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THE EFFECTIVENESS OF VOCATIONALLY ORIENTED MEDICAL REHABILITATION (ASLAK®) AMONGST PUBLIC SECTOR EMPLOYEES

by

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To my wife

ABSTRACT

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The effectiveness of vocationally oriented multidisciplinary rehabilitation (ASLAK®) amongst public sector employees

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In Finland, vocationally oriented medical rehabilitation (ASLAK®) is a common preventive rehabilitation measure with the primary goal of preserving and improving work ability. The ASLAK® programme has been used for almost 30 years, although limited data exist on its effectiveness. The aims of this study were to determine whether the increased risk of work disability predicts the participants' likelihood to be granted ASLAK® rehabilitation and to assess the effectiveness of the programme in decreasing the risk of work disability and modifying health-risk behaviours.

This study is a part of the on-going Finnish Public Sector Study conducted by the Finnish Institute of Occupational Health. Data on 53 416 employees (81% women) were gathered from employers' records, national health registers and repeated survey responses.

During the 5-year follow-up, increased levels of the risk factors for work disability did not predict participation in the rehabilitation programme. During the 2.8-year follow-up (range 0.04–5.0 years), the risk of long-term work disability (sick leave >90 days or retirement) overall or, more specifically, due to musculoskeletal or mental diseases did not differ between the rehabilitants who participated in ASLAK® in 1997–2005 and their propensity score matched controls. There was no evidence of ASLAK® being effective in changing participants' health-risk behaviours or in improving perceived general or mental health.

The results suggest that potential participant recognition, mainly taking place in occupational health care, may fail to identify those with a higher risk of work disability. No evidence on the effectiveness of the programme was found in the study cohort when measured by the selected indicators.

Key terms: early rehabilitation; vocational rehabilitation; work disability; disability pension; propensity score; retirement; health risk behaviours; perceived health.

TIIVISTELMÄ

Mikhail Saltychev

Ammatillisesti syvennetyn lääkinnällisen kuntoutuksen (ASLAK®) vaikuttavuus kunnallissektorin työntekijöillä

Kansanterveystieteen laitos, Turun yliopisto
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Ammatillisesti syvennetty lääkinnällinen kuntoutus (ASLAK®) on Suomessa yleisesti käytetty ehkäisevä kuntoutusmuoto jonka ensisijaisena tavoitteena on työkyvyn säilyttäminen ja parantaminen. ASLAK® on ollut käytössä lähes 30 vuotta vaikkakin näyttöä sen vaikuttavuudesta on vähän. Tämän tutkimuksen tavoitteena oli arvioida ennustaako kohonnut työkyvyttömyysriski pääsyä kuntoutukseen, sekä arvioida ASLAK® kuntoutuksen vaikuttavuutta mitattuna työkyvyttömyyden riskitason sekä terveyskäyttäytymisen muutoksilla.

Tutkimus on osa Työterveyslaitoksen käynnissä olevaa tutkimusprojektia, jossa kohderyhmänä ovat kunnallissektorin työntekijät. Tiedot 53 416 työntekijästä (81 % naisia) on kerätty työnantajien rekistereistä, kansallisista terveysrekistereistä sekä toistetuin kyselyin.

Työkyvyttömyyden riskitekijöiden kohonneet esiintymisluvut eivät ennustaneet yksilön pääsyä kuntoutukseen viiden vuoden seurannassa. Yleisen, tai tuki- ja liikuntaelimistön tai psyykkisistä sairauksista johtuvan pitkäaikaisen työkyvyttömyyden (sairausloma > 90 päivää, kuntoutustuki tai työkyvyttömyyseläke) riskitasossa ei ollut eroa kuntoutujien (osallistuneiden ASLAK® kuntoutukseen vuosina 1997–2005) ja heidän propensity score menetelmällä kaltaistettujen verrokkien välillä 2,8 (vaihteluväli 0.04–5.0) vuoden seurannassa. ASLAK® ohjelman vaikuttavuudesta kuntoutujien terveyskäyttäytymiseen tai yleiseen tai psyykkiseen terveyteen ei saatu tutkimukseen valittujen mittareiden mukaan näyttöä.

Tulokset viittaavat siihen että pääasiallisesti työterveyshuollon kautta tapahtuva ohjautuminen ASLAK® ohjelmaan saattaa olla puutteellinen niiden yksilöiden kohdalla joilla on korkeampi riski joutua työkyvyttömäksi. Tutkitussa väestössä käytetyillä arviointimenetelmillä ASLAK® kuntoutuksen vaikuttavuudesta ei saatu näyttöä.

Avainsanat: varhaiskuntoutus; ammatillinen kuntoutus; työkyvyttömyys; työkyvyttömyyseläke; propensity score; eläköityminen; terveyskäyttäytyminen; koettu terveys.

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ABBREVIATIONS

ASLAK®	Vocationally oriented medical rehabilitation
ATC	Anatomical therapeutic chemical
BMI	Body mass index (kg/m2)
CI	Confidence interval
DDD	Defined daily dose – the assumed average maintenance dose per day for a drug used for its main indication in adults
EEA	European Economic Area
EMG	Electromyography
EU	European Union
FPSS	Finnish Public Sector study
GEE	Generalised estimating equation
GHQ-12	12-item version of the General Health Questionnaire
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HR	Hazard ratio
IP	In-patient period
ISCO	International Standard Classification of Occupations
JCQ	Job Content Questionnaire
MET	Metabolic equivalent of task
OWAS	Ovako Working Posture Analysing System
PR	Prevalence ratio
ROM	Range of motion
RCT	Randomised controlled trial
SD	Standard deviation
SES	Socioeconomic status
S-GT	Gamma-glutamyl transferase
SII	Social Insurance Institution of Finland
$VO_{2\ max}$	Maximal oxygen consumption
WHO	World Health Organisation

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following original publications, which are referred to in the text by their corresponding Roman numerals I–V.

I. Mikhail Saltychev, Katri Laimi, Tuula Oksanen, Jaana Pentti, Marianna Virtanen, Mika Kivimäki, Jussi Vahtera. Predictive factors of future participation in rehabilitation in the working population: the Finnish public sector study. Journal of Rehabilitation Medicine 2011; 43(5):404–410.

II. Mikhail Saltychev, Katri Laimi, Ashraf El-Metwally, Tuula Oksanen, Jaana Pentti, Marianna Virtanen, Mika Kivimäki, Jussi Vahtera. Effectiveness of multidisciplinary primary prevention in decreasing the risk of work disability in a low-risk population. Scandinavian Journal of Work Environment and Health. 2011 May 12. [Epub ahead of print].

III. Mikhail Saltychev, Katri Laimi, Ashraf El-Metwally, Tuula Oksanen, Jaana Pentti, Marianna Virtanen, Anne Kouvonen, Mika Kivimäki, Jussi Vahtera. The effectiveness of a multidisciplinary early rehabilitation on reducing behaviour-related risk factors. Journal of Rehabilitation Medicine. doi: 10.2340/16501977-0956 [Epub ahead of print].

IV. Mikhail Saltychev, Katri Laimi, Tuula Oksanen, Jaana Pentti, Marianna Virtanen, Mika Kivimäki, Jussi Vahtera. Effect of a Multidisciplinary Rehabilitation Programme on Perceived Health among Employees at Increased Risk of Incapacity for Work: a Controlled Study. Clinical Rehabilitation. 2011 Dec 2. [Epub ahead of print].

1. INTRODUCTION

1.1 Background

Long-term work disability affects the economy of most Western countries even more than unemployment (OECD, 2006, OECD, 2007, OECD, 2008b, Whyte, 2007). Together with the rapid ageing of the population, work disability creates the major problem of a forthcoming shortage of workforce and induces great interest in developing efficient ways to prevent early retirement on health grounds (Christensen et al., 2009). To keep ageing employees in good health and assure their participation in worklife, preventive intervention needs to be adapted to a form that will improve the health and health behaviour of workers, improve work conditions, and reduce work-related stress (Burdorf, 2010, Westerlund et al., 2010). In order to reduce the burden of early retirement on health grounds, different forms of rehabilitation programmes have been introduced. Some of them focus primarily on medical rehabilitation of health disorders, while others target mainly vocational goals. Vocational rehabilitation interventions are aimed at achieving either changes at worksites or changes on an individual level (Marine et al., 2006, Schaafsma et al., 2011, Schaafsma et al., 2010, van Wyk and Pillay-Van Wyk, 2010). Some rehabilitation programmes can be understood as measures of tertiary prevention, focusing on workers with severe health problems and an insufficient capacity for work. Other programmes are measures of primary prevention, targeting a low-risk working population, in which work ability has not yet started to deteriorate but in which deterioration can be expected in the near future.

Due to limited resources, health policy makers face the demand to prioritise rehabilitation programmes that favour those that have been found to be efficient on the basis of scientific evidence. Multidisciplinary medical and vocational rehabilitation programmes are widely used to sustain participation in worklife (Norlund et al., 2009, van Geen et al., 2007). Some evidence exists of the effectiveness of multidisciplinary rehabilitation in general as regards the prevention of work disability (Jensen et al., 2005, Marnetoft and Selander, 2002, Marnetoft et al., 1999, Mellin et al., 1990, Mitchell and Carmen, 1994, Norlund et al., 2009, Taimela et al., 2000, van den Hout et al., 2003, Westman et al., 2006). Previous investigations have found early rehabilitation to be more effective than delayed rehabilitation with respect to the prevention of work disability (Marnetoft and Selander, 2002, Marnetoft et al., 1999, Westman et al., 2006). However, the evidence is not strong (Kuoppala and Lamminpää, 2008), and there is a need for high-quality investigations on this subject (Karjalainen et al., 1999, Karjalainen et al., 2000, Karjalainen et al., 2003).

The commonest Finnish form of early rehabilitation, vocationally oriented medical rehabilitation (ASLAK®), has been widely used for 30 years. For example, in 2010 the Social Insurance Institution of Finland (SII) sponsored ASLAK® with the sum of EUR 33 million, which is 12% of the annual rehabilitation budget of the SII (SII, 2011d).

Unlike all other traditional forms of vocational or medical rehabilitation, ASLAK® targets low-risk populations. The participants should be relatively healthy but at risk of developing deterioration of work capacity because of work-related strain. Despite the commonness of ASLAK® in Finland, the evidence of its effectiveness is limited. Only a few controlled studies have so far been conducted on ASLAK®. Most studies are suffered from severe methodological inadequacy. Thus further assessment of this costly form of rehabilitation is needed.

1.2 Main terms and concepts

Documents published in English contain numerous definitions of the term rehabilitation, all of them based on the concept of existing disability. **Disability** can be defined as any restriction or lack of ability to perform an activity within the range considered normal for a human being, depending on age, gender, and social and cultural factors (WHO, 1981). Via impairment, disease may lead to disability and result in a handicap. According to the World Health Organization (WHO), "**Rehabilitation** of people with disabilities is a process aimed at enabling them to reach and maintain their optimal physical, sensory, intellectual, psychological and social functional levels." (WHO, 2011). In a recently published meta-analysis, rehabilitation was similarly defined as measures required for coping with functional consequences of a disease, defect or trauma (Kuoppala and Lamminpää, 2008). It is essential to distinguish between the concepts of rehabilitation, medical treatment, and prevention. The *Oxford Dictionary of English* defines **prevention** as "action of stopping something from happening or arising", and **treatment** as "medical care given to a patient for an illness or injury" (Oxford, 2010). In medical sciences, preventive measures are traditionally divided into primary, secondary, and tertiary. **Primary prevention** is directed towards preventing the initial occurrence of a disorder. **Secondary prevention** assesses and treats an existing disease through early detection and appropriate treatment before it results in a significant health problem. **Tertiary prevention**, in turn, focuses on reducing the occurrence of relapses and the establishment of chronic conditions through, for example, effective rehabilitation (WHO, 1998).

Medical rehabilitation is a process "of medical care aiming at developing the functional and psychological abilities of the individual and, if necessary, his compensatory mechanisms, so as to enable him to attain self-dependence and lead an active life" (WHO, 1969). **Vocational rehabilitation** can be understood as "medical, psychological, social and occupational activities aiming to re-establish among sick or injured people with previous work history their working capacity and prerequisites for returning to the labour-market, i.e. to a job or availability for a job" (Ekholm and Ekholm, 2009). However, the term "vocational rehabilitation" is often used to describe only a non-medical, occupational part of the rehabilitation programme. Therefore, terms like "work-oriented medical rehabilitation" or "vocationally oriented medical rehabilitation" are used to accentuate the comprehensive and holistic nature of the particular programme.

The term **early rehabilitation** has not been clearly specified. In Finland, this term has been mainly used to define vocational rehabilitation directed towards employees in a very

early stage of deterioration in their work capacity. Unlike other forms of rehabilitation, the Finnish concept does not place early vocational rehabilitation *after*, but rather *before,* disability is formed, or even before disease itself has occurred (Järvikoski, 1992). The timeline is shown in Figure 1.

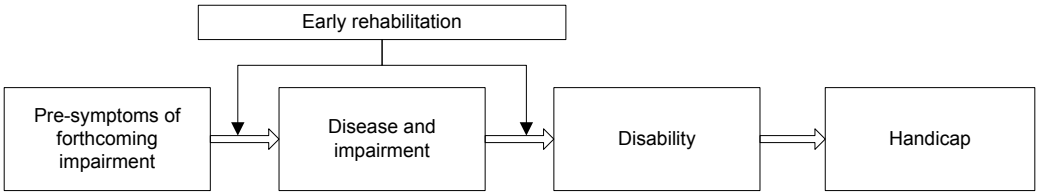

Figure 1. Timing of early rehabilitation.

Restoring work ability (working ability, work capacity, capacity for work) is the main target of vocational rehabilitation. The conceptual definition for **work ability** represents the question: "How good is the worker at present and in the near future, and how able is he or she to do his or her work with respect to work demands, health, and mental resources?" (Ilmarinen and Tuomi, 1992). **Work disability** (reduced work ability, incapacity for work, work incapacity) can be defined as the inability of a person to fulfil work demands because of disease or impairment that creates a legitimate reason for sickness absence with benefits (Lindberg et al., 2006).

Intervention (in this case rehabilitation) should be considered effective when it achieves its main goal. Effectiveness must be distinguished from efficacy or efficiency. While **efficacy** describes the therapeutic potential of a treatment, **effectiveness** refers to actual results obtained in clinical practice. In turn, **efficiency** describes how well the intervention is used for the intended task or purpose.

1.3 Factors predictive of a deterioration in work capacity

During the last decade, there has been extensive interest in establishing the risk factors of work disability that are not related directly to specific, severe medical problems.

A low occupational grade and a low level of education, along with a low income, have previously been found to be strong correlates of diseases and premature death (Adler and Rehkopf, 2008, Matthews et al., 2010).

Shift work has been suggested as a risk factor for cardiovascular diseases and diabetes, which are common reasons for work disability (Kivimaki et al., 2011, Kivimaki et al., 2006).

Work-related stress has become more prevalent and more intense due to, for example, increased work hours and haste, project-like jobs, and job insecurity (OECD, 2003, OECD, 2008a, European Commission, 2007). One of the leading models of work stress, the job strain (the demand–control) model, proposes that job strain is a result of high job demands in combination with low job control (Karasek et al., 1981). Recent systematic reviews and meta-analyses suggest that job strain or its components are associated with an increased risk of cardiovascular diseases and mental health problems

(Bonde, 2008, Kivimäki et al., 2006, Stansfeld and Candy, 2006), an increased incidence of musculoskeletal disorders (Ariëns et al., 2001, Hoogendoorn et al., 2000), and an increased rate of sickness absence (Virtanen et al., 2007), a key factor in the long process leading to an early exit from the work force due to permanent disability (Gjesdal and Bratberg, 2002, Kivimäki et al., 2004, Lund et al., 2008). The limited evidence available also suggests a link between job strain and subsequent all-cause disability retirement (Laine et al., 2009, Stattin and Jarvholm, 2005). Moreover, depressive disorders and cardiovascular diseases are the two leading causes of morbidity in developed European countries (Mathers and Loncar, 2006, WHO, 2008).

Temporarily employed workers have been shown to have a risk of receiving a disability pension that is similar to the risk of permanently employed people. However, they more often have severe chronic health problems and increased mortality (Kivimäki et al., 2003), as well as perceived job insecurity (Matthews et al., 2010). Higher job insecurity may increase the likelihood of attending work while ill (Theorell et al., 2003, Vahtera et al., 2004a).

The seven most important modifiable risks responsible for over half of the disease burden across Europe are tobacco, high blood pressure, extensive alcohol consumption, high cholesterol level, overweight, poor diet, and physical inactivity (WHO, 2002). Smoking, extensive alcohol consumption, overweight and physical inactivity, factors used in the present study as matching and outcome variables, have been found to be associated with a risk of deteriorating work capacity (Albertsen et al., 2007, Ferrie et al., 2007, Kouvonen et al., 2005, Robroek et al., 2010, Skillgate et al., 2009, Vahtera et al., 2002).

The risk of disability retirement is strongly associated with the rates of sickness absence. The importance of especially long-term, over 60 days, sickness absence has been reported in a register-based study conducted on participants in different types of rehabilitation, funded by SII (Lind et al., 2007).

A comprehensive analysis of the risk factors of work disability related to low-back pain was part of a recent Finnish doctoral thesis (Martimo, 2010). In addition to physical risk factors, some psychosocial and psychological factors were pointed out as important risks of prolonged incapacity for work. Amongst these factors were lack of recognition and respect at work, low job control, low support at the workplace, high job demands, job dissatisfaction, distress, low self-rated work ability, social isolation, shorter job tenure and a high level of potential compensation.

An intention to retire early and life dissatisfaction have been reported to be strong predictors of disability retirement (Harkonmäki et al., 2009). Some recent reports suggest that also childhood adversities (especially in the case of early retirement due to mental disorders) and even genetic predisposition (especially at a younger age) may be predictive of disability retirement (Harkonmäki et al., 2007, Harkonmäki et al., 2008).

1.4 Brief historical overview of ASLAK®

In Finland, the comprehensive planning of early, vocationally oriented medical rehabilitation started in 1980 as a collaborative effort between several public and private

institutions. The actors were the Centre for Occupational Safety, employers (i.e. Enso-Gutzeit), trade unions, forestry colleges, the occupational health office of the Kuopio district, the Kuopio branch office of the Finnish Institute of Occupational Health, SII, and the state-owned enterprise Metsähallitus ("Administration of Forests") (Rissanen, 1992). The model for ASLAK® was adopted from rehabilitation programmes that have been started for forest workers in Sweden and Norway in the 1950s–1960s, and from a work-hardening programme developed in United States in the 1970s (Rissanen, 1992, Johnson et al., 2001). Originally, the main target group of ASLAK® was forest workers, who had a low level of education and health-behaviour risks like leisure-time physical inactivity and bad dietary habits (i.e. only every fourth had a warm meal during the day). Their work schedule was irregular, their tasks were extremely physically demanding, and the ergonomics were poor (Rissanen, 1992). In the 1980s, work with chain saws was still dominant in the field, and forest workers were exposed to snow and the cold. The commonest occupational diseases were hearing loss, vibration disease, and strain injuries of the upper extremities. Forest workers generally had more diseases, died younger, and were rarely able to work to their retirement age (Soininen H. Overview of occupational health problems in forestry. Paper presented in the *Seminar on occupational health and rehabilitation of forest workers*, held in Kuopio, Finland, in 1986). One of the main developers of the ASLAK® concept, medical advisor for the SII, Paavo Rissanen (2011), explained in a personal communication that "there was a need to develop a new rehabilitation form for those workers who were *too sick* to participate in any existing rehabilitation programme".

In 1983, the first ASLAK® course was implemented by the Siilijärvi rehabilitation centre. Soon, also an ASLAK® programme for farmers was introduced, and, for a few years, ASLAK® remained a form of rehabilitation targeted towards workers in extremely physically demanding occupations (Rissanen, 1992). The vocational part of the programme was crucial and well-modifiable, depending on the needs of the occupational group and on the individual participants. A multi-professional team, involved in the programme, collaborated closely with the participants' occupational health services, supervisors, and even company owners during the entire implementation of the course, starting with the selection process. It was important that, during the course, the participants could perform their own real work activity under the supervision of the members of the rehabilitation team so that they would be able to recognize and intervene in individual work-related problems, for example, with ergonomic education.

In 1991, the experimental stage of ASLAK® was officially completed. In order to distinguish the term ASLAK® from other rehabilitation programmes with similar names, SII registered the ASLAK® structure and title (Finnish acronym ASLAK®) with the National Board of Patents and Registration of Finland. In the late 1980s–early 1990s, the structure of the Finnish workforce quickly changed. Reflecting this process, the target group for ASLAK® has extended, involving, not only physically, but also psychologically and socially strained employees (Ylisassi et al., 2004). In 1992, the following 11 occupational groups were involved in ASLAK®: forest workers, farmers,

drivers, health care workers, social workers, service workers, trade workers, office workers, cleaners, industrial workers, and builders.

The theoretical argumentation, target groups, structure of the programme, and role of ASLAK® in the Finnish rehabilitation system has substantially changed since its first implementation. In 1987, there were 33 courses with 361 participants. In 1992, the numbers were 270 and 2817, respectively. In 2010, ASLAK® was the commonest rehabilitation programme of SII with 13 100 participants in 730 ASLAK® courses (SII, 2011d). In 2010, SII funded ASLAK® in 31 different private and third sector rehabilitation centres across the country, using a sum of EUR 32.8 million, which is 12% of the annual rehabilitation budget of SII (SII, 2011a, SII, 2011d).

Simultaneously, with the widening of the occupational spectrum of ASLAK®, also the structure of the programme and the composition of its multi-professional team changed. The programme became less individual and more group-based with lectures, workshops, and group physical activities, amongst others. At the same time, the individually planned vocational part of the programme diminished. Collaboration with the participant's worksite often became limited to a one-day joint session with the employers and occupational health personnel. Regarding the purpose of the present study, the most important change that has occurred is the change in the inclusion criteria and the process of the participants' selection. In the "original version" of ASLAK®, the participants, working in physically demanding occupations, were thoroughly selected by an occupational physician in collaboration with the ASLAK® team, the employer, and the participant's supervisor. They usually had some substantial health problems, poor health-related habits, and a low level of education. Their work capacity had already begun to deteriorate and the risk of early retirement was high. If, in the 1980s, the participants had to be *healthy enough* to participate in the programme, in the 1990s they should not be *too sick*. Since the 1990s, ASLAK® has been recommended for persons with work-related physical or psychological or social strain, but who do not yet have substantial health problems or a history of recent long-term sick leaves.

During the lifespan of ASLAK®, numerous theoretical context models have been suggested and described elsewhere. Regardless of the theoretical model at hand, the ideological uniqueness of ASLAK® is in its emphasis on the primary prevention of work disability. ASLAK® is the only known complex multidisciplinary programme that aims at low-risk populations who are still relatively healthy but may develop an incapacity for work in forthcoming years due to work-related stress.

The liability of ASLAK® is based on the Act on the Social Insurance Institution rehabilitation benefits and rehabilitation allowances 566/2005 12§.

1.5 ASLAK® at the time of this study

The ASLAK® of today is a multidisciplinary, early rehabilitation programme that targets workplaces and occupations in which workers are subjected to considerable physical, mental or social strain that may easily lead to health problems and a deterioration of work capacity. ASLAK® aims at the primary prevention of work disability. The participants

generally have only minor health problems, as the ASLAK® selection criteria include, amongst others, an absence of recent long-term sick leave or a severe illness decreasing work capacity or any indication of alcohol or drug abuse. In 2010, the median age of the employees participating in ASLAK® was 50 years (SII, 2011d). The participants are selected by occupational physicians, and each group of rehabilitants usually has the same employer and/or profession. The final acceptance of selected employees is determined in social insurance offices around the country. Rejection is rare: only 12.8% of all applications for ASLAK® were rejected in 2010 (SII, 2011d).

At the time of the study in 1997–2005, the ASLAK® programme was implemented as in-patient or out-patient (ambulatory) courses, most of the courses being in-patient. As all previous trials, also this study evaluates the effectiveness of the in-patient form of ASLAK®, which usually contained three or four periods of in-patient, extensive, multi-modal, and multi-professional rehabilitation (total: 15–21 days) implemented as group-based (8–10 persons), supervised activity 4 to 6 hours per day. The multi-professional team consisted of a physician, a physiotherapist, a psychologist, a social worker, and a vocational rehabilitation specialist. In addition, a nurse, an occupational therapist, an occupational physiotherapist, and a nutritionist were often involved. The modalities included physiotherapy and physical and psychological education. All of the activities targeted the improvement of the physical and mental health status of the participants, enhancing their stress management and encouraging a healthy lifestyle (e.g. improving dietary habits and leisure-time physical activity and reducing or quitting smoking and drinking). The concept of physical training included an individual assessment of the participants and a plan for exercising at home, during workday breaks, and during the in-patient period of the programme. It also included ergonomic education and exercises performed in groups. Problems at the worksites, such as work-related strain and ways to manage it, were discussed in group-based sessions with a psychologist, a social worker, and a physician. The programme included a one-day participation of representatives from the worksite (usually supervisor and occupational physician) in joint-group sessions. Sometimes adjustments were made to the physical work environment.

In Finland, SII is one of the main providers of state-subsided rehabilitation for people under the age of 65 years (Suoyrjö et al., 2007). Although ASLAK® is implemented in different independent rehabilitation facilities, SII strictly defines the inclusion criteria, the structure of the programme, the multi-professional team composition, the modalities, and the assessment tests (SII, 2011c).The programme follows this pre-determined plan, but the content of the group-based sessions may differ slightly, based on the occupational characteristics of the participants in the group. Between the inpatient periods, the participants are expected to follow an individual exercise plan at home, which usually consists of self-reliant physical activities and psychological exercises.

The participants do not work during the in-patient periods, and the entire programme is free of charge. The participants receive a so-called "rehabilitation compensation" paid by SII, which is about 75% of the participant's usual salary (minimum EUR 22 per workday). The participants also receive compensation for travelling expenses. The employers are not financially compensated for hiring temporary agency workers or substitutes.

2. REVIEW OF THE LITERATURE

2.1. Formulation of the clinical question

The objective of this systematic review was to determine the effectiveness of ASLAK® for any selected outcome amongst the programme participants. The clinical question was formulated according the evidence-based PICO (Patient/population and/or problem, Intervention, Comparison and Outcome) model as follow:

***P**opulation:* Working age adults (18 to 65 years) under increased risk of deteriorating health or work ability due to work-related physical, psychological, or social stress.
***I**ntervention:* Vocationally oriented medical rehabilitation (ASLAK®) funded by the Social Insurance Institution of Finland (SII).
***C**omparison:* non-rehabilitants or no comparison.
***O**utcome:* The following outcomes were looked for in the selected studies:

- Perceived health and global status (e.g. overall improvement, self-rated scales for physical, mental and general health, psychological distress, experienced benefit from rehabilitation, physical strain at work).
- Pain intensity (e.g. visual analogue scale, ordinal scale, Borg, Waddel & Main, self-rated need for rehabilitation).
- Generic functional status or quality of life (e.g. SF36, 15-D, RAND-36, Sickness Impact Profile, Health Assessment Questionnaire, self-efficacy, sleep disorders).
- Health-risk behaviours (e.g. physical inactivity, overweight, excessive alcohol consumption and smoking).
- Ability to work (e.g. perceived work ability, sickness absence, number of days off work).
- Worksite-related factors (e.g. workspace functionality, work accidents and fear of them, work ergonomics and postures, general atmosphere at work, exercise breaks at work, development in professional education).
- Factors related to job control and satisfaction (e.g. support by supervisor and co-workers, support by occupational health care, sufficiency of teamwork, job control, job insecurity, job satisfaction, intention to quit or switch work).
- Objective physical health (e.g. body mass index (BMI), cycle ergometry, walk test, muscle strength, flexibility of the trunk and extremities, blood tests).
- Health care consumption and costs (e.g. physician's consultations, psychologist's or social worker's consultations, use of physiotherapy, intake of analgesics, antidepressants or other prescribed drugs, visit to a physician, cost-effectiveness).
- Satisfaction with treatment.

2.2. Criteria for considering studies for this review

2.2.1. Types of studies

Despite the fact that ASLAK® has been used since the early 1980s and it is the commonest type of rehabilitation targeting the Finnish working population, almost every report on ASLAK® states that the effectiveness of the programme has been studied insufficiently. There is a limited number of randomised controlled trials (RCTs) in the rehabilitation field in general, and concerning ASLAK® in particular. Therefore, not only RCTs and non-randomised control trials (CCTs), but also any studies on the effectiveness of ASLAK® with respect to any selected outcome reported in English, Finnish or Swedish were considered.

2.2.2. Search methods for the identification of studies

For relevant studies, MEDLINE and the Cochrane Central Register of Controlled Trials (CENTRAL) were searched from 1980 on. The references of identified articles and reviews were checked to widen the net. In addition, studies published in Finland from 1980 on were screened using the Finnish medical database Medic. Due to its primary preventive character, ASLAK® is a unique programme targeting a low-risk population, with no comparable interventions being used in any other country. Moreover, most of the available information on ASLAK® can only be found in Finnish. These facts substantially limit the use of any search in international medical databases like MEDLINE. Thus, in addition to the reports identified through the aforementioned search, this review includes references collected through manual searches in libraries and with the aid of Internet common search engines. The author also consulted experts in the field of rehabilitation to identify potentially relevant studies that might have been missed. The author's own work experience with ASLAK® since the early 1990s was also helpful.

The lack of logical and specific key words for the type of rehabilitation in question created difficulties for the search process. Examples of previously used key words are "low back pain", "exercise", "rehabilitation", "work ability", "work postures", "OWAS method", "computerized OWAS method", "agriculture", "motor skill", "work technique", "lifting", "absenteeism", "effectiveness", "muscle strength", "musculoskeletal diseases", "oxygen consumption", "neck pain" and "back pain".

The protocol of the original search, conducted in MEDLINE, is included in Appendix 1.

2.2.3. Data collection and analysis

The methods for the systematic review and for the assessment of the methodological quality of the trials were based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework.

2.3. Study selection

All of the studies assessing the effectiveness of ASLAK® on any selected outcome were included in the review. The title, key words, abstract, and main text of the studies were assessed in order to determine whether they met the inclusion criteria.

2.3.1. Evaluation of the effectiveness of the studies

A study was considered to have a positive outcome if ASLAK® showed improvement in at least one of the selected outcome measures, and the outcome was deemed negative if the multidisciplinary rehabilitation was less effective than the reference intervention(s) or had a negative impact on an outcome. A study was considered neutral if ASLAK® was considered ineffective in comparison with the reference intervention(s) or the outcome remained unchanged in the follow-up. A meta-analysis was not conducted in this review.

2.3.2. Methodological quality assessment

The methodological quality of the trials was assessed with the GRADE framework. The initial quality of an included study was considered "high" (grade 4) if it was an RCT, "moderate" (grade 3) if it was a quasi-RCT, "low" (grade 2) if it was an observational study, and "very low" (grade 1) if it could not be identified as any of the aforementioned. Factors that lowered the quality of the included study were the study limitations/risk of bias (–1 grade if serious and –2 grades if very serious), inconsistency of the results (–1 grade if serious and –2 grades if very serious), indirectness of the evidence (–1 grade if there was some uncertainty, –2 grades if there was major uncertainty), imprecise results (–1 grade if serious and –2 grades if very serious), and publication bias (–1 grade if likely, –2 grade if very likely). Factors that raised the quality of evidence were a large magnitude of effect (+1 grade if large, +2 if very large), a dose–response relationship (+1 grade), and plausible confounding (+1 if it would reduce a demonstrated effect or suggest a spurious effect when the results showed no effect).

2.4. Search results

2.4.1. Description of the studies

In this review, the type of rehabilitation intervention under scrutiny is the programme, known as "vocationally oriented medical rehabilitation". This type of rehabilitation is well identifiable in the scientific literature, mainly due to its specific inclusion criteria. The ASLAK® programme targets a low-risk working-age population that is at risk of developing incapacity for work in forthcoming years due to work-related strain (SII, 2011f). The inclusion criteria allow participants to have only minor health problems and no severe disease.

Only three reports on the effectiveness of ASLAK® were found by searching MEDLINE (see Appendix 1 for the search strategy used) (Arokoski et al., 2002,

Holopainen et al., 2004, Suoyrjö et al., 2009). Search of the Finnish database Medic resulted in 11 more reports (Helo, 2000, Hinkka et al., 2000, Holopainen et al., 1998, Järvinen et al., 1995, Kurki, 2004, Nevala-Puranen, 1996, Tirkkonen and Kinnunen, 2010, Tirkkonen et al., 2011, Turja, 2009, Turja et al., 2006, Turja et al., 2005a). In addition, eight reports were identified in a manual search.

Most of the studies were conducted on a small number of participants and without a properly selected control group. Of the included studies, eight were controlled.

The term "vocationally oriented medical rehabilitation" has been used in most of the included studies. In some studies (mostly conducted in the 1990s), also other terms were used, for example, "occupationally oriented rehabilitation" (Nevala-Puranen et al., 1998, Nevala-Puranen, 1996) or "occupationally oriented medical rehabilitation" (Nevala-Puranen, 1995) or "neck course" (Arokoski et al., 1996) or "work-oriented fitness course" (Leino et al., 1994) or "vocationally oriented multidisciplinary intervention" (Suoyrjö et al., 2009); in one case, the report referred to the intervention simply as a "training programme" (Väyrynen and Könönen, 1991). This inconsistency of the terminology used can be explained by the fact that the term "ASLAK®" became officially registered only in 1991. Despite this inconsistency, studies on ASLAK® are easily identifiable due to the descriptions of the intervention evaluated in the reports.

Table 1 shows the objectives of the studies, the individual characteristics of the participants, the follow-up periods, the structure of the rehabilitation courses, the data collection methods, the main outcome measures, and the main results of the included studies. This review of the literature does not deeply analyse the quantitative results of the included studies, but rather focuses on their qualitative analysis. For convenience, the main results of each study are divided into three categories (or less, if not applicable), which are "+" improvement in outcome, "+/-" no change in outcome, and "–" deterioration in outcome (Table 1).

Table 1. Characteristics of the selected studies.

Abbreviations: IP – in-patient period, SES – socioeconomic status, ROM – range of motion, $VO_{2\ max}$ – maximal oxygen consumption, EMG – Electromyography, BMI – body mass index, S-GT – gamma-glutamyl transferase, **(+)** – improvement in outcome, **(+/–)** – no change in outcome, **(–)** – deterioration in outcome.

CONTROLLED STUDIES	**Main results:**
(Leino et al., 1994) **Main topics of interest:** Perceived physical and general health and perceived work ability. **Subjects:** 148 male forest workers (87 cases / 61 controls). **Follow-up:** 1.0 year for survey; 0.5 year for physical tests; 0.25 year for work postures. **Control selection:** Non-randomly selected by occupational physician. **Structure of the course:** 2 IP: 1st IP 1 week; 2nd IP 2 days (0.5 years in between). **Data collection and outcomes:** *Registers:* Data on sickness absence from employers' records. *Questionnaire (before intervention and 1.0 year after):* Work physical and psychological stress, leisure-time physical activity, perceived physical and general health, musculoskeletal pain, dyspepsia, anxiety, psychological endurance, sleep disorders, headache, irritable bowel etc. *Physical tests (at the beginning of 1st IP and during 2nd IP):* Muscle strength tests (trunk, lower extremities), body weight, and cycle ergometry. Work postures at the beginning of the1st IP and 0.25 years later (tested by non-medical personnel).	**(+)** Perceived physical and general health, distress, perceived work ability. **(+/–)** Leisure-time physical activity, back and muscle pain, ergonomics, rates of sickness absence.

(Järvinen et al., 1995) **Main topics of interest:** Rates of sickness absence. **Subjects:** 416 industrial workers (208 cases [58% men] / 208 controls [58% men]). **Follow-up:** up to 3.3 years. **Control selection:** Matching for age, gender, occupation, days on sick leave during 1.0 year before the intervention. **Structure of the course:** 2 IP: 1st IP 2 weeks; 2nd IP 1 week (1.0 year in between) **Data collection and outcomes:** *Questionnaire:* Estimated rates of sickness absence and incident sickness after intervention (d/year), commitment to programme (participation in leisure-time physical training programme). *Comparison between:* a) Cases and controls, b) 2 companies (A and B), c) 21 rehabilitation groups, d) 3 rehabilitation facilities. **Notes:** There were differences in incident sickness between groups and in commitment to programme between the companies and rehabilitation facilities.	**(+)** Rates of sickness absence in company A compared with the controls. **(+/–)** Rates of sickness absence or incident sickness in the entire study population and in company B.
(Helo, 2000) **Main topics of interest:** Cost-effectiveness of ASLAK®. **Subjects:** Three-study population: 1st (register-based): 3733 cases (61% women), 165 controls (58% women); 2nd (cross-sectional survey, uncontrolled): 878 cases (61% women); 3rd (register-based, uncontrolled) – register of competitive bidding of SII. **Follow-up:** 4.0 years. **Control selection:** Only the register-based section of the study was controlled. Controls were persons who were selected for ASLAK® but did not enter (or discontinued after a few days) the programme. **Structure of the course:** 92% of courses contained 3 IP, 8% – 2 or 4 IP. The duration of each IP and the periods between them varied. **Data collection and outcomes:** *Registers*: Data from registers kept by SII. Age, gender, marital status, occupation, main diagnosis in physician's referral, days on sick leave. Register of competitive bidding of SII used for obtaining financial information (23 private rehabilitation facilities). *Questionnaire:* 54 questions, divided into 8 sections (demographics, work situation and work ability, work conditions, general health, ability to function, life management, use of health care and drugs, experienced benefits from ASLAK®).	**(+/–)** Cost-effectiveness, improvement in perceived work ability and quality of life amongst the women when they were compared with the men.
(Turja et al., 2005a) **Main topics of interest:** Physical work strain. **Subjects:** 79 cases (86% men) and 141 controls (83% men) working in small companies. **Follow-up:** 2.7 years. **Control selection:** Matching for age, gender, field of business, perceived need for rehabilitation and perceived work ability. **Structure of the course:** Structure and duration of courses varied from 2 to 4 IP. **Data collection and outcomes:** *Questionnaire:* Physical strain at work, ergonomics, workspace functionality, fear and possible sources of work accidents.	**(+/–)** Workspace functionality, fear of work accidents. **(–)** Physical strain at work.
(Turja et al., 2006) **Main topics of interest:** Psycho-social conditions at workplace. **Subjects:** 79 cases (86% men) and 141 controls (83% men) working in small companies. **Follow-up:** 2.7 years. **Control selection:** Matching for age, gender, business field, perceived need for rehabilitation and perceived work ability. **Structure of the course:** Structure and duration of courses varied from 2 to 4 IP. **Data collection and outcomes:** *Questionnaire:* Psychosomatic and physical complaints, experienced stress, perceived work ability, perceived need for rehabilitation, job control, work atmosphere, teamwork, support by supervisor and co-workers.	**(–)** Support by supervisor. **(+/–)** All other outcomes.

(Turja et al., 2007) **Main topics of interest:** Perceived psychological and general health and work ability in relation to changes in work conditions. **Subjects:** 79 cases (86% men) and 141 controls (83% men) working in small companies. **Follow-up:** 2.7 years **Control selection:** Matching for age, gender, field of business, perceived need for rehabilitation and perceived work ability. **Structure of the course:** Structure and duration of courses varied from 2 to 4 IP. **Data collection and outcomes:** *Questionnaire:* Perceived health and work ability, ability to function, work-related stress, psychosocial and physical work conditions, job control, support by supervisor and co-workers, ergonomics, workspace functionality, fear and possible sources of work accidents. **Notes:** Changes in all of the characteristics were unrelated (or related only weakly) to positive changes in work conditions.	**(+/–)** Positive changes in psychosocial and physical conditions only at workplaces in which these conditions / attitudes were good before the rehabilitation. **(–)** Perceived general and psychological health, perceived work ability.
(Suoyrjö et al., 2009) **Main topics of interest:** Rates of sickness absence and disability pension. **Subjects:** 11 180 employees in public sector (2236 cases (74% women), 8944 controls (74% women). **Follow-up:** 8 years. **Control selection:** Matching for age, gender, occupational grade, region of Finland. **Structure of the course:** Structure and duration of the courses varied. **Data collection and outcomes:** *Registers:* Data from national health registers and employers' records: demographics, work-related, health-related (presence of chronic diseases, use of prescribed analgesics and antidepressants).	**(+)** Rates of sickness absence decreased. Effect was restricted to 3–4 years after the intervention. **(–)** Low cost-effectiveness – decrease in sickness absence covered 54% of the programme's cost.
(Tirkkonen and Kinnunen, 2010) **Main topics of interest:** Work conditions and health (subproject #1 – effects of ASLAK®; subproject #2 – effects of health promotion courses). **Subjects:** Subproject #1: 148 cases (58% women), 34 controls (82% women) - managers or experts. **Follow-up:** 1.3 years for survey, 1 year for physical tests. **Control selection:** Managers or experts who could to apply for ASLAK®, but did not. 11 controls recruited from same companies as the cases, the rest were substituted from the participants in other rehabilitation programmes in the same rehabilitation facility, and managers and experts working at the rehabilitation facility. **Structure of the course:** Structure and duration of the courses varied from 3 to 4 IP. **Data collection and outcomes:** *Questionnaire:* SES, work-related factors (i.e. job control, support by supervisor and co-workers, job satisfaction, perceived work ability etc.), self-efficacy, perceived general and mental health, sleep disorders, health behaviours (leisure-time physical activity, dietary habits), and experienced benefits from ASLAK®. Shorter version of questionnaire for controls. *Physical tests:* BMI, cycle ergometry, muscle strength (trunk and extremities), trunk flexibility.	**(+)** Muscle strength of trunk and extremities, trunk flexibility, perceived work ability and general health, perceived mental health, perceived psychological work stress, job control. **(+/–)** Cycle ergometry, BMI.
UNCONTROLLED STUDIES	
(Väyrynen and Könönen, 1991) **Main topics of interest:** Work postural load. **Subjects:** 4 male forest workers. **Follow-up:** 4 years. **Structure of the course:** 3 week IP. **Data collection and outcomes:** Data on work postures collected by videotaping	**(+)** Work postures.

(Nevala-Puranen, 1995) **Main topics of interest:** Work postural load. **Subjects:** 27 female farmers. **Follow-up:** 0.5 year. **Structure of the course:** 2 IP: 3 week and 1 week, 0.5 years in between. **Data collection and outcomes:** Data on work postures collected by videotaping.	**(+)** Work techniques
(Arokoski et al., 1996) **Main topics of interest:** Neck and shoulder pain and physical performance. **Subjects:** 27 male Air Force fighter pilots. **Follow-up:** 1 year. **Structure of the course:** 3 IP: 13–14 days in total during 1.0 year. **Data collection and outcomes:** *Questionnaire:* Perceived general health, neck and shoulder pain, work stress, leisure-time physical activity, exercise breaks at work, rates of sickness absence (days/year), rates of grounding (days/year). *Physical tests:* ROM of cervical spine, muscle strength tests (neck and upper extremities).	**(+)** Perceived work stress, ROM of cervical spine, neck muscle strength, exercise breaks at work. **(+/–)** Neck pain, use of physiotherapy, rates of sickness absence or grounding, leisure-time physical activity, muscle strength of upper extremities.
(Nevala-Puranen, 1996) **Main topics of interest:** Work techniques, musculoskeletal pain and perceived work ability. **Subjects:** 95 farmers (55% women). **Follow-up:** 1 year. **Structure of the course:** Single 3-week IP. **Data collection and outcomes:** *Questionnaire:* musculoskeletal pain, work ability index. *Physical tests:* Data on work techniques collected by videotaping.	**(+)** Work posture, perceived work ability, pain. **(–)** Lifting techniques amongst the men.
(Holopainen et al., 1998) **Main topics of interest:** Work ability and functioning. **Subjects:** 20 male aircraft mechanics. **Follow-up:** 0.5 years. **Structure of the course:** 2 IP: 1st IP 12 days, 2nd IP 5 days (0.5 year in between). **Data collection and outcomes:** *Questionnaire:* Work stress, leisure-time physical activity, use of physiotherapy, neck and back pain, sickness absence (days/year). *Physical tests:* ROM of cervical spine, muscle strength (trunk, upper extremities), $VO_{2\ max}$.	**(+)** Neck and back pain, leisure-time physical activity, ROM of cervical spine, muscle strength. **(+/–)** Rates of sickness absence, use of physiotherapy, perceived physical and psychological work stress, $VO_{2\ max}$.
(Nevala-Puranen et al., 1998) **Main topics of interest:** Work techniques, $VO_{2\ max}$, muscular pain and perceived work ability. **Subjects:** 10 female hairdressers. **Follow-up:** 1.5 years. **Structure of the course:** 3 IP: 1st IP 7 days, 2nd IP 13 days (0.5 year in between), 3rd IP 5 days (1.0 year in between). **Data collection and outcomes:** *Questionnaire:* Perceived work ability, musculoskeletal pain, visits to a physician and use of physiotherapy (during 6 months), self-report on ergonomic changes at the workplace. *Physical tests:* Data on work techniques collected by videotaping (+ muscle activation in shoulder and arm by EMG), $VO_{2\ max}$, muscle strength tests (extremities, trunk).	**(+)** Work techniques, $VO_{2\ max}$, musculoskeletal pain, perceived work ability. **(+/–)** Muscle activation (EMG) in arm, muscle strength.

(Hinkka et al., 2000) **Main topics of interest:** Health behaviours and cardiovascular indicators. **Subjects:** 127 male members of merchant navy crews. **Follow-up:** 1 year. **Structure of the course:** 3 IP: 1st IP 5–6 days; 2nd IP 11–14 days (1 month in between); 3rd IP 4–5 days (1.0 year in between). **Data collection and outcomes:** Data from patient records from a rehabilitation facility. Baseline data obtained during the 1st IP. Follow-up data obtained during the 3rd (the last) IP. BMI, blood lipids, S-GT[6], cycle ergometry, blood pressure.	**(+)** All outcomes: BMI, blood lipids, S-GT, cycle ergometry, blood pressure.
(Arokoski et al., 2002) **Main topics of interest:** Use of health care services, work absenteeism, leisure-time physical activity, musculoskeletal symptoms and physical performance. **Subjects:** 265 participants: 51 female farmers, 89 male forest workers, 64 police officers (94% males), 61 female hairdressers. **Follow-up:** 1.5 years. **Structure of the course:** 3 IP: 1st IP 14 or 21 days, 2nd IP 7 days (0.5 year in between), 3rd IP 5 days (1.0 year in between). **Data collection and outcomes:** *Questionnaire:* Neck and back pain, subjective physical and mental strain at work, number of visits to a physician and to a physiotherapist, rates of sickness absence due to musculoskeletal symptoms, leisure-time physical activity. *Physical tests:* Muscle strength of extremities and trunk, $VO_{2\ max}$, cycle ergometry, BMI.	**(+)** Subjective physical and mental strain at work, neck and back pain, number of visits to a physician, leisure-time physical activity, muscle strength (extremities and trunk), $VO_{2\ max}$, BMI. **(+/–)** Rates of sickness absence, use of physiotherapy.
(Holopainen et al., 2004) **Main topics of interest:** Physical performance, musculoskeletal symptoms and perceived work ability. **Subjects:** 20 male aircraft mechanics. **Follow-up:** 5 years. **Structure of the course:** 2 IP: 1st IP 12 days; 2nd IP 5 days (0.5 year in between). **Data collection and outcomes:** *Questionnaire:* Neck and back pain, perceived physical and mental work strain, number of visits to a physician, use of physiotherapy, rates of sickness absence due to musculoskeletal symptoms (days/6 months), leisure-time physical activity, exercise breaks at work. *Physical tests:* $VO_{2\ max}$, cycle ergometry, muscle strength (extremities and trunk), ROM of cervical spine. Data on work postures collected by videotaping.	**(+)** Back pain, rates of sickness absence due to musculoskeletal symptoms, exercise breaks at work. **(+/–)** Perceived physical or mental strain at work, neck pain, use of physiotherapy, leisure-time physical activity, $VO_{2\ max.}$
(Kurki, 2004) **Main topics of interest:** 1) Historical overview of rehabilitation development in Finland; 2) multiple effects of back and neck rehabilitation courses and ASLAK®. **Subjects:** 198 participants (65 in back courses, 66 in neck courses, 67 in ASLAK®). **Follow-up:** 3 years. **Structure of ASLAK® course:** 3 IP: 1st IP 5 days, 2nd IP 12 days (1 month in between), 3rd IP 5 days (0.7–1.0 year in between). **Data collection and outcomes:** *Questionnaire:* self-esteem, self-efficacy, severity of pain, general life satisfaction, perceived physical and general health, use of physiotherapy, number of visits to a physician and rates of sickness absence (days/3 years after the end of the rehabilitation), work situation, intention to retire. *Physical tests:* Trunk muscle strength, walk test, BMI.	**(+)** Self-esteem, self-efficacy, leisure-time physical activity, perceived physical and general health improved during the programme (1 year), but reverted to the baseline after a 3-year follow-up. Muscle strength, walk test and BMI. **(+/–)** Perceived pain, use of physiotherapy and visits to a physician. **(–)** Life satisfaction. Physical activity worsened during the 3-year follow-up.

(Turja et al., 2005b) **Main topics of interest:** Work conditions. **Subjects:** 79 workers in small companies (86% males). **Follow-up:** 2.7 years. **Structure of ASLAK® course:** Structure and duration of courses varied from 2 to 4 IP, 17–25 days in total. **Data collection and outcomes:** *Questionnaire:* Ergonomics, physical and mental health, leisure-time physical activity, dietary habits, work methods, workspace functionality, development in professional education, work atmosphere and teamwork, support by occupational health service, support by supervisor and co-workers, shift work etc.	**(+/–)** Recommendations given during ASLAK® course did not induce any change in work conditions.
(Suoyrjö et al., 2007) **Main topics of interest:** Allocation of rehabilitation services provided by SII. **Subjects:** 67 106 public-sector employees. 2409 ASLAK® participants (74% women). **Follow-up:** Not applicable (cross-sectional study). **Structure of ASLAK® course:** Not defined. **Data collection and outcomes:** Data from national health registers and employers' records.	Rate of sickness absence and job permanency were higher amongst the rehabilitants when compared with the non-rehabilitants.
(Pekkonen, 2010) **Main topics of interest:** Validity of the RAND-36 life amongst the working-age rehabilitants. **Subjects:** 320 ASLAK® participants (35% women). **Follow-up:** 1 year **Structure of ASLAK® course:** 3 IP. **Data collection and outcomes:** RAND-36.	**(+)** Pain level, quality of life.
(Tirkkonen et al., 2011) **Main topics of interest:** Health and well-being. **Subjects:** 433 cases (70% women). **Follow-up:** 1 year. **Structure of ASLAK® course:** Structure and duration of courses varied from 2 to 3 IP during 1.0 year, 15–22 days in total. **Data collection and outcomes:** *Questionnaire:* Work ability index, recovering from work stress, psychological resources for work, symptoms of depression and burnout, work control, presence of diseases affirmed by a physician, rates of visits to a physician, rates of sickness absence, quality of life (RAND-36). *Physical assessment:* Muscle strength tests, BMI.	**(+)** Work ability index, psychological resources for work, tiredness, burnout, recovering from work stress, positive thinking, rates of sickness absence, visits to a physician, perceived general, social and psychological health, pain, self-management of pain, muscle strength, BMI.

2.4.2. Risk of bias in the included studies, their subjects and methods

Overall, the methodological quality of the included studies was modest. None could be described as a high-quality study. There were no RCTs, and all of the included studies were observational. Two of them were cross-sectional (Helo, 2000, Suoyrjö et al., 2007); all of the others were longitudinal. Almost all of the studies were based on relatively small study populations and did not have properly selected control groups. The methodologically strongest study was the one conducted by Suoyrjö et al. (Suoyrjö et al., 2009). In this study, the investigators used register data derived from a cohort of almost 70 000 employees and created a control group matched according to the demographic characteristics of the rehabilitants.

Of the included studies, 8 studies were controlled and 14 uncontrolled. Five controlled studies used different matching procedures to create a control group (Järvinen et al., 1995, Suoyrjö et al., 2009, Turja et al., 2006, Turja et al., 2005a, Turja et al., 2007). Three studies compared cases with unmatched controls as follows: 1) the control group was non-randomly selected by an occupational physician (Leino et al., 1994), 2) the controls were persons who had been selected to participate in ASLAK®, but who did not enter the programme or discontinued their participation after a few days (Helo, 2000), and 3) the controls were non-randomly assigned by the investigators on the basis of the similarity in occupational status (Tirkkonen and Kinnunen, 2010). Initially, all of the included controlled studies received grade 3 according to the GRADE model. However, due to flaws in their design, an inconsistency of results, indirectness of the evidence or imprecise results, the grades of their quality were downgraded to grade 2 or 1.

For the included controlled studies, the median sample size of the study population (ASLAK® participants) was 117.5 (range from 148 to 3733). For the uncontrolled studies, the median sample size was 87.0 (range from 4 to 2409).

All of the ASLAK® courses evaluated in the included trials were implemented in private or third sector rehabilitation facilities located in Finland and were funded by SII. Most of the courses included in the trials were not diagnosis specific. A few courses were diagnosis specific, for example, their inclusion criteria required the presence of back or neck problems (Arokoski et al., 1996). All of the courses can be considered comparable, as their structure and target groups followed the primary preventive nature of ASLAK®. There was a substantial heterogeneity in the number and duration of in-patient periods, as well as in the intervals between them. Most of the courses were divided into two to four in-patient periods, each lasting from a few days to two weeks, and the entire course took one year to complete. Most of the studies emphasised the fact that the participant selection, structure, and methods used during the rehabilitation course had been strictly defined by SII.

Because of its purpose and inclusion criteria, ASLAK® targets people of working age, preferably around 50 years of age. As expected, also the populations of the included studies belonged to this age group. In only one of the included studies were the participants, due to their specific occupation, considerably younger, Air Force fighter pilots (Arokoski et al., 1996). Of the included trials, 40% were gender specific, including either male or female participants.

Most of the studies collected data from both participant questionnaires and physical tests. Four studies used register-based data from national health registers and/or from the employers' records (Helo, 2000, Leino et al., 1994, Suoyrjö et al., 2009, Suoyrjö et al., 2007). There was considerable inconsistency in the terminology used by the investigators to present the participants, methods, and results of their studies. In this review, some terms have been substituted by similar common expressions so that the data could be presented more consistently (Table 1).

2.5. Main results of the included studies

2.5.1. Participant selection

Only two controlled studies reported characteristics of the rehabilitants that may have affected the process of recognising the need for ASLAK® (Suoyrjö et al., 2007, Helo, 2000). In these studies the rehabilitants and non-rehabilitants were compared at the beginning of the programme. Suoyrjö et al. (2007) reported that sickness absence and job permanency were higher amongst the rehabilitants. Helo et al. (2000) reported that the rehabilitants had had fewer sick leaves than the non-rehabilitants had. In addition, one uncontrolled study reported that the participants in ASLAK® experienced less psychological, but more physical, limitations than the general population, as measured by the RAND-36 (Pekkonen, 2010).

2.5.2. Effects of the intervention (controlled studies)

Table 2 shows the incoherency and controversy of the results of the included controlled trials. While some studies reported improvements in a particular characteristic, others reported a neutral, or even negative, effect on the same outcome. Examples of such characteristics are health-related factors such as perceived general, mental and physical health and work-related factors such as perceived work ability and rates of sickness absence. One report found no evidence of the effectiveness of ASLAK® on pain reduction, an increase in leisure-time physical activity, or improvement in job control or support by co-workers (Leino et al., 1994). One controlled trial reported a neutral effect of ASLAK® on maximal oxygen consumption and body mass index (Tirkkonen and Kinnunen, 2010). Support by a supervisor was reported to decline after the rehabilitation (Turja et al., 2006).

A decrease in the risk of work disability has been reported as either neutral (Järvinen et al., 1995, Leino et al., 1994) or positive (Suoyrjö et al., 2009). In a recent study, ASLAK® seemed to be effective in reducing the incidence of sickness absence and early retirement on health grounds for only 3–4 subsequent years (Suoyrjö et al., 2009). This registry-based study was not able to control for important behavioural and work-related risk factors, and therefore the study was vulnerable to comparison biases.

The economic benefit of ASLAK® has been considered to be small when compared with the cost of the intervention (Suoyrjö et al., 2009). The cost-effectiveness of ASLAK® has been reported to be better for women than for men (Helo, 2000).

2.5.3. Effects of the intervention (uncontrolled studies)

The results of the uncontrolled studies showed the same incoherency and controversy as the controlled trials. Some of the studies reported positive effects of ASLAK® on perceived health (Kurki, 2004, Tirkkonen et al., 2011), pain reduction (Arokoski et al., 2002, Hinkka et al., 2000, Holopainen et al., 1998, Holopainen et al., 2004, Nevala-Puranen et al., 1998, Tirkkonen et al., 2011), leisure-time physical activity (Arokoski et al., 2002, Holopainen et al., 1998, Kurki, 2004), muscle strength (Arokoski et al., 1996, Arokoski et al., 2002, Holopainen et al., 1998, Kurki, 2004), maximal oxygen

consumption (Arokoski et al., 2002, Hinkka et al., 2000, Nevala-Puranen et al., 1998), and the number of visits to a physician (Arokoski et al., 2002, Tirkkonen et al., 2011). On the contrary, other investigations found that these effects were neutral (Arokoski et al., 1996, Holopainen et al., 2004, Kurki, 2004, Nevala-Puranen et al., 1998) or, regarding physical activity and life satisfaction, even negative (Kurki, 2004).

The effects of ASLAK® on experienced physical and mental work-related stress have also been incoherently reported as positive (Arokoski et al., 1996, Arokoski et al., 2002, Hinkka et al., 2000, Tirkkonen et al., 2011) or neutral (Holopainen et al., 1998, Holopainen et al., 2004, Turja et al., 2007). Some of the studies reported that ASLAK® was effective in decreasing body mass index (Arokoski et al., 2002, Hinkka et al., 2000, Kurki, 2004, Tirkkonen et al., 2011). Positive effects were observed on the range of spinal motion (Arokoski et al., 1996, Holopainen et al., 1998), blood pressure, the plasma level of gamma-glutamyl transferase, and blood lipids (Hinkka et al., 2000). ASLAK® has been found to improve work ergonomics, work techniques, and workplace functionality (Nevala-Puranen, 1995, Nevala-Puranen, 1996, Nevala-Puranen et al., 1998, Väyrynen and Könönen, 1991) and to increase exercise breaks at work (Holopainen et al., 2004). On the other hand, one study implied that the recommendations given to the participants during the rehabilitation did not lead to any changes in their work conditions (Turja et al., 2005a).

The rates of sickness absence were reported to decrease in two uncontrolled studies (Holopainen et al., 2004, Tirkkonen et al., 2011) and remain unchanged in three others (Arokoski et al., 1996, Arokoski et al., 2002, Holopainen et al., 1998).

2.6. Gaps in the evidence

The evidence on the overall effectiveness of ASLAK® is limited. Most of both the controlled and uncontrolled studies were limited to short follow-ups and/or the absence of properly selected control groups, and they reported controversial and inconsistent results. Previous investigations have primarily focused on such outcomes of ASLAK® as changes in physical or mental health or changes in the participants' perceived work-related strain, leaving the effect on preventing a decrease in work ability unrevealed [see Suoyrjo et al. 2009 for an exception]. Furthermore, it is not known, how much the participants' individual characteristics (age, occupational status, health complaints, and health-risk behaviours) influenced the effectiveness of ASLAK®.

How well occupational health professionals are able to recognise, in good time, employees who would benefit from ASLAK® not yet been studied.

Modifying participants' health-risk behaviours is an important tool used by a multi-professional team in order to preserve and improve work ability. Moreover, only a small number of studies has evaluated the effectiveness of the programme on improving health-risk behaviours, which are important risk factors of work disability. The limited evidence on the effects of ASLAK® on body mass index and leisure-time physical activity are inconsistent, and the effects of ASLAK® on smoking and drinking problems have thus far not been studied.

Thus the effectiveness of this costly (EUR 2500/rehabilitant (SII, 2011d)) intervention, widely used in Finland for 30 years, is not known.

3. AIMS OF THE STUDY

1. To examine the extent to which a wide range of risk factors of work disability predicts the probability of being granted in-patient, vocationally oriented medical rehabilitation (ASLAK®) (I).

2. To evaluate the effectiveness of vocationally oriented medical rehabilitation (ASLAK®):
   – In reducing the risk of long-term work disability (II)
   – In reducing health-risk behaviours (III)
   – In reducing perceived health problems (IV).

4. MATERIAL AND METHODS

4.1. Participants and study design

The study population was derived from the Finnish Public Sector Study (FPSS), which is an on-going prospective study of employees working either in 10 municipalities (Turku, Espoo, Vantaa, Tampere, Oulu, Raisio, Naantali, Valkeakoski, Virrat, and Nokia) or in 21 hospitals in 6 hospital districts (Hospital District of Southwest Finland, Hospital District of South Finland, Hospital District of Vaasa, Pirkanmaa Hospital District, Northern Ostrobothnia Hospital District, and Hospital District of Helsinki and Uusimaa). The FPSS has been designed and carried out by the Finnish Institute of Occupational Health. The Ethics Committee of this institute approved the study.

The descriptive characteristics of studies I–IV are presented in Table 2.

Table 2. Descriptive characteristics of studies I–IV.

	I	II	III	IV
Study design	Follow-up	Follow-up	Follow-up	Follow-up
Controlled	No	Propensity-score matched control group	Propensity-score matched control group	Propensity-score matched control group
Study population[2]	49 264 (1551 ASLAK®[a] participants[b])	5540 (1394 ASLAK®[a] participants[b] and 4146 controls)	3312 (872 ASLAK®[a] participants[b] and 2440 controls)	3312 (872 ASLAK®[a] participants[b] and 2440 controls)
Gender distribution (% women)	81%	87%	90%	90%
Main topic of interest	Selection for ASLAK®[a]	Reduction of long-term work disability	Change in behaviour-related risk factors	Change in subjective health problems

[a] Vocationally oriented medical rehabilitation. [b] All of the studied rehabilitants participated in ASLAK® between 1997 and 2005.

The register cohort of the FPSS is comprised all 151 618 employees with a ≥6-month job contract in any year from 1991/1996 to 2005. The nested survey cohort is based on the questionnaire survey responses of 70 376 employees who were at work in the years 1997–1998 (phase 1, sub-cohort), 2000–2002 (phase 2), or 2004–2005 (phase 3) and responded at least once (target population over the phases 94 494, response rate 74%). All of the respondents have been followed with repeated surveys (2006, phase 4; 2008–2009, phase 5; 2010, phase 6).

For this study, the participants who responded to an identifiable survey (see Appendix 2 for survey questions) either in 1997–1998 or in 2000–2002 were included. The first

survey response was considered for those who answered both surveys (response rate 70%), yielding a sample of 53 416 employees (81% women).

In study I, the granting of participation in ASLAK® after the baseline measurements was followed until 31December 2005. To ensure that the rehabilitation process had not been initiated at baseline, all 4152 employees who participated in rehabilitation provided by SII in the survey year or the following year were excluded. The study cohort comprised a total of 49 264 employees (81% women) with a mean age of 43.5 (standard deviation (SD) 9.4) years. This cohort was followed until 31 December 2005.

In study II, the risk of work disability after ASLAK® was followed until 31December 2005. Those who had been granted rehabilitation by SII before the baseline survey or had missing data on any of the matching variables were excluded. The eligible population consisted of 1398 cases and 35 946 non-cases of future ASLAK®. For each case, up to three controls with the same propensity score as the case were selected, the result being a total of 5540 participants (1394 rehabilitants and 4146 controls) for the statistical analyses.

In studies III and IV, short- and long-term changes in behavioural health risks and subjective health problems after ASLAK® were examined, based on the pre- and two post-rehabilitation survey responses. All of those who had been granted any rehabilitation by SII before the baseline survey or had missing data on any of the matching variables were excluded. The potential participants (cases) were all those who had entered the vocationally oriented medical rehabilitation between the first (baseline) and the second (first follow-up) survey. Up to three controls per case with the same propensity to be granted participation in ASLAK® were selected, resulting in 872 cases and 2440 controls.

All of the cases participated in the ASLAK® programme between 1997 and 2005.

The case–control selection flow of studies I–IV is presented in Figure 2.

4.2. Periods of follow-up

The mean follow-up of *study I* was 5.0 (standard deviation (SD) 1.7, range 1.0–8.0) years. The study began on 1 January immediately after the year of the survey response, and it ended at the beginning of rehabilitation, retirement (early retirement on health grounds or statutory retirement), death, or 31 December 2005, whichever came first.

In *study II*, the mean follow-up for long-term work disability was 2.8 (SD 1.49, range 0.04–5.0) years. The study began immediately after the rehabilitation and ended with a long-term sickness absence or disability pension, official retirement pension (old-age pension), death, or 31 December 2005, whichever came first.

In *studies III* and *IV,* data on the baseline characteristics of the study population were gathered before the beginning of the intervention (mean 1.8 (SD 1.07) years). The short-term follow-up was based on the first survey after the beginning of ASLAK®, while the long-term follow-up lasted until the next survey 4 years later. The mean time for the short-term follow-up was 1.7 (SD 1.01, range 0.003–4.55) years. The corresponding figure for the long-term follow-up was 5.8 (SD 1.13, range 3.12–9.16) years. As it is

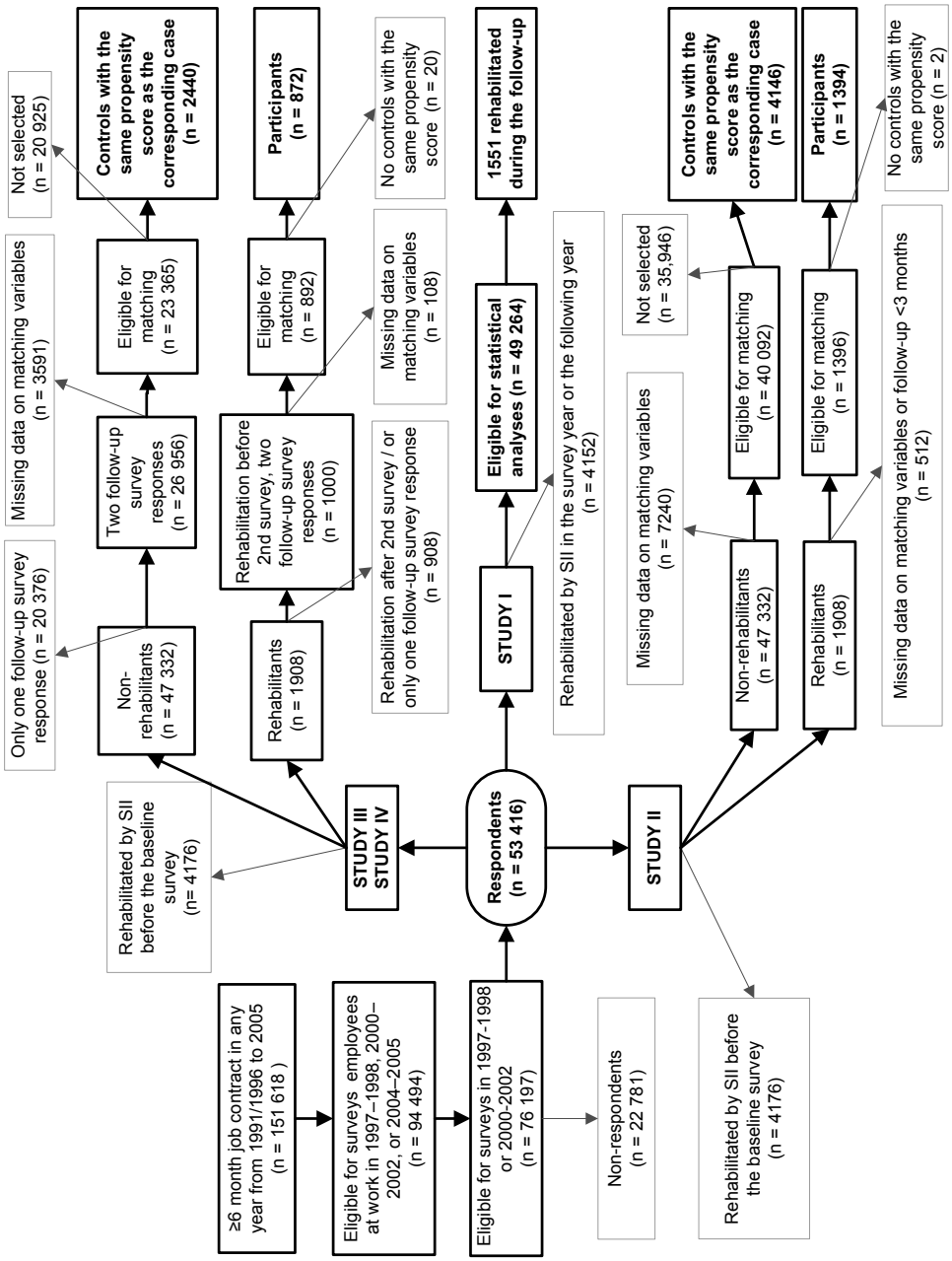

Figure 2. Flow-chart showing the selection of subjects for studies I–IV.

possible that the longest duration of the short-term follow-up in some cases exceeded the shortest duration of the long-term follow-up, a sensitivity analysis was carried out that included the 750 cases with a short-term follow-up of 3 years or less, and the long-term follow-up was at least 4 years. The results did not differ from those of the main analyses: no benefits other than a higher likelihood of quitting smoking were observed in the short-term amongst the cases (data not shown).

4.3. Registers used in the study

The FPSS uses the unique personal identification codes assigned to all citizens in Finland to link the participants to employers' records, the Pensions Register of the Finnish Centre for Pensions, the Register of Statistics Finland, the Finnish Cancer Registry (not used for the present study population), and registers kept by SII – the Drug Reimbursement Register, the Drug Prescription Register, the Sickness Absence Register, and the Rehabilitation Register (Table 3).

Table 3. Descriptive characteristics of national health registers used in this study

Register	Description
The Pensions Register of the Finnish Centre for Pensions	Data on pension decisions issued by the pension providers, data on periods of drawing a pension which accrue new pension rights. The register also contains data on foreign pension decisions issued on the basis of the EU[a] and EEA[b] rules or a social security agreement. The data are obtained from domestic and foreign pension providers.
Register of Statistics Finland	Finnish public authority specifically established for statistics. It produces the vast majority of official Finnish statistics.
Drug Reimbursement Register	Kept by SII[c] and contains information about persons entitled to special reimbursement of the costs for medication for some chronic and severe diseases. Patients who apply for the special reimbursement need to attach a detailed physician's certificate of confirmed diagnosis.
Drug Prescription Register	Kept by SII[c] and includes all out-patient data of filled prescriptions classified according to the ATC[d] classification code of WHO[e]. The Register does not include diagnoses for prescriptions, but the data contain the exact dates of all purchases of these prescribed drugs and the corresponding number of DDDs[f].
Sickness Absence Register	Kept by SII[c] and reliably covers all reimbursed sickness absences in that all Finnish residents aged 16–67 years are eligible for daily allowances due to medically certified sickness absence.
Rehabilitation Register	Kept by SII[c] and reliably covers all rehabilitation granted by SII[c].

[a] EU – European Union. [b] EEA – European Economic Area. [c] SII – Social Insurance Institution of Finland. [d] ATC – anatomical therapeutic chemical. [e] WHO – World Health Organization. [f] DDD – defined daily dose – the assumed average maintenance dose per day for a drug used for its main indication in adults.

4.4. Definitions of the variables used in the study

Table 4. Definitions of the variables used in the study.

Variable and definition	Data source	Studies
Demographic characteristics		
Age group (years): 40 or under, 41 – 50, and 51 or older.	Employers' records	I–IV
Gender: Male / female.	Employers' records	I–IV
Occupational grade (ISCO[a] grade)**:** Managers and professionals (1–2), technicians and associate professionals (3), clerks (4), service workers (5), manual workers (6–9).	Employers' records	I–IV
Educational level: High school yes / no.	Survey	I–IV
Marital status: Married or cohabiting versus single, divorced or widowed.	Survey	I–IV
Type of employer: Municipality or hospital district.	Employers' records	I–IV
Residential region: Southern, Northern, or Central Finland.	Employers' records	I–IV
Work characteristics		
Type of job contract: Permanent / temporary.	Employers' records	I–IV
Length of the contract (years): <1; 1 – 9; >9.	Employers' records	I–IV
Shift work: Direct question "Do you work regular day shifts?" Yes / no.	Survey	I–IV
- **Intention to leave work:** Continue the job / Switch jobs / Give up the job.	Survey	I–IV
Job insecurity: Two questions, which estimate the threat of long-term unemployment or dismissal (from 1 = very little to 5 = very much). Low, intermediate and high.	Survey	I–IV
Job control: 9 items derived from the JCQ[b]. Low, intermediate and high.	Survey	I–IV
Severe financial difficulties: During the baseline year. Yes / no.	Survey	I–II
Health behaviour		
Current smoking: Yes / no.	Survey	I–IV
Heavy drinking: 3 questions on average weekly consumption of beer, wine, and spirits. Cut-off point >210 g of pure alcohol per week. Yes / no.	Survey	I–IV
Obesity: BMI[c] ≥ 30 kg/m^2. Yes / no.	Survey	I–IV
Physical inactivity: 4 questions on the quantity of physical activity equivalent to walking, brisk walking, jogging, or running. Cut-off point ≤2 MET[d] hours/day. Yes / no.	Survey	I–IV
Binge drinking: Participant had passed out due to heavy alcohol consumption once or more often during the past 12 months. Yes / no.	Survey	III–IV
Health indicators		
Sickness absence: >60 absence days during the last 3 years. Yes / no.	Sickness Absence Register of SII[h]	I–IV
Psychological distress: Responses to GHQ-12[e] were dichotomised as no/yes, using 3/4 as the cut-off point. Yes / no.	Survey	I–IV
Anxiety: 6 items derived from the Spielberger's State-Trait Anxiety Inventory (1, 6, 10, 13, 16, and 19). A mean score was computed and divided into tertiles to indicate low, intermediate or high anxiety. In studies III–IV the result was dichotomised as high anxiety vs. low and intermediate anxiety.	Survey	I–IV
Self-rated health: Assessed with a standard question: "How would you judge the state of your general health?" and response placed on a 5-point scale (1 – very good to 5 – very poor). The results were dichotomised by the categorising response scores 1–2 as good health and scores 3–5 as sub-optimal health.	Survey	I–IV
Baseline physical health: Presence of a chronic disease[f]. Yes / no.	Drug Reimbursement Register of SII[h]	I–IV
Use of prescribed painkillers: >30 defined daily dosages during the survey year (ATC[g] code N02 and M01A). Yes / no.	Drug Prescription Register of SII[h]	I–IV
Use of prescribed antidepressants: >30 defined daily dosages during the survey year (ATC[g] code N06A). Yes / no.	Drug Prescription Register of SII[h]	I–IV

[a] ISCO – International Standard Classification of Occupations. [b] JCQ – Job Content Questionnaire. [c] BMI – body mass index. [d] MET – Metabolic Equivalent of Task. [e] GHQ-12 – 12-item version of the General Health Questionnaire. [f] Indicated by special reimbursement for the medical treatment of hypertension, cardiac failure, ischaemic heart disease, diabetes, asthma or other chronic obstructive lung disease, and rheumatoid arthritis. [g] ATC – anatomical therapeutic chemical. [h] SII – Social Insurance Institution of Finland.

4.5. Outcome measures

4.5.1. Participation in ASLAK® granted by SII (I)

The factors predicting the probability of an employee being granted participation in ASLAK® were studied. Data on granted participation in ASLAK® were obtained from the Rehabilitation Register kept by SII.

4.5.2. Long-term work disability (II)

The effectiveness of the ASLAK® programme in reducing the risk of long-term work disability was studied. The outcome measure was documented as long-term work disability, defined as either sick leave of >90 days or disability retirement, whichever came first. The duration of 90 days was used as a cut-off point for sick leave because, from 1997 on, diagnoses have been available for these very long absences. The outcome was quantified with the use of data obtained from the Sickness Absence Register kept by SII and the Pension Register of the Finnish Centre for Pensions. These national registers reliably cover all reimbursed sickness absences and retirements in that all Finnish residents 16–67 years of age are eligible for daily allowances due to medically certified sickness absence and all gainful employment is insured in some pension scheme and accrues a pension. Work disability was analysed, firstly, as being caused by any disease and, secondly, as being caused by musculoskeletal or mental disorders, the two most prevalent and significant causes of work disability in most European countries (Chamberlain et al., 2009).

4.5.3. Behavioural health risks (III)

The effect of the ASLAK® programme on the change in health-risk behaviours (leisure-time physical inactivity, smoking, heavy drinking and obesity) was evaluated. Using three repeated questionnaire surveys, two types of outcomes were measured. Firstly, the changes in the prevalences of obesity, leisure-time physical inactivity, smoking, and heavy drinking were measured. Secondly, the changes in weight, level of leisure-time physical activity, and alcohol consumption were measured.

The body mass index (BMI; kg/m^2) was derived from self-reported weight and height and dichotomised to indicate obesity (BMI $\geq$30). The change in self-reported weight (kg) was measured for those who were obese or non-obese at baseline.

The participants' reports of the level of their physical activity equivalent to walking, brisk walking, jogging, or running was used to estimate the metabolic equivalent of task (MET) hours per day. Physical inactivity was defined as $\leq$2 MET hours (no/yes) (Kujala et al., 2002). The change in MET hours/day was assessed for those who were physically active and for those who were physically inactive at baseline.

Smoking status (never, ex-smoker and current smoker) was operationalised as current smoking (yes/no). Smoking cessation was identified amongst the baseline smokers.

The participants reported their average weekly consumption of beer, wine, and spirits in units. The units were converted into grams of pure alcohol, and >210 grams of pure

alcohol per week was considered the cut-off for heavy drinking (no/yes) (Kouvonen et al., 2008, Rehn et al., 2001). Binge drinking was determined by inquiring whether the participant had passed out due to heavy alcohol consumption once or more often during the past 12 months (Paljärvi et al., 2009). The Finnish term used for "pass-out" refers to alcohol-related loss of consciousness, but without reference to loss of memory (blackout) (Paljärvi et al., 2009).

4.5.4. Subjective health problems (IV)

The effect of the ASLAK® programme on the perceived health of the participants was assessed. The assessment of health change was based on three repeated measurements of self-rated sub-optimal general health, psychological distress, and anxiety amongst the participants and controls.

Self-rated general health was assessed with the following standard question: "How would you judge the state of your general health?", and the response was placed on a 5-point scale (1 – very good to 5 – very poor). The results were dichotomised by categorising the response scores 1–2 as good health and the scores 3–5 as sub-optimal health (Ferrie et al., 2011, Westerlund et al., 2009).

Psychological distress was assessed using the 12-item version of the General Health Questionnaire (GHQ–12), which produces results comparable with the longer versions of the General Health Questionnaire. The General Health Questionnaire is a well-established scale for the evaluation of psychological distress in general population samples and is recommended for large epidemiologic studies because of its excellent screening performance and the briefness of the scale. The responses were dichotomised as no/yes, using 3/4 as the cut-off point (Holi et al., 2003).

Symptoms of anxiety were measured by six items derived from the State-Trait Anxiety Inventory (Spielberger et al., 1983). The respondents were asked to indicate how well statements ("I feel calm", "I feel upset", "I feel comfortable", "I am jittery", "I feel content", and "I feel pleasant", i.e. items 1, 6, 10, 13, 16, and 19) describe them, expressed on a scale ranging from 1 (not at all) to 4 (very much so). A mean score was computed and divided into tertiles to indicate low, intermediate, and high anxiety. The result was dichotomised as high anxiety versus low and intermediate anxiety.

4.6. Selection of the control group in studies II–IV with propensity-score matching

The purpose of the matching procedure is to mimic the randomised selection process of subjects who are going to be treated by the intervention. The conventional matching procedure identifies the treated and non-treated subjects by matching them exactly, for example, by demographic characteristics such as gender, age group and socioeconomic position. After the matching, these characteristics are distributed evenly in the groups. This procedure enables the control of the selection for only the selected variables, which

clearly distinguishes it from true randomisation, which is based on a countless number of observed and unobserved characteristics.

A conventional exact matching procedure may work sufficiently when the number of variables is relatively small. When there are too many matching variables, a multi-dimensional problem may occur, in that the list of possible variables is too large and the match is difficult to achieve for each observed variable. Therefore, the growing list of matching variables may amplify the number of subjects who remain unmatched.

Propensity-score matching avoids the multi-dimensional problem as it transforms the matching process into single dimensional one. The procedure of propensity score matching is not performed on each given variable separately, but, instead, on a single calculated variable, called a propensity score. A calculated propensity score describes the probability of each subject being selected into the intervention. In other words, instead of using many matching variables and taking the risk of potential confounding, as well as the risk of leaving many subjects outside the matching, the investigator can match cases and controls according to only one calculated variable and avoid, as well as possible, the substantial drop-off of study subjects and bias from confounding.

Propensity score matching is a good choice for creating a control group in an epidemiologic study when true randomisation is not applicable. It is well applicable to large study populations when data on the subjects' characteristics are gathered before the intervention (Rosenbaum and Rubin, 1983, Shah et al., 2005). One disadvantage of any matching is the risk of confounding as some matching variable may affect both the determinant and the outcome. Moreover, propensity score matching cannot rule out confounding from unmeasured third factors, as it is based on measured variables only.

In *studies II–IV*, the control groups were selected by the propensity-score matching to approximate the exchangeability of the comparison groups. The propensity score is the conditional probability of being assigned "treatment", here ASLAK®, given the observed covariates (Rosenbaum and Rubin, 1983, Shah et al., 2005). In other words, this approach ascertains – in theory – that the cases and controls would differ only in the receipt of ASLAK®.

The propensity scores were calculated by using binary logistic regression models for being granted participation in ASLAK® (dichotomous outcome) as the dependent variable and including 25 (*study II*) or 24 (*studies III–IV*) pre-treatment variables, known to be associated with rehabilitation, and their interactions with gender, socioeconomic status, and age group as the dependent variables, in all 96 terms in the models. For each subject, the modelling gives a score ranging from 0 to 1 (i.e. his /her probability to be a case as a function of the predictor terms). Once the propensity score had been estimated, each case was matched with one to three controls (non-ASLAK® recipients) according to a pre-defined calliper width of +0.01, and the unmatched cases were discarded. The balance achieved by matching was studied using the chi-square test. The case–control selection flow of *studies I–IV* is presented in Figure 2.

The simplified illustration of the differences between conventional and propensity score matching is given in Appendix 3.

4.7. Statistical methods

In *study I*, Cox proportional hazard models were used to study the associations between the potential predictors and the subsequent beginning of the rehabilitation. The results were reported as hazard ratios (HRs) and their 95% confidence intervals (95% CIs). The first set of analyses examined the associations in four different groups of predictors (demographics, work or life stress, health behaviours and health-related variables) adjusted for demographics. Then, all of the significant predictors of rehabilitation found in the first step were entered into a single model to examine their independent associations with rehabilitation.

In *study II*, Cox proportional hazard models were used to study the risk of work disability amongst the rehabilitants and controls. The results were reported as hazard ratios (HRs) and their 95% CIs.

In *studies III* and *IV,* repeated-measures log-binomial regression analysis with generalised estimating equations (GEE) method was applied for studying the changes in the prevalence of the behaviour-related risk factors (III), and the prevalence of sub-optimal health, anxiety and psychological distress (IV) amongst the participants and controls (Lipsitz et al., 1994, Spiegelman and Hertzmark, 2005). The GEE method takes into account the correlation between measurements of health within persons. For the participants and their matched controls, the prevalence ratios (PRs) for the outcome of interest and their 95% CIs for each phase of the follow-up were calculated. Point estimates were derived from GEE models including the interaction term "caseness x phase".

In *study III,* repeated-measures analysis of variance was performed to study the changes in the continuous variables (weight, physical activity and alcohol consumption) and the results were reported as the mean values, their 95% confidence limits, and p-values.

All of the statistical analyses were performed using SAS© 9.2 software (SAS Institute, Inc., Cary, North Carolina, USA).

5. RESULTS

5.1. Risk factors of work disability as predictors of participation in the ASLAK® programme (I)

Of all the 49 264 employees, 1551 (86.8% women, mean age 44.0 years) participated in ASLAK® during the mean follow-up of 5.0 (SD 1.7, range 1.0–8.0) years (Tables 5 and 6).

Rehabilitation was more likely to be granted to women than to men, and to employees 41–50 years of age, and with the highest occupational status. These associations remained significant after adjustment for all of the statistically significant variables related to demographics, work and life stress, health behaviours and health.

Fixed-term employees and those with a short tenure had a lower probability of being granted rehabilitation than permanent employees. Low job control and high job insecurity were associated with a 20–30% lower likelihood of selection into ASLAK®.

Obesity was not associated with subsequent ASLAK® participation. Smokers were 23% less likely to receive rehabilitation than non-smokers. This association was strong in all of the adjustments (Table 6). A corresponding finding was observed for physical inactivity as physically inactive participants had a 15% smaller probability of being selected for participation in ASLAK® than physically active persons. Heavy drinking was not associated with subsequent ASLAK® participation.

Participation in ASLAK® was independently associated with sickness absence, use of painkillers, and trait anxiety. The association of sickness absence with ASLAK® was observed only amongst those with a moderate number of sickness absence days. The use of painkillers predicted an approximately 22% higher likelihood of selection into ASLAK®. The employees belonging to the group with the highest tertile of anxiety were over 40% more likely to be rehabilitated than those in the lowest tertile. Poor self-rated health was not associated with granted ASLAK® participation. The use of antidepressants, chronic medical conditions and psychological distress were not associated with participation in ASLAK®.

Table 5. Demographic characteristics, work stress or life stress as predictors of subsequent rehabilitation. Hazard ratios (HRs) and 95% confidence intervals (95% CIs) derived from Cox proportional hazard models.

			Model 1[a]		Model 2[b]	
	N	%	HR	95% CI	HR	95% CI
Gender						
Women	39 719	81	1.57	1.33–1.83	1.51	1.29–1.77
Men	9545	19	1.00	ref	1.00	ref
Age-group – years						
40 or under	18 314	37	1.00	ref	1.00	ref
41–50	17 168	35	2.62	2.33–2.95	2.39	2.11–2.70
51 or older	13 782	28	0.73	0.61–0.88	0.69	0.57–0.84
ISCO[c] grade						
1–2 (managers)	13 855	28	1.00	ref	1.00	ref
3	12 887	27	0.72	0.62–0.83	0.78	0.67–0.91
4	3511	7	0.51	0.40–0.65	0.58	0.45–0.75
5	10 647	22	0.67	0.57–0.80	0.79	0.68–0.93
6–9 (manual)	7728	16	0.57	0.47–0.71	0.75	0.62–0.92
Marital status					–	
Married/cohabiting	37 057	76	1.06	0.94–1.20		
Single	11 634	24	1.00	ref		
Job contract						
Permanent	39 016	81	1.00	ref	1.00	ref
Fixed–term	9350	19	0.44	0.37–0.53	0.51	0.42–0.63
Shift work					–	
No	31 409	65	1.00	ref		
Yes	17 140	35	0.94	0.84–1.06		
Intention to leave work						
Continue the job	24 271	51	1.00	ref	–	
Switch jobs	12 633	27	1.11	0.98–1.25		
Give up the job	10 658	22	1.00	0.87–1.16		
Financial difficulties					–	
No	37976	93	1.00	ref		
Yes	2862	7	1.09	0.89–1.33		
Job insecurity						
Low	19 165	39	1.00	ref	1.00	ref
Intermediate	18 717	38	0.92	0.82–1.03	0.92	0.82–1.04
High	10 848	22	0.71	0.61–0.82	0.79	0.67–0.92
Job control						
Low	15 333	31	0.79	0.69–0.92	0.81	0.70–0.94
Intermediate	16 204	33	0.96	0.85–1.08	0.95	0.84–1.08
High	17 321	35	1.00	ref	1.00	ref

[a] Adjusted for demographic variables. [b] Adjusted for statistically significant variables related to demographics, work or life stress, health behaviours or health. [c] ISCO – International Standard Classification of Occupations

Table 6. Health-risk behaviours and health-related characteristics as predictors of subsequent rehabilitation. Hazard ratios (HRs) and 95% confidence intervals (95% CIs) derived from Cox proportional hazard models.

			Model 1[a]		Model 2[b]	
	N	%	HR	95% CI	HR	95% CI
Obesity – BMI[c] ≥30 kg/m^2					–	
No	43 186	90	1.00	ref		
Yes	4964	10	0.94	0.79–1.14		
Smoking						
No	38 986	82	1.00	ref	1.00	ref
Yes	8588	18	0.78	0.68–0.91	0.77	0.66–0.89
Alcohol consumption – g/week					–	
0–210g	44 775	92	1.00	ref		
>210g	3887	8	1.02	0.84–1.24		
Physical inactivity						
No	36 967	76	1.00	ref	1.00	ref
Yes	11 409	24	0.85	0.75–0.97	0.85	0.75–0.97
Previous rehabilitation						
No	47 383	96	1.00	ref	1.00	ref
Yes	1881	4	0.33	0.21–0.52	0.27	0.17–0.43
Sickness absence – days/3 years						
No	33 675	68	1.00	ref	1.00	ref
1–59	11 219	23	1.17	1.04–1.32	1.15	1.02–1.31
60 or more	4370	9	1.08	0.89–1.32	1.06	0.86–1.31
Chronic medical problems[d]					–	
No	43 903	89	1.00	ref		
Yes	5361	11	0.94	0.78–1.13		
Use of antidepressants					–	
No	39 626	94	1.00	ref		
Yes	2439	6	1.09	0.87–1.36		
Use of pain killers						
No	32 442	77	1.00	ref	1.00	ref
Yes	9623	23	1.21	1.07–1.36	1.22	1.07–1.38
Anxiety						
Low	13 476	28	1.00	ref	1.00	ref
Intermediate	19 275	40	1.23	1.08–1.40	1.30	1.14–1.49
High	15 114	32	1.31	1.14–1.50	1.42	1.23–1.64
Poor self-rated health					–	
No	36 957	76	1.00	ref		
Yes	11 727	24	1.01	0.89–1.15		
Psychological distress					–	
No	37 137	76	1.00	ref		
Yes	11 840	24	1.11	0.99–1.25		

[a] Adjusted for demographic variables. [b] Adjusted for statistically significant variables related to demographics, work or life stress, health behaviours or health. [c] BMI – body mass index. [d] Hypertension, cardiac failure, ischaemic heart disease, diabetes, asthma or other chronic obstructive lung disease, and rheumatoid arthritis.

5.2. Baseline characteristics of the ASLAK® rehabilitants (II–IV)

The occupational status of the rehabilitants, according to the International Standard Classification of Occupations (ISCO), varied widely from manual workers to managers. Most of the rehabilitants were permanently employed, held the highest occupational positions, did not experience high job insecurity, and did not intend to give up their jobs. Women predominated in the study population. Most of the rehabilitants were healthy, reported good self-rated health, and did not use prescribed painkillers or antidepressants. They also reported low levels of anxiety and psychological distress. The prevalences of such health risk behaviours as smoking, heavy drinking, obesity, and leisure-time physical inactivity were relatively low amongst the participants. No differences were observed between the rehabilitants and their controls regarding the individual variables used in the calculation of the propensity score, except for self-reported psychological distress and the participants' age in study II, and for the type of employer in studies III–IV. The health-related characteristics of the rehabilitants and the controls in study II were similar also at the time the rehabilitation started.

Table 7. Distribution of the variables used for the propensity score matching of the rehabilitants and control group in study II.

Covariates used in the propensity score matching	Rehabilitants (N=1394) N (%)	Control group (N=4146) N (%)	Chi²-test p-value	t-test p-value
Propensity score – mean (range)	0.082 (0.002–0.297)	0.081 (0.002–0.295)		0.411
Gender			0.685	
Women	1214 (87)	3593 (87)		
Men	180 (13)	553 (13)		
Age–group – years			0.001	
40 or under	315 (23)	1036 (25)		
41–50	850 (61)	2584 (62)		
51 or older	229 (16)	526 (13)		
Mean age (SD)	44.8 (5.5)	43.9 (6.4)		<0.001
ISCO[a] grade			0.690	
1–2 (managers)	506 (36)	1466 (35)		
3	365 (26)	1098 (26)		
4	59 (4)	215 (5)		
5	306 (22)	904 (22)		
6–9 (manual)	158 (11)	463 (11)		
Type of employer			0.766	
Municipality	870 (62)	2569 (62)		
Hospital district	524 (38)	1577 (38)		
Residential region			0.681	
Southern Finland	799 (57)	2331 (56)		
Central Finland	418 (30)	1295 (31)		
Northern Finland	177 (13)	520 (13)		
Marital status			0.375	
Married/cohabiting	1081 (78)	3262 (79)		
Single	313 (22)	884 (21)		

Covariates used in the propensity score matching	Rehabilitants (N=1394) N (%)	Control group (N=4146) N (%)	Chi²-test p-value	t-test p-value
High educational level			0.401	
No	636 (46)	1838 (44)		
Yes	758 (54)	2308 (56)		
Job contract			0.315	
Permanent	1286 (92)	3789 (91)		
Fixed-term	108 (8)	357 (9)		
Length of job contract (years)			0.169	
10 or over	227 (16)	684 (17)		
1–9	1007 (72)	2908 (70)		
<1	160 (11)	554 (13)		
Mean length (SD)	4.78 (5.7)	4.72 (5.7)		0.753
Shift work			0.442	
No	894 (64)	2706 (65)		
Yes	500 (36)	1440 (35)		
Intention to leave work			0.447	
Continue the job	727 (52)	2114 (51)		
Switch jobs	402 (29)	1270 (31)		
Give up the job	265 (19)	762 (18)		
Job insecurity			0.832	
Low	589 (42)	1782 (43)		
Intermediate	577 (41)	1678 (40)		
High	228 (16)	686 (17)		
Mean score (SD)	1.64 (0.75)	1.63 (0.76)		0.647
Job control			0.632	
Low	340 (24)	1006 (24)		
Intermediate	480 (34)	1377 (33)		
High	574 (41)	1763 (43)		
Mean score (SD)	3.76 (0.60)	3.76 (0.63)		0.937
Obesity, BMI[b] $\geq$ 30 kg/m²			0.853	
No	1269 (91)	3781 (91)		
Yes	125 (9)	365 (9)		
Mean (SD)	24.9 (3.8)	24.6 (3.8)		0.011
Smoking			0.654	
No	1207 (87)	3570 (86)		
Yes	187 (13)	576 (14)		
Mean consumption[e] (SD)	10.3 (6.5)	11.0 (6.6)		0.217
Alcohol consumption – g/week			0.867	
0–210g	1295 (93)	3846 (93)		
>210g	99 (7)	300 (7)		
Mean consumption (SD)	62.2 (83.1)	61.5 (96.5)		0.789
Physical inactivity			0.449	
No	1110 (80)	3340 (81)		
Yes	284 (20)	806 (19)		
Mean – MET[c]/day (SD)	4.77 (4.1)	4.85 (4.2)		0.540

Covariates used in the propensity score matching	Rehabilitants (N=1394) N (%)	Control group (N=4146) N (%)	Chi²-test p-value	t-test p-value
Sickness absence (days/3yrs)			0.260	
No	939 (67)	2886 (70)		
1–59	359 (26)	1007 (24)		
60 or more	96 (7)	253 (6)		
Mean (SD)	13.4 (28.0)	13.4 (32.1)		0.936
Chronic medical problems [d]			0.586	
No	1291 (93)	3821 (92)		
Yes	103 (7)	325 (8)		
Use of antidepressants			0.487	
No	1256 (95)	3720 (95)		
Yes	68 (5)	182 (5)		
Use of painkillers			0.416	
No	1010 (76)	3019 (77)		
Yes	314 (24)	883 (23)		
Anxiety			0.212	
Low	346 (25)	1066 (26)		
Intermediate	558 (40)	1729 (42)		
High	490 (35)	1351 (33)		
Mean score (SD)	1.96 (0.56)	1.93 (0.54)		0.030
Suboptimal self-rated health			0.106	
No	1085 (78)	3311 (80)		
Yes	309 (22)	835 (20)		
Mean score (SD)	1.90 (0.78)	1.81 (0.81)		<0.001
Psychological distress			0.032	
No	1022 (73)	3158 (76)		
Yes	372 (27)	988 (24)		
Mean score (SD)	2.03 (0.45)	2.00 (0.44)		0.027

[a] ISCO – International Standard Classification of Occupations, [b] BMI – body mass index, [c] MET – metabolic equivalent of task, [d] Hypertension, cardiac failure, ischaemic heart disease, diabetes, asthma or other chronic obstructive lung disease, and rheumatoid arthritis, [e] Cigarettes/day.

5.3. Effectiveness of ASLAK® on reducing the risk of long-term work disability (II)

During the mean follow up of 2.8 (SD 1.49, range 0.04–5.0) years, incident long-term work disability due to any disease was observed for 85 (6.1%) rehabilitants and 257 (6.2%) controls. The Kaplan-Meir curves, showing the probability of work disability for the cases and controls, as a function of time, were practically identical over the whole exposure window (Figure 3).

The hazard ratio for incident work disability due to any disease was 0.98 (95%CI 0.76–1.25) between all of the rehabilitants and controls: 0.96 (95%CI 0.74–1.26) for the women and 1.10 (95%CI 0.55–2.20) for the men. For work disability due to musculoskeletal and mental disorders, the corresponding hazard ratios were 0.86 (95%CI 0.57–1.30) and 1.08 (95%CI 0.67–1.74), respectively.

During the follow-up, there was no significant difference between the groups in terms of duration of sick leaves (11.8 days/year for the cases and in versus 10.7 days/year for the controls). Instead, the number of sick leaves of any duration was higher for the rehabilitants (HR 1.19, 95% CI 1.09–1.29).

The risk of non-return to work within a 1-year time window was calculated for those who received a work disability benefit (sick leave >90 days or disability retirement). The data for this calculation were available for 61 of the 85 rehabilitants and for 177 of the 257 controls. Although a slightly higher proportion of the rehabilitants than the controls returned to work, the risk of non-return did not significantly differ between the cases and the controls in relation to all-cause or cause-specific work disability.

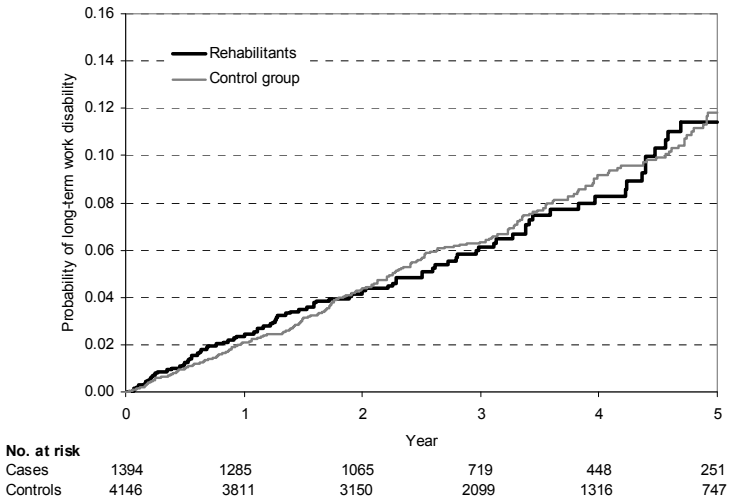

Figure 3. Incidence of long-term work disability during the follow-up.

5.4. Effectiveness of ASLAK® in reducing the health risk behaviours (III)

Changes in the prevalences of the behaviour-related risk factors (leisure-time physical inactivity, smoking cessation, heavy drinking and obesity)

Figure 4 shows the changes in the prevalence of behaviour-related risk factors shortly after the intervention (mean 1.7 (SD 1.01, range 0.003–4.55) years) and in the long-term follow-up (mean 5.8 (SD 1.13, range 3.12–9.16) years). The prevalence of obesity increased amongst the participants and controls (by 6.4% and 4.1%, respectively) during the entire follow-up without a significant difference between the two groups. The prevalence of smoking decreased in both groups during the entire follow-up, amongst the participants by 4.5% and amongst the controls by 3.8%. Although the participants quit smoking (p=0.037) more often than the controls did during the short-term follow-up, this difference disappeared during the long-term follow-up. The prevalence of physical inactivity increased slightly amongst the participants and controls during the

long-term follow-up (by 2.5% and 3.1%, respectively) without a significant difference between the groups (p=0.68). The prevalence of heavy and binge drinking remained almost unchanged in both groups.

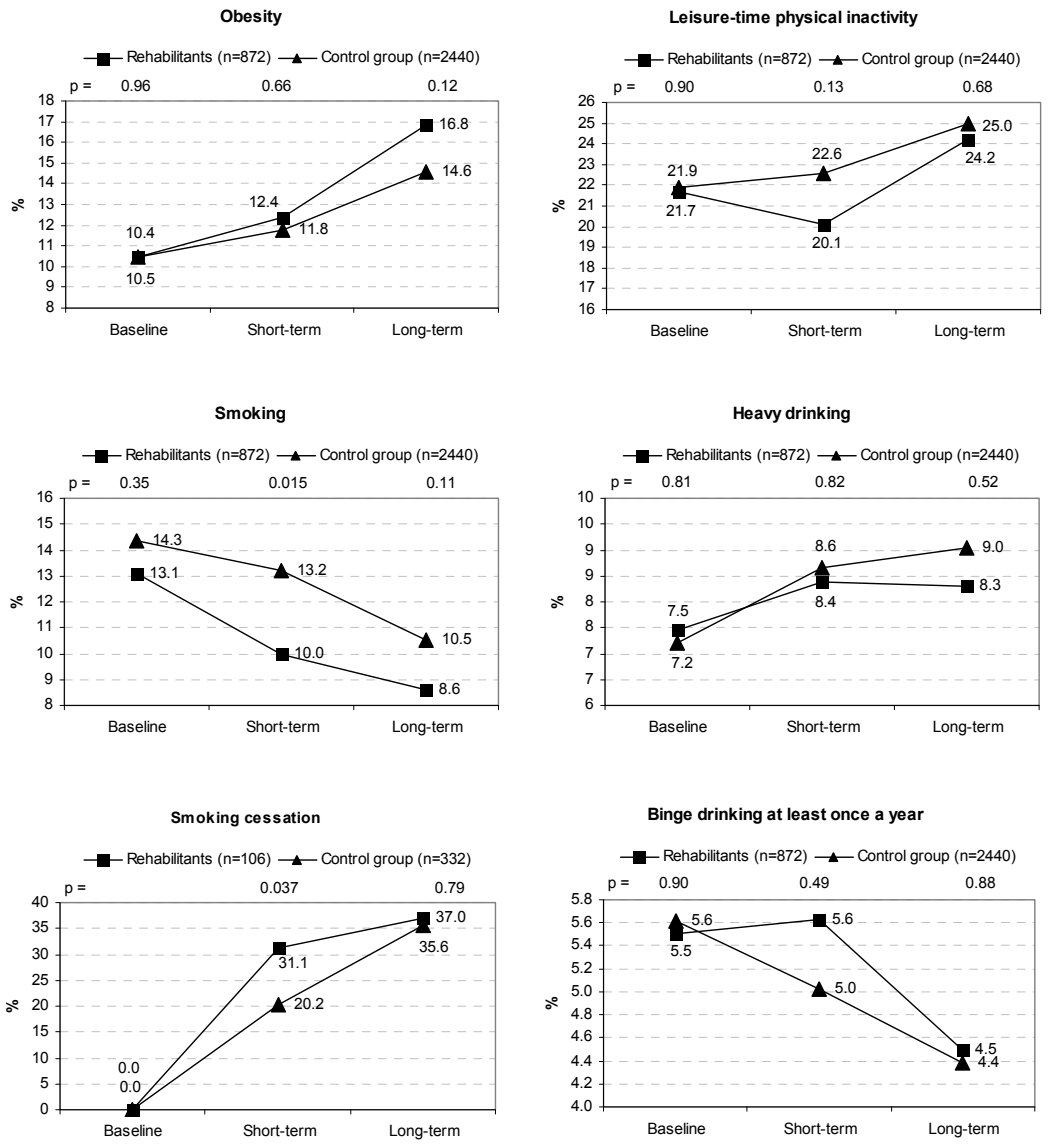

Figure 4. Prevalence of the participants' behaviour-related risk factors at the baseline and at the short-term (mean 20 months) and long-term (mean 70 months) follow-ups in comparison with the controls.

Changes in individual characteristics of the participants (weight, intensity of physical activity, and alcohol consumption)

There was a minor increase in body weight amongst the participants who were not obese at baseline when they were compared with their controls (mean increase by 3.5 kg and

2.8 kg, respectively) in the long-term follow-up (p=0.005). Amongst the participants who were obese at baseline, no significant difference in weight change was observed. The physically inactive cases and controls at baseline increased their physical activity in the short-term follow-up (mean 1.66 and 1.69 MET hours/day, respectively), and the improvement lasted also through the entire follow-up (mean 1.46 and 1.71 MET hours/day, respectively), with no difference between the two groups. At the same time, the cases and controls physically active at baseline slightly reduced their activity throughout the entire follow-up. Also in relation to changes in alcohol consumption, no significant difference was observed between the two groups during the follow-up.

5.5. Effectiveness of ASLAK® in improving perceived health (IV)

Amongst participants, the prevalence of sub-optimal health increased by 8.9% in the short-term follow-up and by 11.2% in the long-term follow-up. Also, for the controls, the prevalence of sub-optimal health increased by 5.7% and 6.1%, respectively. Thus, by the end of the long-term follow-up, the prevalence ratio of poor health amongst the participants, compared with amongst the controls, increased to 1.17 (95% CI 1.04–1.31). However, the time x group interaction was not significant (p=0.088) (Figure 5). There was no difference in the prevalence ratio of psychological distress between the groups at any time point. The prevalence of anxiety remained nearly unchanged during the entire follow-up (33.0% amongst the participants and 33.8% amongst the controls at baseline). The time x covariate interactions for sub-optimal self-rated health, anxiety and psychological distress were p=0.088, p=0.551, and p=0.534, respectively.

Table 8. Changes in the participants' health behaviours and general and mental perceived health at baseline and at the short-term and the long-term follow-ups in comparison with the controls.

	Change in comparison with baseline value			
	Short-term follow-up		Long-term follow-up	
Characteristic	Mean difference (95% CI)	p-value	Mean difference (95% CI)	p-value
BMI [a] – kg/m^2		0.158		0.165
Rehabilitants	0.56 (0.41–0.71)		1.16 (0.96–1.35)	
Controls	0.44 (0.38–0.51)		1.01 (0.92–1.10)	
Physical activity – MET[b]/day		0.886		0.528
Rehabilitants	-0.10 (-0.36–0.16)		- 0.28 (-0.57–0.00)	
Controls	-0.12 (-0.28–-0.03)		-0.39 (-0.55–-0.22)	
Alcohol consumption – g/week		0.729		0.297
Rehabilitants	5.96 (1.10–10.82)		1.00 (-4.12–7.84)	
Controls	4.89 (1.23–8.55)		4.31 (0.77–7.84)	
Suboptimal self-rated health		0.073		0.201
Rehabilitants	0.18 (0.12–0.23)		0.20 (0.13–0.26)	
Controls	0.12 (0.09–0.15)		0.15 (0.11–0.18)	
Psychological distress		0.714		0.059
Rehabilitants	-0.01 (-0.04–0.03)		0.00 (-0.03–0.04)	
Controls	-0.01 (-0.03–0.01)		-0.04 (-0.06–-0.02)	
Anxiety		0.350		0.124
Rehabilitants	0.03 (-0.00–0.07)		0.02 (-0.02–0.06)	
Controls	0.01 (-0.01–0.03)		-0.02 (-0.04–0.00)	

[a] BMI – body mass index; [b] MET – metabolic equivalent of task.

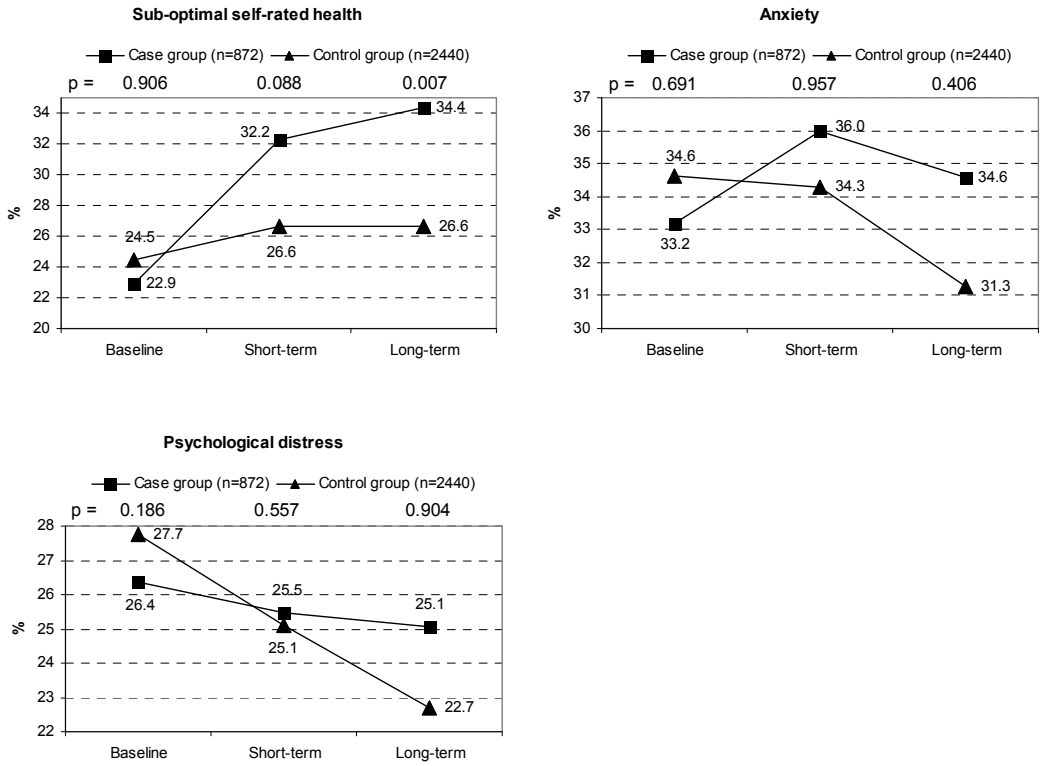

Figure 5. Prevalence of sub-optimal self-rated health, psychological distress, and anxiety with their p-values for the cases and controls at the baseline and at the short-term (mean 20 months) and the long-term (mean 70 months) follow-ups in comparison with the controls.

6. DISCUSSION

6.1. Main findings

The main findings of this prospective controlled cohort study of the effectiveness of vocationally oriented medical rehabilitation (ASLAK®) amongst nearly 50 000 public sector employees were:

Firstly, the process of participants' recognition into the programme, which primarily targets the preservation or improvement of work ability, may fail to detect relevant indicators of the need for rehabilitation and to identify the population that may benefit from rehabilitation the most. Moreover, this process may favour persons with less risk of developing an incapacity for work (I).

Secondly, no evidence was obtained for the effectiveness of the ASLAK® programme, neither with respect to reducing the risk of long-term work disability nor as regards achieving positive changes in health behaviours and an improvement in perceived physical and mental health (II–IV).

6.2. Findings in relation to previous studies

6.2.1. Recognition of the target group by occupational health care

Little information is available on the extent to which the ASLAK® programme actually reaches persons with an increased need of rehabilitation. A few cross-sectional studies have compared the characteristics of rehabilitants with those of non-rehabilitants at the beginning of the rehabilitation and have reported job permanency to be higher amongst the rehabilitants (Helo, 2000, Suoyrjö et al., 2007). In these studies, the rate of sickness absence was inconsistently reported to either increase or decrease the probability of being recommended for the ASLAK® programme. Predictive factors for being granted participation in ASLAK® have not been studied thus far with a longitudinal controlled study design.

As the main goal of ASLAK® is to improve or preserve work ability, it could be expected that factors previously associated with the risk of sickness, mortality, and work disability would increase the probability of being recommended for participation in ASLAK® in forthcoming years. However, the results of this study show that determining potential participants for ASLAK® may fail in the following two ways: 1) persons who have no risk factors for deteriorating work capacity have better chances of being suggested for the programme and 2) persons with more risks of work disability have smaller chances of being recommended for participation in ASLAK®.

Many factors previously found to be predictive of health impairment and the deterioration of work capacity did not predict the probability of being recommended for ASLAK® in this study. Amongst these factors were low occupational grade and

low level of education. Instead, employees at the higher occupational levels had better chances of being granted participation in an ASLAK® programme. One reason could be the great responsibility and workload in leading positions, resulting in fatigue, depression and anxiety (Hobson and Beach, 2000, Melchior et al., 2007). Because of overburdening, these employees may more often seek occupational healthcare, which can lead to referrals to rehabilitation. The reason occupational health professionals seem to be prone to recommend rehabilitation to people with higher rather than lower socioeconomic status is unclear.

In this study, ASLAK® was not targeted towards those experiencing high stress at work. On the contrary, a low level of experienced work stress increased the chances of an employee being recommended for an ASLAK® programme.

In the present study, having a permanent job increased the likelihood of a person being recommended for an ASLAK® programme, and having a temporary job decreased this likelihood**,** possibly because having a job and a relatively long work history is often emphasised in a physician's referral and in the selection for rehabilitation that takes place in social insurance offices (Suoyrjö et al., 2007). On the other hand, temporary employees are probably not fully covered by occupational health services, and this difference may play an important role in people seeking and being recommended for rehabilitation (Suoyrjö et al., 2007). Moreover, arranging for an absence from work during rehabilitation or illness may be easier for employees with a permanent job.

In the present study, there were no associations between behaviour-related health risks (i.e. obesity, smoking, sedentary lifestyle and extensive alcohol consumption) and attendance in rehabilitation. One finding of concern in this study was that a lack of smoking, adequate leisure-time physical activity, and a lack of work stress increased the chances of a person being recommended for ASLAK®. Obviously, the actual population at risk has not been recognised, but the reason for the failure remained unrevealed in this study.

In this study, employees who were prone to anxiety were more often granted rehabilitation. In previous studies, the probability of reporting symptoms and using health services was reported to be higher amongst persons with dispositional anxiety (Martin-Merino et al., 2010, Ng et al., 2008). It is possible that these persons are more prone to seek help and advice, and therefore receive more attention from occupational health professionals. However, they are not necessarily a high-risk population in terms of hard end points, such as coronary heart disease (Macleod et al., 2002).

6.2.2. Effectiveness of ASLAK® in reducing the risk of work disability

In this study, ASLAK® was found to be ineffective in reducing the risk of work disability. No difference was found in all-cause or cause-specific work disability between the 1394 employees who participated in ASLAK® and their 4146 propensity score matched controls.

The evidence for the effectiveness of multidisciplinary rehabilitation in general and specifically for work ability is limited (Karjalainen et al., 1999, Karjalainen et

al., 2000, Karjalainen et al., 2003, Kuoppala and Lamminpää, 2008). Some previous studies, which evaluated the rehabilitation of persons whose work capacity had already deteriorated due to substantial health problems, have however reported positive effects of multidisciplinary rehabilitation on the risk of work disability (Norlund et al., 2009, Jensen et al., 2005, Marnetoft and Selander, 2002, Marnetoft et al., 1999, van den Hout et al., 2003, Westman et al., 2006). In addition, evidence concerning the effectiveness of individual patient education is limited (Engers et al., 2008, Haines et al., 2009). The rehabilitation interventions studied in those reports were hardly comparable to ASLAK® due to the primary preventive nature of ASLAK®. As described in the review of the literature, the evidence on the effectiveness of ASLAK® in reducing the risk of work disability is also insufficient, mostly due to the modest methodological quality of previous studies.

6.2.3. Effectiveness of ASLAK® in relation to health-risk behaviours and perceived health

Improving participants' motivation and skills to endure more-intense leisure-time physical activity is the main tool used by ASLAK® teams to achieve changes in other health behaviours as well. In this study, no change was observed in obesity, leisure-time physical inactivity, or heavy drinking when 872 participants in ASLAK® were compared with their 2440 controls' respective behaviours after the rehabilitation. This finding is in line with the results of most previous studies on modifiable health risk behaviours, which also reported minor or null effects of individual-based primary prevention in a low-risk population (Ebrahim et al., 2006, Ketola et al., 2000, Summerbell et al., 2005, Prochaska et al., 2008). As presented in the review of the literature, previous studies have incoherently reported positive, null, or even a negative effect of ASLAK® on the change in the participants' leisure-time physical activity.

While a decrease in BMI during ASLAK® was reported in a few previous uncontrolled studies, this study confirms the results of the only controlled trial, which reported a null effect of the programme on a change in BMI (Tirkkonen and Kinnunen, 2010). The effectiveness of ASLAK® regarding smoking or alcohol consumption has not been studied earlier. Regarding smoking, the results of this study are in accordance with the results of a previous study reporting that multidisciplinary rehabilitation may be effective in helping participants to quit smoking (Paone et al., 2008). However, the improvement found in the present study was not sustained in the long run.

In this study, there was no evidence of ASLAK® being effective in improving perceived health, in terms of self-rated general health, anxiety, and the psychological distress of the rehabilitants. Previous data on the effects of ASLAK® on perceived health are inconsistent and controversial. Two controlled studies reported a positive effect of ASLAK® on perceived general health (Leino et al., 1994, Tirkkonen and Kinnunen, 2010), while one controlled study reported a negative effect on the same outcome (Turja et al., 2007). In addition, previous evidence on the effectiveness of ASLAK® as regards improvements in work-related stress or sleep disorders is controversial. Of the controlled

studies, one reported that ASLAK® may have a positive effect on experienced work-related stress (Leino et al., 1994), while two other studies found no evidence of such effectiveness (Turja et al., 2006, Turja et al., 2007).

6.3. Explanations for the lack of the effectiveness of ASLAK®

The reason ASLAK® seems to be ineffective in achieving positive changes in the outcome measures of this study remains unclear. However, several speculations can be made:

1) Occupational health services may fail to recognise the population with a higher risk of work disability, favouring instead those who have fewer risks. ASLAK® is directed towards workplaces and occupations that are presumably stressful. According to commonly accepted theoretical models, ill health from stress at work is the result of a combination of high psychological demands and low decision latitude at work (Karasek et al., 1981), or a conflict between high work effort and low reward (unsatisfactory salary, lack of esteem or respect at work, job insecurity and low career opportunities) (Kivimäki et al., 2007, Siegrist, 1996). The actual process of recognising workers with a greater need for ASLAK® has not been highly standardised in occupational health care and has been found to favour highly educated, satisfied employees who are not exposed to severe stress or do not perceive stress-related symptoms (I).

In other rehabilitation programmes, the process of recommending a participant for rehabilitation originates from an individual need for rehabilitation. This need rises from a disease and its consequence, a functional impairment. In the case of ASLAK®, the process differs basically from this scheme. The process usually starts as an initiative of the occupational physician, who applies for ASLAK® courses from the regional SII office for the coming year (SII, 2011b). The application contains the number of participants and courses needed, but the participants are not selected at this point. When the application is approved, the occupational physician searches for potential participants accordingly to the number and size of the approved courses. Thus ASLAK® may not be directed towards individuals, worksites, and occupations that need the rehabilitation the most at a given time.

2) Even though compliance in terms of discontinuing of the programme seems to be good (Helo, 2000), the participants may not follow the individual plans during out-patient periods or after the programme ends. The lack of long-term changes in health-risk behaviours found in this study supports this explanation.

3) The effect of ASLAK® on achieving changes at participants' worksites could be insufficient. Previous studies suggest that there is a minimum set of factors that preventive intervention should contain in order to be successful in reducing work-related psychosocial constraints (Goldenhar et al., 2001, Kompier et al., 1998, Vézina et al., 2004, Finnish National Research and Development Centre for Welfare and Health, 2002). These studies accentuated the importance of changes especially at worksites (i.e. support from employer, employee participation in discussions and solutions of problems, identification of workers at risk on the basis of validated theoretical

models, implementation of necessary changes in targeted worker populations, and on-site management of changes). If an intervention does not achieve any meaningful improvement at the employee's worksite, it may leave the actual causes of work-related stress unaffected and result in limited effects of the individual-based programme. On the other hand, also studies on workplace interventions that used changes in the workplace and equipment, changes in work design and organizations, and case management with the worker and employer in order to reduce sickness absence showed only minor effects of such interventions (van Oostrom et al., 2009).

4) The basic concept of individual-based primary prevention of work disability may be in essence ineffective. There is no evidence to support or to reject the hypothesis of early rehabilitation, operating with education, counselling and physical training, being effective (Kuoppala and Lamminpää, 2008). The Finnish form of early rehabilitation, placed on a timeline before any notable disability and even before the occurrence of a disease, differs basically from common definitions of rehabilitation in general and vocational rehabilitation specifically. No previous analysis has been done regarding a comparison between the effectiveness of individual-based primary and secondary prevention of work disability. One reason could be that ASLAK® is the only known complex multidisciplinary measure of the primary prevention of work disability, and the number and methodology of the trials on this topic are modest. In addition, a recent meta-analysis of studies on multiple risk-factor interventions suggested that primary prevention may be ineffective in inducing multiple changes in health-risk characteristics and may have low cost-effectiveness in comparison with secondary prevention (Ebrahim et al., 2006).

5) The assumption of an occupational physician being able to predict which employee is going to develop health problems leading to long-term work disability and which one is going to preserve his or her capacity for work despite experienced work-related stress may be impossible. The identification of a population at a higher risk of work disability may be too difficult at such an early stage, when there is no severe disease or impairment but only minor symptoms of potential upcoming health problems.

6) There could have been possible flaws in the structure and methods of the ASLAK® programme at the time of the present study. The historical point of view should be taken into account. In the 1980s, when ASLAK® was developed, a similarity in occupation was enough to ensure the homogeneity of the group, as the programme was targeted towards workers in physically strenuous occupations. Workers had similar and specific problems related, for example, to work ergonomics, workday scheduling, and already existing health problems. The individual-based vocational part of the programme has diminished significantly since the 1980s and may be insufficient and too general to induce major changes in participants' work conditions. The ASLAK® programme at the time of the present study was directed towards workplaces and occupations in which workers were subjected to considerable physical, mental, or social strain that may easily lead to health problems and a deterioration of work capacity (SII, 2012). Such strain is a common finding in any Western society and might not be a sufficient criterion to ensure the homogeneity of the rehabilitant group. Even if participants work in the same

occupational field, participant groups may be too heterogenic to achieve improvements in desired outcomes at an individual level if mainly group-based methods are used.

The ASLAK® programme is aimed at achieving changes in individual behaviours of the participants, such as a healthy lifestyle and a better capability to self-manage work-related stress. For that purpose, the programme uses mostly group-based methods, and therefore the individual problems of the participants may remain unrecognised and unaffected during the rehabilitation course.

6.4. Recent changes in the ASLAK® programme

The need for improvements in the structure of ASLAK® is well recognised by SII. Numerous initiatives have been started during the past few years to increase its effectiveness. While many of these initiatives are still in progress, some promising results have been estimated. SII has remodelled the Standard of ASLAK®, emphasising the need for a more individual adjustment of the programme and the key role of occupational health care during the entire process of ASLAK® implementation (SII, 2011c). Examples of SII's recent initiatives are the TUUKKA programme, which emphasises close collaboration between occupational health care and a multi-professional rehabilitation team; and the Modulo programme, which accentuates the importance of the programme's more individual adjustment to participant rehabilitation needs, which rise from concrete demands on the participants' worklife.

At the time of the present study, private entrepreneurs were not necessarily included as a target group of ASLAK®. The situation is changing in that, for several years SII has been developing a programme that takes into account the rehabilitation needs of private entrepreneurs (Jyri and Pyri projects). In addition to the conventional in-patient form of ASLAK®, SII is also developing new out-patient forms of ASLAK® (Hypro project). Improvement in the process of selecting participants for ASLAK® using close collaboration between SII, the rehabilitation provider, and occupational health services is being studied in the Kokoinaiskunto project (SII, 2011e). As occupational health care plays an important role in ASLAK®, workers that are not fully covered by occupational health services (e.g. those with temporary short-term work contracts) have often been left outside the ASLAK® programme. Some on-going projects of SII are aiming at closing this gap (Ala-Kauhaluoma and Henriksson, 2011).

The purpose of all aforementioned initiatives and projects is to gather data which can be used for improving forthcoming Standards of ASLAK® in order to make the programme more flexible meeting individual needs of the participants.

6.5. Strengths and weaknesses of the study

This study is the first attempt to utilise large-scale data obtained from registers and responses to repeated surveys several years before and after ASLAK®. The data covered participants' demographics, work-related characteristics, health behaviours, and health

indicators. The national health registers and employers' records used in this study are reliable and contain comprehensive information about each employee involved.

The simulation of the randomisation process was performed by creating a reliable group of matched controls with the same propensity to be "treated" (i.e. rehabilitated) as the corresponding participants according to a propensity score, which was derived from 24–25 pre-treatment covariates and their interactions with age, gender, and socioeconomic status. All of the case and control groups in this study were essentially similar at baseline with respect to their demographics and their work, health, and health-behaviour characteristics.

The most significant weakness of the study was that it is not a randomised trial. In clinical practice, treatment is not simply an exposure but also a clinical decision and a choice. Treatment decisions are strongly influenced by confounders such as symptoms, severity, prognosis, and the frailty of the patient. According to principles of evidence-based medicine, along with best research evidence and clinical expertise, also patient preferences, concerns and expectations are needed to be integrated into clinical decisions. The analytical methods used to control confounding included risk adjustment methods, such as conventional multivariable regression analyses and propensity score adjustments (Fang et al., 2012). Although the distribution of the covariates used to derive the propensity score were the same for the cases and controls, propensity-based matching cannot remove bias due to unmeasured confounding when strong selection bias exists (Stukel et al., 2007). Factors reflective of patient prognosis and physician decision-making behaviours are not available in observational data sets, although the likelihood of being treated depends on clinical judgement and referral selection. This situation is likely to result in an overestimate of benefit due to residual confounding related to the selection of lower-risk patients for treatment; an underestimate would result from the selection of higher-risk participants, for example, for rehabilitation. However, propensity score matching is likely to produce unbiased findings if the distribution of unmeasured prognostic factors is more likely to be similar when therapies with similar clinical indications and risk are considered. Under such conditions, randomised clinical trials and observational studies show the greatest similarities (Concato et al., 2000, Benson and Hartz, 2000). Because this study focused on a low-risk population (I), strong selection bias did not operate, and major confounding from unmeasured factors was unlikely. Another limitation of propensity score matching is that it may lead to a loss of cases at the tails of the distribution of the propensity score to the extent that they do not overlap. However, in this study only 20 of all of the 892 rehabilitants in study II and 2 of all of the 1396 rehabilitants in studies III–IV were excluded due to a lack of a control subject. Moreover, analyses based on propensity scores may provide a more valid estimate of treatment effect than conventional observational studies, which are based on multivariable adjustments (Austin, 2008). As propensity score matching is performed on a single calculated variable, it offers better control for bias from confounding and assures fewer drop-offs when compared with conventional matching. However, the possibility of confounding can never be ruled out when observational data are being used.

Women are predominated in the study population which also was limited to employees working in the public sector, and this may affect the generalisability of findings. However, the population in this study represented a wide range of the occupational scale, from managers to manual workers.

This study examined only a limited set of effects of ASLAK®, and it is possible that the programme has other beneficial effects that may have been left outside the scope of this evaluation. For example, possible changes induced by ASLAK® in the stressful aspects of the worklife of the participants were not revealed. Moreover ASLAK® may have potential effects on such individual characteristics as perceived work ability, work efficiency, quality of life, and the like. Data on short-term sickness absence, which has not been medically certified or has been compensated by an actor other than SII, was not available in the present study. Some of the sick leaves could also have represented voluntary absenteeism not related to physical or mental illness, and some employees work while ill and record no absences. The SII do not compensate the first day of illness and nine working days after that. Therefore, the register kept by the SII does not contain data on these short sickness absences. However, the lack of data on short sick leaves is an unlikely source of major bias since medically certified, especially long-term, sickness absence have been found to be strongly associated with mortality, morbidity, and work disability, while no such associations have been found for short sick leaves (Kivimaki et al., 2007, Virtanen et al., 2008, Vahtera et al., 2004b).

Although the outcome measures used were standard, widely used, and reliable (Ferrie et al., 2011, Holi et al., 2003, Spielberger et al., 1983, Westerlund et al., 2009), they may not have been sensitive enough to detect minor improvements in the perceived health of the participants. However, the finding of a more rapid decline in self-rated health amongst the participants than amongst their controls speaks against this possible bias. Self-reported data on health-risk behaviours may imprecisely define obesity, smoking habits, and alcohol consumption, despite their strong association with objective indicators of these behaviours (Bes-Rastrollo et al., 2011, Harris et al., 2009, Nyholm et al., 2007, Vahtera et al., 2004b).

Baseline physical health was defined by granted special reimbursement for medications and has not been verified by data on the actual purchase of the drugs in question. It is unknown if prescribed painkillers and antidepressants have been used according to their main indications: for example, antidepressants may be also used as sleeping drugs.

7. CONCLUSIONS

The present study implies the following conclusions:

1. The process of recognising employees under increased threat of forthcoming deteriorating capacity for work, measured by the risk of work disability, seemed to fail and, instead, favoured those who had a lower risk in the study cohort.

2. No evidence was found that indicated that ASLAK® was effective in decreasing the risk of a long-term work disability overall, or due to musculoskeletal causes or mental disorders, the most important causes of disability retirement.

3. No evidence was obtained that indicated that on ASLAK® was effective in reducing modifiable behavioural health risks or common mental health problems or in improving perceived general health

The results of this study imply that the goals of vocationally oriented medical rehabilitation (ASLAK®) may not be achieved. Due to the excessive use of public resources and funds, the ASLAK® programme should be tested in randomised controlled trials (RCTs) for it to become a justified measure of the prevention of early retirement. RCTs are needed to prove that the beneficial effects of an intervention found in observational studies are due to the intervention rather than to systematic differences in the clustering of risk factors between the study groups. The "gold standard" of evidence-based medicine, RCT, is not always applicable in the rehabilitation field due to ethical issues. On the other hand, ethical issues do not create a barrier for trials involving ASLAK®, as the rehabilitants are relatively healthy by default. Although the importance of RCTs should not be underestimated by researchers, the multidimensionality of rehabilitation intervention may create a barrier to the conduction of such studies (Tate et al., 1999, Wade, 2009). Therefore, also well-designed non-randomised controlled trials may add valuable information on the effectiveness of ASLAK®.

8. IMPLICATIONS FOR FURTHER RESEARCH

Identifying effective preventive measures to sustain the worklife participation of a rapidly ageing Finnish workforce is important. Further research may uncover the underlying causes of the lack of evidence on the effectiveness of the costly rehabilitation programme found in the present study. The impact of the "right timing" of rehabilitation on its effectiveness has not yet been studied and needs to be assessed. Additional research may also reveal the reasons for the apparently inadequate process of recognising employees with a higher risk of a deteriorating capacity for work and a greater need for rehabilitation**.** Workers who were suggested for participation in the ASLAK® programme by an occupational physician, but whose applications were rejected by SII, may form a potential control group for further studies.

This complex programme may have other potential beneficial effects on the individual characteristics of the participants or on the work conditions at participants' worksites, which were left outside the scope of the present study and may be identified by further research.

This study assessed predictors of forthcoming rehabilitation. Predictors of a successful outcome of the programme are still unknown. Further research may reveal which individual characteristics are related to a higher effectiveness of ASLAK®. This knowledge may be of help in the allocation of rehabilitation to the population that would benefit from the intervention the most.

It is possible that the poor commitment of the participants to the programme could partly explain the lack of effectiveness of ASLAK®. The role of the participants' motivation and compliance in achieving the goals of ASLAK® should be studied.

Only a few studies have assessed the cost-effectiveness of ASLAK®. Cost-effectiveness should be evaluated in a broader context, and in comparison with both the untreated controls and the people who participated in other, less expensive rehabilitation schemes to reduce work disability (e.g. in an out-patient form of ASLAK® or in work health promotion programmes).

Potential adjustments in the programme's structure and methods, for example, a more individual approach and a more-detailed familiarisation with the participant's actual work-related problems, together with a tighter collaboration with occupational health care during and after the course, may be applied and assessed in experimental settings. As already mentioned, SII has already started numerous initiatives in this direction. The effectiveness of ASLAK® needs to be studied also trough comparisons made within different occupational groups of participants.

Even if the content of ASLAK® is strictly defined by the standards of SII and is similar in all of the rehabilitation facilities involved, minor differences in implementation may still occur. An assessment of these probable differences in relation to the effectiveness of the programme may deliver valuable information for potential adjustments in the structure of the ASLAK® programme.

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APPENDICES

Appendix 1. MEDLINE search strategy

Limits: Humans, English, Finnish, Swedish, Publication Date from 1980/01/01

1. ”vocationally oriented medical rehabilitation”
2. ”occupationally oriented medical rehabilitation”
3. ”vocational medical rehabilitation”
4. ”vocational and medical rehabilitation”
5. ”occupational medical rehabilitation”
6. ”occupational and medical rehabilitation”
7. aslak
8. “yrkesorienterad medicinsk rehabilitering”
9. “finnish social insurance institution”
10. “social insurance institution of finland”
11. “social insurance institution”
12. multidisciplinary
13. multiprofessional
14. rehabilitation
15. vocational
16. “vocationally oriented”
17. occupational
18. “occupationally oriented”
19. “work hardening”
20. “work conditioning”
21. finland
22. (#3 OR #4 OR #5 OR #6 OR #19 OR #20) AND #14 AND (#9 OR #10 OR #11 OR #21)
23. (#12 OR #13) AND (#15 OR #16 OR #17 OR #18) AND #14
24. #23 AND (#9 OR #10 OR #11 OR #21)

Appendix 2. Survey questions extracted from the Finnish Public Sector Study questionnaire used in the present study (in Finnish)

Siviilisäätysi
□ naimaton
□ naimisissa
□ avoliitossa
□ eronnut tai asumuserossa
□ leski

Peruskoulutuksesi
□ kansankoulu tai kansalaiskoulu
□ keskikoulu tai peruskoulu
□ ylioppilastutkinto

Mikä on tavanomainen työaikamuotosi?
□ säännöllinen päivätyö
□ vuorotyö ilman yövuoroja (kaksivuorotyö)
□ yötyötä sisältävä vuorotyö (kolmivuorotyö)
□ säännöllinen yötyö
□ muu epäsäännöllinen työ

Millainen on terveydentilasi?
□ hyvä
□ melko hyvä
□ keskitasoinen
□ melko huono
□ huono

1) Kuinka pitkä olet? _____ cm
2) Kuinka paljon painat? _____ kg

Kuinka paljon liikuit vapaa-aikana tai työmatkalla viimeksi kuluneen vuoden aikana keskimäärin? Miten suureksi arvioit harjoittamasi liikunnan rasittavuuden?

	liikunnan määrä yhteensä viikossa				
Liikunnan rasittavuus (vastaa kaikkiin neljään kohtaan)	ei lainkaan	alle ½ tuntia	noin tunti	2–3 tuntia	4 tuntia tai enemmän
1) kävelyä vastaava	□	□	□	□	□
2) reipasta kävelyä vastaava	□	□	□	□	□
3) kevyttä juoksua (hölkkää) vastaava	□	□	□	□	□
4) reipasta juoksua vastaava	□	□	□	□	□

1) Tupakoitko tai oletko joskus tupakoinut säännöllisesti, toisin sanoen päivittäin tai miltei päivittäin?
□ en
□ kyllä, tupakoinnin aloittamisvuosi 19___
2) Tupakoitko edelleen säännöllisesti?
□ en, tupakoinnin lopettamisvuosi 19___
□ kyllä

1) Oletko koskaan nauttinut vähintään lasillisen jotain alkoholijuomaa?
□ en koskaan, olen ollut raitis koko elämäni
□ kyllä

2) Miten paljon nautit seuraavia alkoholijuomia keskimäärin?

A) Olutta VIIKOSSA	□ en yhtään	□ 13–24 pulloa
	□ vähemmän kuin pullollisen	□ 25–47 pulloa
	□ 1–4 pulloa	□ Yli 48 pulloa
	□ 5–12 pulloa	
B) Viiniä tai muita mietoja alkoholijuomia VIIKOSSA	□ en yhtään	□ 3–4,5 pullollista
	□ vähemmän kuin lasillisen	□ 5–9 pullollista
	□ 1–4 lasillista	□ Yli 10 pullollista
	□ 1–2,5 pullollista	
C) Väkeviä alkoholijuomia KUUKAUDESSA	□ en yhtään	□ 4–9 pullollista
	□ alle puoli pullollista	□ 10–19 pullollista
	□ puoli–1,5 pullollista	□ yli 20 pullollista
	□ 2–3,5 pullollista	

3) Oletko ”sammunut” alkoholinkäytön yhteydessä viimeksi kuluneen vuoden aikana?

□ en kertaakaan	□ 4–6 kertaa
□ kerran	□ 7 kertaa tai useammin
□ 2–3 kertaa	

Seuraavat kysymykset koskevat terveydentaalaasi *viime viikkoina*

1) Oletko viime aikoina pystynyt keskittymään tehtäviisi?
□ paremmin kuin tavallisesti
□ yhtä hyvin kuin tavallisesti
□ huonommin kuin tavallisesti
□ paljon huonommin kuin tavallisesti

2) Oletko viime aikoina valvonut paljon huolien takia?
□ en ollenkaan
□ en enempää kuin tavallisesti
□ jonkin verran enemmän kuin tavallisesti
□ paljon enemmän kuin tavallisesti

3) Onko sinusta viime aikoina tuntunut siltä, että sinusta on hyötyä asioiden hoidossa?
□ enemmän kuin tavallisesti
□ yhtä paljon kuin tavallisesti
□ vähemmän kuin tavallisesti
□ paljon vähemmän kuin tavallisesti

4) Oletko viime aikoina tuntenut pystyväsi tekemään päätöksiä?
□ paremmin kuin tavallisesti
□ yhtä hyvin kuin tavallisesti
□ huonommin kuin tavallisesti
□ paljon huonommin kuin tavallisesti

7) Oletko viime aikoina kyennyt nauttimaan tavallisista päivittäisistä toimistasi?
□ enemmän kuin tavallisesti
□ yhtä paljon kuin tavallisesti
□ vähemmän kuin tavallisesti
□ paljon vähemmän kuin tavallisesti

8) Oletko viime aikoina kyennyt kohtamaan vaikeuksia?
□ paremmin kuin tavallisesti
□ yhtä hyvin kuin tavallisesti
□ huonommin kuin tavallisesti
□ paljon huonommin kuin tavallisesti

9) Oletko viime aikoina tuntenut itsesi arvottomaksi?
□ en ollenkaan
□ en enempää kuin tavallisesti
□ jonkin verran enemmän kuin tavallisesti
□ paljon enemmän kuin tavallisesti

10) Oletko viime aikoina tuntenut itsesi onnettomaksi ja masentuneeksi?
□ en ollenkaan
□ en enempää kuin tavallisesti
□ jonkin verran enemmän kuin tavallisesti
□ paljon enemmän kuin tavallisesti

5) Oletko viime aikoina tuntenut olevasi jatkuvasti ylirasittunut?
□ en ollenkaan
□ en enempää kuin tavallisesti
□ jonkin verran enemmän kuin tavallisesti
□ paljon enemmän kuin tavallisesti

6) Onko sinusta viime aikoina tuntunut, ettei voisi selviytyä vaikeuksista?
□ ei ollenkaan
□ ei enempää kuin tavallisesti
□ jonkin verran enemmän kuin tavallisesti
□ paljon enemmän kuin tavallisesti

11) Oletko viime aikoina menettänyt itseluottamustasi?
□ en ollenkaan
□ en enempää kuin tavallisesti
□ jonkin verran enemmän kuin tavallisesti
□ paljon enemmän kuin tavallisesti

12) Oletko viime aikoina tuntenut itsesi kaiken kaikkiaan kohtalaisen onnelliseksi?
□ enemmän kuin tavallisesti
□ yhtä paljon kuin tavallisesti
□ vähemmän kuin tavallisesti
□ paljon vähemmän kuin tavallisesti

Seuraavassa on annettu joukko lausumia, joita ihmiset ovat käyttäneet kuvatakseen itseään. Rastita kultakin riviltä se vastausvaihtoehto, joka parhaiten kuvaa miltä sinusta yleensä tuntuu.

	ei kuvaa ollenkaan	kuvaa hieman	kuvaa melko hyvin	kuvaa erittäin hyvin
4) Tunnen oloni rauhalliseksi	□	□	□	□
5) Oloni on kireä	□	□	□	□
6) Tunnen olevani poissa tolaltani	□	□	□	□
10) Olen rentoutunut	□	□	□	□
11) Olen tyytyväinen	□	□	□	□
12) Olen huolestunut	□	□	□	□

Seuraavaksi esitetään joitakin omaa työtäsi koskevia väittämiä. Miten hyvin seuraavat väittämät kuvaavat työtäsi? Oletko väittämän kanssa täysin eri mieltä, hiukan eri mieltä, samaa mieltä vai täysin samaa mieltä?

	täysin samaa mieltä	melko samaa mieltä	en samaa enkä eri mieltä	melko eri mieltä	täysin eri mieltä
6)Voin tehdä paljon itsenäisiä päätöksiä työssäni	□	□	□	□	□
7) Työni edellyttää minulta luovuutta	□	□	□	□	□
8) Työni vaatii, että opin uusia asioita	□	□	□	□	□
9) Työhöni kuuluu paljon samanlaisia toistuvia tehtäviä	□	□	□	□	□
10) Minulla on paljon omiin töihini liittyvää sanavaltaa	□	□	□	□	□
11) Työni vaatii pitkälle kehittyneitä taitoja	□	□	□	□	□
12) Työssäni saan tehdä paljon erilaisia asioita	□	□	□	□	□
13) Minulla on mahdollisuus kehittää minulle ominaisia erityiskykyjäni	□	□	□	□	□
14) Minulla on hyvin vähän vapautta päättää, miten teen työni	□	□	□	□	□

Liittyykö työhösi seuraavia epävarmuustekijöitä?

	erittäin paljon	melko paljon	jonkin verran	melko vähän	erittäin vähän
2) vastentahtoinen siirto toisiin tehtäviin	□	□	□	□	□
4) irtisanomisen uhka	□	□	□	□	□

Jos saisit joka tapauksessa riittävän toimeentulon, miten menettelisit mieluiten?

□ jatkaisin nykyisessä työpaikassani
□ vaihtaisin työpaikkani toiseen nykyisellä ammattialallani
□ vaihtaisin työhön toiselle ammattialalle
□ luopuisin työstä kokonaan

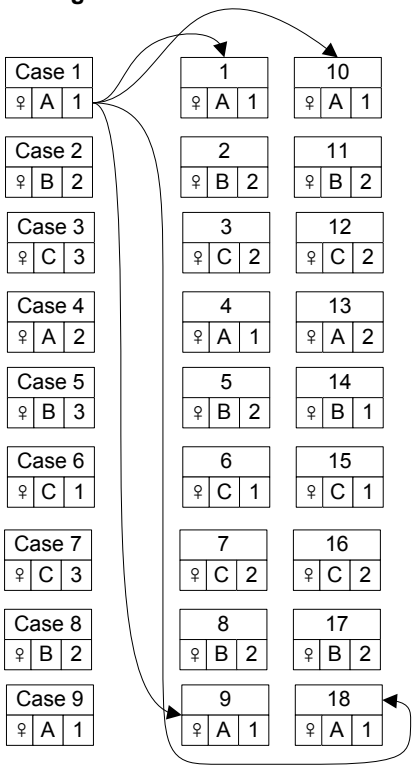
Seuraavassa luetellaan joukko tapahtumia, joita elämässä voi sattua.
Onko sinulle koskaan sattunut seuraavia tapahtumia?
3) Oman taloudellisen tilanteen huomattava vaikeutuminen

Tapahtuma sattui:
□ ei ollenkaan
□ aikaisemmin
□ tänä vuonna

Appendix 3. Simplified scheme showing the difference between conventional and propensity score matching processes.

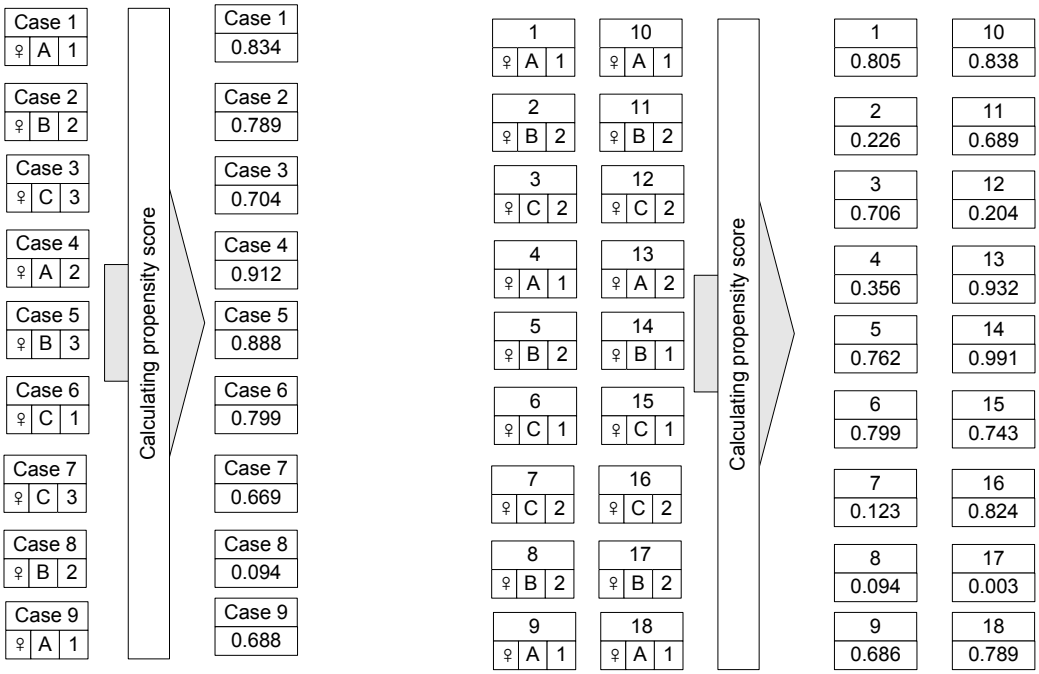
For example, gathered pre-treatment data on cases and 18 controls contains three covariates: gender (male or female), area (A, B or C) and age group (1, 2 or 3). Conventional (exact) matching procedure searches for controls which have exactly the same set of all three covariates as each case (Figure A). In this example, drop-off of cases would be 33% as none of available controls lives at the area 3. When set of studied covariates is large (in the present study 24–25), conventional matching may be impossible as the probability of finding a control with exactly the same set of all 24–25 pre-treatment characteristics becomes too small.

Figure A



Using propensity score matching, single scalar value, which describes the probability of being treated, is calculated for each case and each control (Figure B). The most common method for this calculation is logistic regression.

Figure B



After this calculation, matching is performed not on three but on one calculated variable only (Figure C). Controls are selected according to pre-defined caliper, which tells how much a propensity score of control can differ from the propensity score of case (in the present study caliper is 0.01). If pool of potential untreated controls is large enough, the drop-off of treated cases would be smaller compared with conventional matching.

Figure C