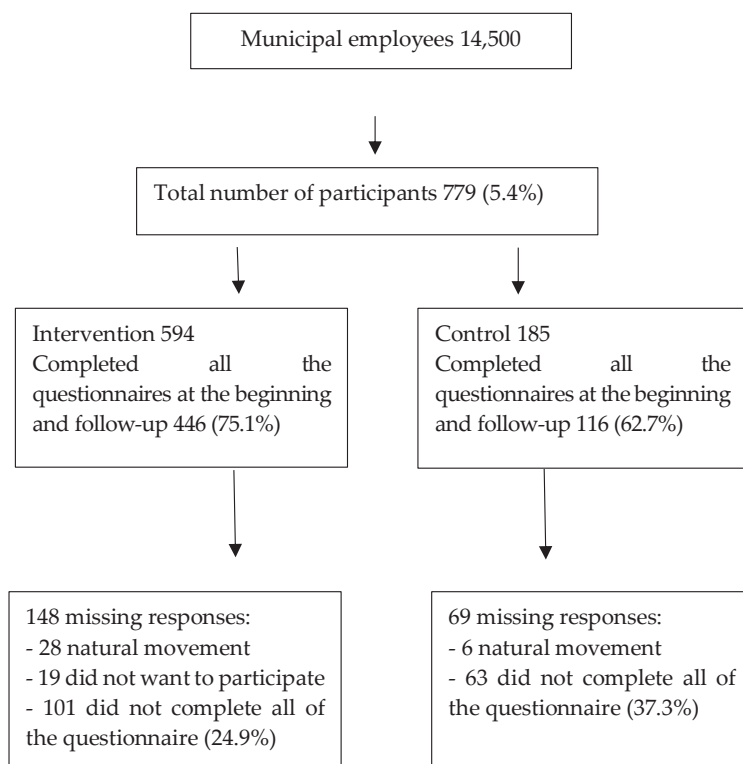


Figure 1. Participants in this study.

2.2. Intervention

An interdisciplinary, goal-oriented multi-professional team (a doctor, an occupational physiotherapist, an occupational psychologist, and a nurse) facilitated each intervention subgroup. The total intervention group was broken down into smaller subgroups for the purposes of the intervention. Goals were set with the participants, who each defined their own goals to improve their work ability. The subgroups met regularly for four months (one day every two weeks). After a further five months, there was the follow-up, which consisted of a three-hour subgroup meeting.

The intervention consisted of different educational components—for example, related to physical training, it was important that all participants understood their own physical test results and how to improve their aerobic condition, muscle strength, balance, and coordination. Physical training included identifying several aspects of one's physical condition and conducting practices based on those aspects, such as aerobic training focused on one's pulse level, or training for strength, balance, and coordination. During group reflection, all participants shared their experiences for last two-week period, providing feedback on what have they done to achieve their goals. Work well-being is in direct connection to the work and coping at work. Participants analysed their everyday work-related problems and found ways to understand changes at work and change-related phenomena and they learned new problem-solving skills and skills to talk with their supervisors at work about their work and develop work relationships in everyday life. Work-related problem-solving skills were practised by analysing the elements of one's work. Skills to talk and develop work relationships in everyday life were practised by starting recommended conversations in the workplace with one's supervisor concerning one's work and its daily challenges. Participants had experience on how to set short- and long-term individual goals and what kind of changes are realistic in their life situation.

On each intervention day, there were discussions of the issues affecting participants' work ability. Every meeting started with individual reflections on the previous two weeks, including things that had been successful, as well as challenging situations. Groups were directed to try to find solutions to challenging situations, rather than to concentrate on problems; to analyse their own work with tools that would help them to see changes in their working lives from a new perspective; to start conversations with their supervisors according to their own interests; and to plan their own paths towards their goals. Peer support was available during the group conversations, which were described as very meaningful by the participants. The group discussions were well received by the participants.

It was considered important that learning should be transferred to everyday health-related activities as soon as possible, to facilitate long-term effects. The rhythm of sessions supported this self-reliance: The sessions were every two weeks, and between sessions, everybody followed their own schedule. This process made it possible to implement practices around all the relevant issues in everyday life. This would be less easy in institutional rehabilitation, where participants usually spend longer periods away from ordinary life situations.

2.3. Study

The study was a nine-month trial to estimate the causal impact of the intervention on an intervention group, with a no-treatment control group that did not take part in the intervention. Only data from participants who had responded to all questions during the intervention and follow-up were included in the data analysis. Invitations to participate in the intervention and control groups were sent out to these employees through their workplace management.

Since this intervention was undertaken at an early, pre-clinical stage, there was no need for a medical certificate to take part. The main purpose was to offer an opportunity for intervention to those who needed some support to maintain their own work ability. This approach ensured that the intervention was offered at a time the participants believed was appropriate for them.

Participants were selected for the intervention by occupational health service professionals who had knowledge of the participants' medical histories, together with the participants' employers, who were aware of their work demands and workloads. Selection for intervention was thus undertaken collaboratively between occupational health service professionals and the employer. The employer, however, made the final decision as to whether the person could take paid leave from work on the outpatient intervention days. Employers paid the costs of the implementation, and employees took part during paid work hours. Social security paid compensation for the wage costs.

Widely used questionnaires with established reliability and validity were used. Questionnaires were completed at the beginning of the intervention and during follow-up. All questionnaires were administered to the intervention and control groups at the same time: Before the intervention and after nine months, just before the monitoring day.

The study was approved by the ethics committees of the Pirkanmaa Hospital District and the University of Tampere (No: R11068). Written informed consent was obtained from all study participants.

2.4. Measurement

The measurement tools used in this study were the Bergen Burnout Inventory (BBI) and the Utrecht Work Engagement Scale (UWES). All measurements were taken at baseline during the information session (autumn 2011); the intervention group completed the measurements at the follow-up test meeting, and the same measurements were taken for the control group at the same time (autumn 2014). The intervention and control subgroups who answered the questionnaires were from the same work units. Each question, including personal information, such as name and social security number, was numbered. The questionnaires were saved in folders, and the folders were archived according to healthcare requirements. The data were stored in a password-protected Excel file, with personal information removed, for statistical tests.

BBI 15 was used to measure burnout. It includes three sub-dimensions: Exhaustion (five items), cynicism (five items), and sense of inadequacy (five items). The internal validity of this test has been previously described [20,21]. The percentiles for age and gender are presented in the manual: Zero to 74 indicates no burnout, 75 to 84 indicates slight burnout, 85 to 94 indicates moderate burnout, and 95 to 100 indicates serious burnout. In this study, we considered only the total sum of BBI 15 and its subdimensions. The BBI 15 measurement can be used in research and occupational health contexts, because BBI 15 has high item–scale reliabilities and good concurrent validity among managers in Finland and Estonia [22].

UWES 9 was used to define three dimensions of work engagement: Vigour (three items), dedication (three items), and absorption (three items) [3]. Persons with high vigour scores report high energy, are willing to invest high effort in their work, and display mental resilience while working; persons with high scores on dedication are inspired by their work, see their work as important, and feel pride in their work; persons with high scores on absorption report giving full attention to their work, and the majority find it difficult to detach from work. The UWES assesses a mental state of accomplishment, which is the opposite to burnout [23,24]. Intercorrelations between the three UWES scales exceed 0.65, and the internal consistency of Cronbach's α is equal to the critical value of 0.70 [25,26]. UWES 9 was developed by Schaufeli and Bakker in the Netherlands [27–29].

Two questions were used to screen for depression: (1) "During the last month, have you often been worried, dismal, depressed or hopeless? Answer yes or no"; (2) "During the last month, have you often been worried about experiencing a lack of interest or unwillingness to accomplish things? Answer yes or no". One or more affirmative answers indicated probable depression [27]. The stress screening question consisted of a single item: "Stress refers to a situation in which a person feels tense, restless, nervous or anxious, or where it is difficult to sleep because of issues constantly on your mind/due to worry. Are you currently experiencing this kind of stress?" The question was answered on a scale from one (not at all) to five (very much) [30].

2.5. Data Collection

The primary measurement tools used in this study were quantitative, like the Bergen Burnout Inventory (BBI15) and the Utrecht Work Engagement Scale (UWES). The intervention and control groups who answered these questionnaires were from the same work unit and they had the same criteria for taking part to the intervention. At the time of the first measurements filling, there was not any group division. We tried to randomise these groups, but we did not totally succeed because of working conditions. All measurements were taken at baseline in the information session of the intervention for both groups; the intervention group completed the measurements at the follow-up test meeting, and the same measurements were posted for the control group at the same time. The questionnaires were distributed to study participants in autumn 2011 and autumn 2014. The participants could fill in the questionnaires during their working hours.

2.6. Statistical Analyses

Differences between the groups at baseline were tested using the Mann–Whitney U test or chi-square test for categorical variables. Within-group comparisons between baseline and nine-month follow-up scores were performed using the Wilcoxon signed-ranks test. The main effects and interactions for the scores of the intervention and control groups at baseline and follow-up were tested using repeated measures analysis of variance. p Values of less than 0.05 were considered statistically significant. The data analysis was performed with SPSS 23.0 software (IBM Corporation, Armonk, NY, USA).

3. Results

The results contain only those answers where all items had been filled in at the beginning and end of the study. Baseline, follow-up, and the changes between baseline values and follow-up for the intervention and control groups are shown in Table 3 for the BBI 15 and UWES.

Total BBI 15 values for the intervention group were 36.9 (standard deviation (SD) 11.8) at baseline and 33.9 (SD 12.3) at follow-up. The change from baseline was -3.0 ($p < 0.001$). Values for the control group were 37.6 (SD 12.2) at baseline and 37.5 (SD 14.4) at follow-up. The change from baseline was 0.1 ($p = 0.912$). The difference in changes between groups was statistically significant ($p = 0.023$).

In the intervention group, the total BBI 15 score ($p < 0.01$) and each of the three subdimensions of burnout (exhaustion, cynicism, and sense of inadequacy) decreased at follow-up. There was no corresponding decrease in BBI 15 scores for the control group. The difference in changes between groups in BBI 15 sub-scores was statistically significant for exhaustion ($p < 0.001$), but not for cynicism ($p = 0.927$) or sense of inadequacy ($p = 0.016$).

Total UWES 9 values for the intervention group were 4.3 (SD 1.1) at baseline and 4.5 (SD 1.1) at follow-up ($p < 0.001$). Values for the control group were 4.2 (SD 1.0) at baseline and 4.4 (SD 1.1) at follow-up ($p = 0.142$). There was no difference in changes (0.2) between the groups ($p = 0.711$), although the change in p -value was significant in the intervention group ($N = 446$) compared with the control group ($N = 116$). The total UWES 9 score and all three of its dimensions of work engagement improved in the intervention group ($p < 0.001$).

There was also a similar improvement in total UWES scores and two of its dimensions (vigour and absorption) compared with the control group (0.2), change in dedication in the intervention group was also 0.2, and in the control group, 0.1. It is possible that the questionnaire itself acted as intervention and led to some positive change. However, there were no statistically significant differences in the changes in any UWES scores from baseline to follow-up between the groups, because the change from baseline was very similar in both groups (Table 3).

Table 3. Intervention and control groups at baseline and follow-up on total Bergen Burnout Inventory (BBI) 15 and Utrecht Work Engagement Scale (UWES) and all items, and changes in BBI 15 and UWES, related factors.

BBI 15		Baseline		Follow-Up		Change from Baseline	p -Value	Difference in Changes between Groups
Intervention Group $N = 425$, Control Group $N = 109$		Mean	SD	Mean	SD			
Total BBI 15	Intervention	36.9	11.8	33.9	12.3	-3	<0.001	0.023
	Control	37.6	12.2	37.5	14.4	0.1	0.912	
Exhaustion (5 items)	Intervention	13.2	4.8	12.1	5.2	-1.1	<0.001	<0.001
	Control	12.9	4.6	13.1	5.3	0.2	0.477	
Cynicism (5 items)	Intervention	10.6	4	10	4	-0.6	<0.001	0.927
	Control	11.2	4.2	11	5.1	0.2	0.622	
Sense of inadequacy (5 items)	Intervention	13.1	4.8	11.8	4.9	-1.3	<0.001	0.016
	Control	13.6	4.9	13.4	5.5	0.2	0.68	
UWES 9		Baseline		Follow-Up		Change from Baseline	p -Value	Difference in Changes between Groups
Intervention Group $N = 446$, Control Group $N = 116$		Mean	SD	Mean	SD			
Total UWES 9	Intervention	4.3	1.1	4.5	1.1	0.2	<0.001	0.711
	Control	4.2	1	4.4	1.1	0.2	0.142	
Vigour (3 items)	Intervention	4.3	1	4.5	1	0.2	<0.001	0.555
	Control	4.2	1	4.4	1	0.2	0.154	
Dedication (3 items)	Intervention	4.4	1.1	4.6	1.1	0.2	<0.001	0.919
	Control	4.4	1.1	4.5	1.1	0.1	0.054	
Absorption (3 items)	Intervention	4.1	1.1	4.3	1.1	0.2	<0.001	0.659
	Control	4.1	1	4.3	1.1	0.2	0.232	

Notes: Within-group changes in intervention and control groups after nine months (2) were compared with baseline (1). Difference in changes between groups measured by analysis of variance. Table shows only answers where all items were filled in at the beginning and end of the study.

The composite score for the two depression screening items decreased significantly from baseline to follow-up for the intervention group ($N = 451$), in which 6.4% of scores increased, 13.3%

decreased, and 80.3% were at the same level as baseline ($p = 0.001$). There was no significant change for the control group ($N = 115$), in which 12.2% of scores increased, 7.8% decreased, and 80% were at the same level as baseline ($p = 0.405$).

The composite score for the one stress screening question compared with the baseline showed significant differences in the follow-up of the intervention group ($N = 445$): 39% increased, 15.5% decreased, and 45.5% were at the same level as baseline ($p < 0.001$). In the control group ($N = 117$), 24% increased, 26% decreased, and 50% were at the same level as baseline ($p = 0.596$).

4. Discussion

The principal finding of this study is a statistically significant improvement in several measures of psychosocial well-being (BBI 15, UWES, stress, depression) for participants who completed the cognitive behavioural intervention programme. No corresponding changes were identified in the control group. There was a significantly greater change in BBI 15 from baseline for the intervention group than for the control group. The UWES questionnaires seemed to produce nearly the same improvement in both the intervention and control groups, although the improvement in the control group was not statistically significant because of the group size. Factors associated with social processes at work seem to be crucial to burnout as measured by BBI 15. Burnout is connected to job demands, a lack of job resources, and health problems. When intervention leads to positive changes in participants' physical condition or work environment, participants have been shown to be able to modify their self-perceptions, resulting in psychological and behavioural changes, such as increased self-approval, self-mercy, and recognition of their inner needs and limits [30].

It seems that the effects of our cognitive behavioural intervention to improve employees' well-being was able to meet some challenges in the improvement of attitudes as measured by BBI 15. The UWES 9, used to define three dimensions of work engagement, showed significant improvement in the intervention group, for whom goals were set in collaboration with the participants, and every participant defined their own goals to improve their work ability. An earlier study also suggested that focusing on work engagement might benefit the individual. Employees who seem to perform better have elevated levels of energy and identification with their work [31].

All three UWES dimensions were at average levels at the beginning and follow-up, although absorption increased to an elevated level in both the intervention and control groups. It may be that the questionnaire acted as an intervention for both groups, regardless of other interventions [25,29].

The composite of two depression screening items showed significant improvement at follow-up for the intervention group. This result contrasts somewhat with earlier evidence that the use of screening for depression is associated with only a modest increase in its recognition. If used alone, screening questionnaires for depression appear to have little or no impact on the management of depression [25]. However, our intervention was performed after initial screening and appeared to influence depressive thoughts positively. The stress screening consisted of a single question, and stress was lower after the intervention. This result is in line with previous findings that cognitive behavioural stress management interventions are more effective than other intervention types [31].

The practical point of intervention is to be aware of the different profiles among employees regarding adjustments in the work and non-work demands they face. It is important to create interventions to support work cultures for diverse ways of working, because there is no single optimal way to manage boundaries between work and non-work. Person-oriented interventions that are tailored to support different profiles are needed [32].

4.1. Limitations of the Study

One limitation is that the participants represent a relatively small population in Finland. The intervention and control groups were selected partly according to the participants' own interests. The overall workload of every employee in the workplace was considered during the selection process by the employer. This selection may have produced differences between the groups at baseline, and selection for the intervention might be one driver of some changes in the scores. Supervisors played a key role in allocating participants to groups.

A randomised control group could not be used for the intervention because of workplace constraints. Issues that needed to be considered included the timetable of the entire process, holidays, individuals' work situations, and the need to achieve a sufficient number of participants in the intervention group—there were not the same numbers of participants in the control group. However, the control group was from the same work unit as the intervention group, and participants were chosen as randomly as possible from that environment.

Question-based research may suffer from bias if the participants feel satisfied with the service and therefore respond positively when they answer the second time. Two dimensions of the UWES 9 results also improved in the control group, and statistically, the same change was significant in the larger intervention group, but not in the smaller control group; the change between the groups showed no statistical difference. This kind of long-lasting service includes many changing variables, which makes it difficult to define the causes of the results. A third measurement point would have enabled broader statistical analysis.

In this study, we had a respectable amount of data to ensure its adequacy for possible dropouts. Dropout is a prevalent complication in the analysis of data from follow-up studies, but in this study, there were no differences between those who responded compared with those who did not in terms of age, gender, years of work or work unit.

As part of our results suggest that the cognitive behavioural intervention was effective in increasing employees' well-being, we currently have no measures to show its financial benefits to the employer. One recent systematic review has found that it is difficult to draw conclusions about the cost-effectiveness of intervention outcomes, because of the shifting quality of the studies [33].

5. Conclusions

This study suggests that a cognitive behavioural intervention achieved significant improvements in several measures of mental health. The results imply that this kind of intervention is needed to give early support on mental health issues for the working-age population. Early rehabilitation allows participants to play an active role while they still have the resources to make changes in their own lives. Overall, the results of this study permit the conclusion that this kind of service does support working ability in today's municipal sector. It is important to act preventively while participants have the resources to play an active role. Peer support also has remarkable value for finding solutions in different life situations.

Author Contributions: All authors were involved in the development of the study design. B.O. was responsible for the data collection and for writing the manuscript. S.T.N., C.-H.N., and P.B. participated in the general coordination of the study and corrected draft versions of the manuscript. H.H. provided statistical consultation.

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Conflicts of Interest: The submitted manuscript does not contain information about medical device(s) or drug(s). No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

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