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PROCESSES OF LONG-TERM WORK DISABILITY AND SOCIOECONOMIC DISPARITIES

Unwinding the roles of family background,
sickness absence, and psychosocial work
environment

Laura Salonen



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ABSTRACT

Due to population ageing and the increasing dependency ratio, maintaining a sufficient workforce has become an important national policy target in Finland. As the population shrinks, prolonging working careers becomes one of the key factors in sustaining a sufficient workforce. Work disability, especially when it is long-term, is one of the main reasons for leaving the labour market early. Previous studies have identified many risk factors associated with long-term work disability, of which one of the most important is low socioeconomic status. However, to date very little research has been conducted on the mechanisms underlying the risk of long-term work disability and the associated socioeconomic disparities. This study examines the process leading to the development of a long-term work disability, and the socioeconomic differences in this process.

This dissertation consists of four studies that examine two aspects of long-term work disability: the transition to sickness absence and disability retirement. Further, they examine the socioeconomic disparities that relate to these transitions arising from family background, sickness absence development and psychosocial work environment. The studies use longitudinal register-based datasets on the Finnish or Swedish population over a fifteen years period from 1999–2014, with national representative samples.

The first article is based on a 10 % population sample of Finnish residents and uses a discrete-time event history model to examine the association between educational attainment and family background on disability retirement in young adulthood. The second and third articles use a 70 % population sample of Finnish residents linked to data on sickness benefits and disability retirement. These articles use a Cox proportional hazards model to study the role of sickness absence length and diagnosis as predictors of disability retirement in different occupational classes among women and men. The fourth article is based on a full population data of Swedish residents linked with data from labour market surveys and sickness insurance. The article examines the relationship between psychosocial work environment, or more precisely, the occupation-specific job demands and job control in occupations, and the risk of accumulating of sickness absence and disability pension days over time using group-based trajectory analysis and multinomial regression analysis.

The results of these articles demonstrate that the risk factors of long-term work disability and the associated socioeconomic disparities are associated with the family background and they are observed at an early phase during the life-course. Low level of education and low levels of parental education and income were associated with young adults' disability retirement. In particular, young adults whose parents have a tertiary education and who themselves have only a basic education are at a greatest risk of disability retirement. This result indicates that parents with higher education can be more able to assist their offspring in getting help for their work disability.

Later in working life, sickness absence is another important factor in which the development of long-term work disability and the associated socioeconomic disparities develop. Long-term unemployed and manual workers have the highest risk of disability retirement, and non-manual employees have the lowest risk. However, the accumulation of sickness absence days increases the risk of disability retirement most strongly among non-manual employees, and the least among manual workers. In particular, long-term sickness absence due to mental and behavioural disorders or musculoskeletal diseases is linked to all-cause disability retirement and disability retirement due to same diagnostic group. Further analysis on the diagnoses revealed that while sickness absence due to respiratory diseases or circulatory diseases were the strongest predictors of disability retirement due to some other diagnostic group. The role of diagnosis in the transition from sickness absence to disability retirement was similar across occupational classes.

Analysing the effect of a psychosocial work environment revealed that occupations with low levels of job demands or low job control, and especially with a combination of these, are associated with unfavourable accumulation of sickness absence and disability pension days. Contrarily, occupations with high levels of job demands and job control are associated with low accumulation of sickness absence and disability pension days.

To conclude, risks of developing a long-term work disability can be identified at different processes in childhood and in work life. Attention should be paid to prevent work disability at an early stage of life. Especially disadvantaged families should be helped by providing low-threshold services to ensure that health problems leading to work disability are identified as early as possible. Work disability can be prevented by intervening, for example, in the accumulation of sickness absence days and in the work environment. In addition, providing equal access to care, low-threshold services and modifying work environment according to individual's work ability can help prevent the onset and development of long-term work disability, improve well-being at work and prolong working careers. Measures should be tailored according to one's socioeconomic position, as the development of long-term work disability varies between occupations. Understanding the risk factors associated with long-term work disability not only helps to prevent long-term work disability at the population level, but also helps to target preventive actions more effectively at those who need it, reducing social inequalities in well-being at work and in health.

KEYWORDS: sickness absence, disability pension, health inequality, socioeconomic differences, regression analysis, event history, group-based trajectory analysis

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TIIVISTELMÄ

Väestön ikääntymisen ja huoltosuhteen heikentymisen vuoksi riittävän työvoiman ylläpitämisestä on tullut tärkeä tavoite suomalaisessa politiikassa. Väestönkasvun hidastuessa on työurien pidentäminen yksi tärkeimmistä keinoista riittävän työvoiman ylläpitämiseksi. Etenkin pitkittynyt työkyvyttömyys on yksi keskeisimmistä syistä ennenaikaiseen työelämästä poistumiseen. Aikaisemmat tutkimukset ovat tunnistaneet monia pitkittyneeseen työkyvyttömyyteen liittyviä riskitekijöitä, joista yksi tärkeimmistä on matala sosioekonominen asema. Pitkittyneen työkyvyttömyyden riskin ja siihen liittyvien sosioekonomisten erojen taustalla olevia mekanismeja on toistaiseksi tutkittu melko vähän. Tämän tutkimuksen tavoitteena on selvittää pitkäaikaisen työkyvyttömyyden kehitysprosesseja sekä siinä ilmeneviä sosioekonomisia eroja.

Väitöskirja koostuu neljästä osatutkimuksesta. Osatutkimukset käsittelevät sairauspäiväraahakaudelle ja työkyvyttömyyseläkkeelle siirtymistä sekä niihin liittyviä sosioekonomisia eroja perhetaustan, sairauspäiväraahistorian ja psykososiaalisen työympäristön näkökulmista. Tutkimuksessa käytetään pitkittäisiä rekisteriaineistoja suomalaisesta ja ruotsalaisesta työikäisestä väestöstä ajanjaksolla 1999–2014.

Ensimmäisen artikkelin aineisto pohjautuu 10 % satunnaisotokseen suomalaisista. Artikkelissa tutkitaan diskreetin elinaikamallin avulla perhetaustan ja kouluttautumisen yhteyttä nuorten aikuisten työkyvyttömyyseläkkeelle siirtymiseen. Toisessa ja kolmannessa artikkelissa käytetään 70 % satunnaisotosta työikäisistä suomalaisista, yhdistettynä sairauspäiväraha- ja työkyvyttömyystietoihin. Näissä artikkeleissa tarkastellaan Coxin suhteellisten hasardien mallin avulla sairauspäivärahan pituuden ja diagnoosin roolia työkyvyttömyyseläkettä ennustavana tekijänä eri ammattiasemissa olevilla naisilla ja miehillä. Neljännessä artikkelissa käytetään ruotsalaista väestöaineistoa yhdistettynä sairausvakuutustietoihin ja työelämäntutkimuksissa kerättyihin aineistoihin. Artikkelissa tutkitaan kehityspolkuanalyysin ja multinominaalisen regressioanalyysin avulla psykososiaalisen työympäristön yhteyttä sairauspäiväraha- ja työkyvyttömyyseläkepäivien kertymiseen pitkällä aikavälillä naisilla ja miehillä.

Ensimmäisen artikkelin tulokset osoittavat, että pitkittyneen työkyvyttömyyden riskitekijät ja siihen liittyvän sosioekonomiset erot ovat yhteydessä perhetaustaan ja ne ovat havaittavissa jo varhaisessa elämänvaiheessa. Vanhempien matala koulutus ja matalat tulot, sekä nuoren oma matala koulutus ovat yhteydessä nuoren aikuisen työkyvyttömyyseläkkeelle siirtymiseen. Erityisesti nuoret aikuiset, joiden vanhemmilla on korkea-asteen koulutus ja itsellään perusasteen koulutus, ovat suurimmassa riskissä siirtyä työkyvyttömyyseläkkeelle.

Myöhemmin työelämässä sairauspäiväraha-kausina on toinen tärkeä nivelvaihe, jossa pitkittyneen työkyvyttömyyden kehitys ja siihen liittyvät sosioekonomiset erot kehittyvät. Pitkäaikaistyöttömillä ja työntekijäammateissa työskentelevillä on korkein ja ylemmillä toimihenkilöillä kaikkein matalin riski siirtyä työkyvyttömyyseläkkeelle. Kertyvät sairauspäivärahopäivät kuitenkin kasvattavat työkyvyttömyyseläkkeelle siirtymisen riskiä kaikkein voimakkaimmin ylemmillä toimihenkilöillä, ja hitaimmin työntekijäammattissa työskentelevillä. Erityisesti pitkittynyt mielenterveyden ja käyttäytymisen häiriöiden tai tuki- ja liikuntaelinsairauksien perusteella myönnetty sairauspäiväraha on vahvasti yhteydessä työkyvyttömyyseläkkeelle siirtymiseen mistä tahansa tai samasta diagnoosista. Lisäanalyysit osoittavat, että sairauspäiväraha hengityselinten tai verenkiertoelinsairauksien diagnoosilla ennustivat ennen kaikkea työkyvyttömyyseläkettä jollain muulla diagnoosilla. Diagnoosin rooli sairauspäivärahalla työkyvyttömyyseläkkeelle siirryttäessä oli melko samankaltainen eri ammattiryhmissä.

Työympäristön näkökulmasta ammatit, joissa on matala työn vaatimustaso ja matala vaikutusmahdollisuuksien taso, tai joissa nämä molemmat yhdistyvät, ovat yhteydessä epäedulliseen sairauspäiväraha- ja työkyvyttömyyseläkepäivien kertymiseen. Näiden matalaan kertymiseen ovat yhteydessä sen sijaan ammatit, joissa työn vaatimus- ja vaikuttamismahdollisuudet ovat korkeita.

Yhteenvedon voidaan todeta, että pitkittyneen työkyvyttömyyden riski on tunnistettavissa erilaisissa prosesseissa sekä lapsuudessa, että työelämässä. Työkyvyttömyyden ehkäisemiseen tulisikin kiinnittää huomiota jo varhaisessa elämänvaiheessa. Erityisesti vähäosaisemmille perheille olisi tarjottava matalan kynnyksen palveluita, jotta työkyvyttömyyteen johtaviin terveysongelmiin voitaisiin tarttua mahdollisimman varhain. Pitkittynyttä työkyvyttömyyttä voidaan ehkäistä myös myöhemmin työelämässä puuttamalla esimerkiksi sairauspoissaolopäivien kertymiseen ja psykososiaaliseen työympäristöön. Yhdenvertainen hoitoon pääsy, matalan kynnyksen palvelujen tarjoaminen ja työympäristön muuttaminen yksilöllisen työkyvyn mukaan voi auttaa estämään pitkäaikaisen työkyvyttömyyden syntymistä, parantamaan työhyvinvointia ja pidentämään työuraa. Kaikki nämä toimenpiteet tulisi räätälöidä ammattiryhmän mukaan, sillä pitkäaikaisen työkyvyttömyyden kehitys vaihtelee niiden välillä.

Ymmärtämällä pitkittyneeseen työkyvyttömyyteen liittyviä riskitekijöitä voidaan sekä ehkäistä työkyvyttömyyttä väestötasolla, että kohdentaa ennaltaehkäiseviä toimia yhä tehokkaammin niitä tarvitseville, kaventaen työhyvinvointiin ja terveyteen liittyvää sosiaalista eriarvoisuutta.

ASIASANAT: sairauspäiväraha, työkyvyttömyys, terveyden eriarvoisuus, sosioekonomiset erot, regressioanalyysi, elinaikamalli, ryhmäperusteinen trajektorianalyysi-malli

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List of Original Publications

This dissertation is based on the following original publications, which are referred to in the text by their Roman numerals:

- I Salonen Laura, Kailaheimo-Lönnqvist Sanna & Pöyliö Heta. Unravelling the relationship between parental resources and disability pension in young adulthood. *Social Science Research*, 2019; 83.
- II Salonen Laura, Blomgren Jenni, Laaksonen Mikko & Niemelä Mikko. Sickness absence as a predictor of disability retirement in different occupational classes: a register-based study of a working-age cohort in Finland in 2007–2014. *BMJ Open*, 2018, 8:e020491.
- III Salonen Laura, Blomgren Jenni & Laaksonen Mikko. From Sickness absence to disability retirement: the role of diagnosis and occupational class within the working-age Finnish population. *BMC Public Health*, 2020, 20: 1078.
- IV Salonen Laura, Alexanderson Kristina, Rugulies Reiner, Framke Elisabeth., Niemelä Mikko & Farrants Kristin. Job demands and job control and future trajectories of sickness absence and disability pension: An 11-year follow up of 2.1 million employees in Sweden. *Journal of Occupational and Environmental Medicine*. 2020. (Epub ahead of print version).

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1 Introduction

Populations are rapidly ageing across Europe. In 2019, every fifth citizen living in Europe was over the age of 65, and the number is expected to increase by almost 30 % by 2050 (Eurostat, 2019). This development is largely a result of increasing life expectancy and declining fertility rates (Bloom et al., 2010). European societies are facing major challenges such as increasing pension, healthcare and long-term care costs with a shrinking labour force. This has led countries to focus on extending working lives, for example, by increasing the minimum old-age pension age (OECD, 2011). However, lengthening working careers by increasing working years only at the beginning or at the end of the career is insufficient. Improving workers' health and wellbeing in the middle of work career also plays an important role in maintaining and prolonging work careers.

Every year, a large number of employees are absent from work or retire early due to health problems. In Finland, annually around 6 % of the working-age population is on disability retirement (ETK and Kela, 2019). Especially in Nordic countries the number of disability pension receivers and expenditure on disability benefits are relatively high. Both Finland and Sweden, the countries this dissertation focuses on, are Nordic welfare states with a generous, and universal social- and healthcare systems where the incapacity to work due to illness or accident is compensated mainly by the public sector. As work disability imposes high costs on society, employers, and individuals, the prevention of long-term work disability is an important health and social policy target. However, to introduce and develop better policies and interventions, a sufficient understanding of the underlying mechanisms leading to long-term work disability is needed.

The development of a long-term work disability is a complicated process, which manifests in diverse ways during the life-course. While ultimately there are several push- and pull -factors affecting the decision to retire early, health can be considered as one of the strongest predictors of (involuntary) early retirement (Beehr, 1986; Feldtman & Beehr, 2011). In general, childhood is one of the most important phases in predicting health, work ability and labour market position later in life (Duncan and Brooks-Gunn, 2000; Halonen et al., 2014; Harkonmäki et al., 2007; Heckman, 2006). Childhood is also a crucial phase for the development of socioeconomic

disparities in these domains. Children are born into families with different sets of resources setting them on different pathways (Björklund and Jäntti, 2011; Erola et al., 2016; Erola and Kilpi-Jakonen, 2017a; Ganzeboom et al., 1989). This influence of family background on health and socioeconomic outcomes later in life reflects the different social and biological factors in childhood that can affect various health and social outcomes later in adulthood including work disability (Ben-Shlomo and Kuh, 2002).

Important processes of long-term work disability also occur later in work life. The accumulation of days of sickness absence is an important risk marker for future disability retirement (Gjesdal and Bratberg, 2003; Kivimäki et al., 2004; Lund et al., 2008) especially when the sickness absence is due to mental disorders or musculoskeletal diseases (Alexanderson et al., 2012; Jansson and Alexanderson, 2013; Kivimäki et al., 2004). Although socioeconomic disparities are well documented in the prevalence of both sickness absence and disability retirement (Leinonen et al., 2011; Polvinen et al., 2016, 2014), much less is known on how sickness absence predicts disability retirement between different socioeconomic groups. This has gained attention only recently (Helgadóttir et al., 2019a, 2019b) and is still poorly understood.

Socioeconomic disparities mainly derive from unequal distribution of different resources and environments (such as work environment) in which socioeconomic groups act. Work environments can either ‘cause’ ill-health (social causation mechanism) or push individuals with poor health into certain work environments (health selection mechanism) which in turn are associated with an increased risk of work disability. In particular, a psychosocial work environment is becoming increasingly important, as physically demanding jobs are disappearing (Cerdas et al., 2019). A common way to measure a psychosocial work environment is to measure the level of demands and control in occupations. Previous studies have indicated that especially high levels of job demands and low levels of control are associated with subsequent work disability (Canivet et al., 2013; Christensen et al., 2008; Clausen et al., 2014; Knardahl et al., 2017). However, research on the association between psychosocial working environment and disability retirement has faced numerous short-comings in data and methods (Fila 2016; Kain and Jex, 2010). Little is known of how and which type of occupation-specific exposures of job demands and job control are associated with the development of a long-term work disability.

In general, disability retirement is more common among those with low socioeconomic positions, and these socioeconomic differences have remained persistent since the 1970s in Finland (Hytti, 2006, 1988; Leinonen et al., 2011; Notkola et al., 1995; Polvinen et al., 2016, 2014). However, the mechanisms behind the association between socioeconomic position and the development of long-term work disability are still not well understood.

This dissertation aims to examine the risk of developing a long-term work disability, and the socioeconomic disparities in this process. The key factors relevant to the development of long-term work disability consist of family background, sickness absence, and psychosocial work environment. These are considered important in the process of developing a long-term work disability, and they are treated as processes themselves. In all studies, socioeconomic disparities have a central role. Different measures of socioeconomic positions are used to reflect the available socioeconomic resources and labour market position.

The first article studied the long-term work disability risk as a process of intergenerational inheritance. The article investigated the association between parental socioeconomic position, young adult's education and the risk of disability retirement in young adulthood. The second and third articles focused on the process of long-term work disability by investigating the transition from sickness absence to disability retirement. The articles studied the association between the length and diagnosis of sickness absence with diagnosis-specific disability retirement. The fourth article examined the association between occupation-specific psychosocial work environment with the development of sickness absence and disability pension days across eleven years. While the studies are conducted on data from two different countries — Finland and Sweden — the focus is not to be comparative. These countries share high similarities as a welfare state, and in reference to sickness and disability insurance systems and labour market composition.

The dissertation is divided in two main parts: a summary chapter and the original publications. Chapter 2 discusses the theoretical approaches and conceptualisations of work ability and social gradient. Chapter 3 reviews empirical research literature on determinants of long-term work disability and the socioeconomic disparities in them. Chapter 4 describes the research design, data and methods used in the original publications. Chapter 5 summarizes the results of the articles, and chapters 6 and 7 discusses the conclusions of the results, as well as the limitations of the study and includes a discussion on policy implications and future research.

2 Conceptualising work disability and social disparities

2.1 Definition of work disability

Work ability is a complex, dynamic, and multidimensional concept and central for many fields of sciences, sickness insurance schemes, medical practitioners, and legislators. The concept of work ability often remains insufficiently defined in research and its definition varies across contextual environments (Cadiz et al., 2019; Tengland, 2011).

According to the earliest definitions, work ability is tightly connected with health. Good health is perceived as a sign if not a synonym for a good work ability, while illness or impairment is a sign of work disability (Ilmarinen et al., 2006; National Research Council, 2002). While a certain level of health is necessary for work ability, it is not sufficient. For example, performing work tasks also require specific skillset, training, and motivation. Later the perspective has developed from the so-called medical model to more holistic one that include interactions between health and the work environment, the role of prevention, and eventually preventive measures to enhancing measures (Loppela, 2004; Rantanen, 1995). These days a widely used holistic model for work ability is based on an idea that there is a need for a balance between many fields, such as the society, work environment, close community, and individual characteristics (Ilmarinen et al., 2006). According to this conceptual framing, work disability is a result of malfunctioning in this multidimensional structure or a mismatch between an individual's resources and work environment.

A common way to describe the different layers of resources and their associations with the environment is the 'house model of work ability' developed by Juhani Ilmarinen (2006) (Figure 1). The house consists of multiple floors that are structured in an order of importance, and the house itself is situated in a complex environment. In this house, health and functional capacity form the base of work ability. Work ability is then built on the person's health and functional capacity, human resources, and working conditions (Ilmarinen et al., 2006). Finally, work ability is in a constant interaction between the person's family and the closest community, which are embedded in the wider context of the whole society. Thus,

work ability can be supported in various ways from different dimensions. Ultimately, a good work ability consists of well-balanced floors.

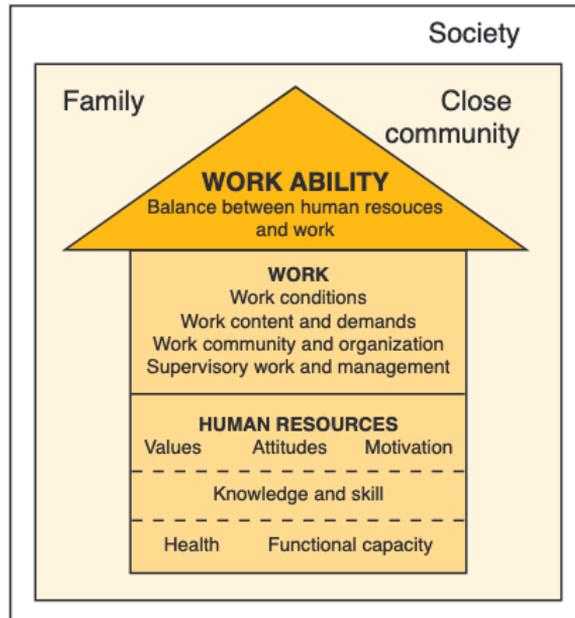


Figure 1. The house model of work ability. Source: Ilmarinen (2006).

However, this conceptual framing was created as a health-based concept, not as a theoretical model to be used in scientific research. Although it is very commonly used, it is criticized for lacking comprehensive testing on validity and generalizability (Cadiz et al., 2019). One of the greatest disadvantage of the model is the inability to distinguish between perceived and objective work ability. As a solution, a recent review article proposed that this work ability model could be studied through a job demands-resources (JD-R) model, an expansion of job demands-control mode (see Bakker and Demerouti, 2007; Cadiz et al., 2019). According to the authors, the JD-R model creates a theoretical foundation of the ‘house’ model, where all the levels and their associations can be broken down to ‘demands’ versus ‘resources’. While the house model of work ability is criticized in a context of empirical research, it can be useful in drafting the theoretical framework. One of its advantages is in the way it describes the multidimensional nature of work ability. The model is a powerful illustration of how work ability is not only a measure of individual’s state of health, but how health and work ability are related to multiple individual, environmental and societal factors.

There are many ways of measuring work ability. A common way is to divide work ability into subjective and objective measures. Subjective measures, such as a self-rated estimate of current work ability and self-reported work disability days and Work Ability Index are common in surveys. While self-reported work disability (usually referring to sickness absence) is often a good indication of an ‘objective’ work ability, administrative data on work disability often provides accurate information on the starting and ending days of the work disability. Sickness allowance and disability pension days derived from an administrative register data are examples of objective measures. These so-called medically certified sickness absences can further be divided into two categories: those covered by sickness insurance and those that are not. Sufficiently long sickness absence is required to receive sickness allowances. This period is commonly used as a threshold for the definition of short- and long-term work disability, although there are no clear rules to what constitutes short- or long-term disability. Sickness absence is a measure of a rather long-term illness since it usually refers to an absence of at least 1 to 2 weeks from work due to illness. Research on sickness absences is predominantly about long-lasting absences because data for shorter sick leaves are not easily available. Data on very short-term sick leaves are not recorded in national registers but only in employers’ databases. Further, there are large differences between workplaces in the policies and practices of recording sick leaves. Even physicians handling sickness absence certifications report difficulties in assessing them, thus adding to the variability in the workplace-level practices (Hinkka et al. 2019). Disability pension or retirement is a measure of long-term work disability, and as in most countries it refers to a work disability that has lasted for a long period or is admitted with a stricter eligibility rule.

Work disability can be measured in several ways by the number of absence days or its duration or the number of allowance days, or by their development over time. The latter are usually referred to as work disability trajectories. Studies on disability pension trajectories, however, are limited. Some studies have used the combination of sickness absence and disability pension days to form work disability days (Farrants et al., 2018; Hiilamo et al., 2019).

2.1.1 Institutional and country context

Transition to an early retirement is influenced by several factors, which can be categorised to push and pull factors (Kohli and Rein, 1991). Disability retirement is a particular form of early retirement that reflects a decreased level of health, work ability and their association with the work environment. For example, health problems and downsizing at the workplace can push the employee out of the work life and to an early retirement (Vahtera et al., 2005). Economic incentives, partner’s

retirement and other individual factors and social environment factors can be considered as pull factors that attract the employee out of work life.

Work disability benefits are also related to job market stability. The utilisation of the social insurance benefits is affected by political decisions, such as compensation levels, and by economic factors, and the business cycle. Sickness allowances are more commonly used during good economic times than during recessions (Pichler, 2015; Thorlacius and Olafsson, 2012; Wallman et al., 2009). Sickness absence incidence also fluctuates according to unemployment levels (Blomgren, 2018, 2017). When the unemployment level is low, sickness absence and disability pension levels rise and vice versa.

Furthermore, all this develops in certain institutional and labour-market settings that determine the availability and the attractiveness of the early retirement (Leinonen, 2014, p. 18). Sickness insurance and social security systems determine which benefits are available or sensible in the case of deteriorating health. Being sickness absent or retired due to a disability also reflects the availability and profitability of other benefits. Depending on the job contract and employment status, sometimes other social security benefits might be more appealing than sickness benefits. For example, while the unemployed are eligible for sickness allowances, the amount of allowance is lower than the unemployment benefit in which case sickness allowance might not be availed. This leads to a situation where a person ends up receiving ‘wrong’ benefit. In fact, unemployment and disability pensions often function as alternatives for people with restricting illnesses. Up to one half of the Finnish long-term unemployed have been estimated to have poor work ability, and thus are not realistically able to find employment (Kerätär et al., 2016).

As one of the articles of this thesis uses data from Sweden, it is necessary to provide a short description of the sickness and disability insurance systems of both countries. Finland and Sweden both represent Nordic welfare states with relatively generous and universal social security systems. In both countries, the system is based on a combination of universal basic security and supplementary income security that forms a comprehensive social security system designed to protect against social risks through the life-course. However, the countries also differ in terms of eligibility criteria and level of payment in sickness absence and disability retirement.

Sickness and disability insurance system in Finland

In Finland, sickness allowance is paid to compensate for the income losses caused by work incapacity lasting up to one year, after which a disability pension can be granted. All 16 to 67-year-old non-retired Finnish citizens are eligible to receive a sickness allowance, including full-time students and unemployed job seekers. Sickness allowance can be paid after a waiting period of ten working days of work

incapacity (Sundays and midweek holidays are not counted as working days). During the waiting period, employers pay full salary to the employees but depending on collective agreements, longer periods of full salary are possible (Toivonen, 2012). A sickness certificate from a physician is always required to receive sickness allowance.

The foundations of sickness allowance were introduced in 1964 when the first Sickness Insurance Act was implemented in Finland (Kangas, 2006, 2004; Niemelä, 2014). Since then, several new legislations have been introduced. In 2012, three important changes were introduced to the Health Insurance Act and the Occupational Health Service Act in Finland. These changes are also called the '30-60-90 day rule'. These changes obligated the employers to inform the occupational health service providers when an employee had been ill for 30 or more days. A deadline for the employer to send a bill on daily allowance to the Social Insurance Institution was set to 60 days. Finally, an assessment by an occupational physician was set as a requirement if the work disability lasted for more than 90 days. The aim was to provide early intervention points and thus promote the rehabilitation and an earlier return to work (Halonen et al., 2016).

Disability pension can be granted after a long-term incapacity for work, generally, after the individual has received sickness allowance for the maximum of 300 working days (about one year). The remaining work ability is assessed based on medical diagnosis, occupational factors and social circumstances. Finland has both national and earnings-related pension schemes that cover disability retirement. The national pensions are administered by the Social Insurance Institution of Finland (Kela) and the earnings-related pensions are administered by multiple pension insurance companies. These pension schemes have supplemented each other since the introduction of the earnings-related pension scheme. Disability pensions can be granted to people aged 18–62 (earnings-related scheme) or 16–67 (national pension scheme), if their work disability is medically assessed to be long-term, i.e. at least one year. Disability pension can be granted for part- or full-time (in the earnings-related scheme), either fixed-term (e.g. fixed-term rehabilitation subsidy) or permanently. Individuals aged 16 to 19 have their own Rehabilitation Allowance for young persons (Kela, 2019).

Sickness and disability insurance system in Sweden

In Sweden, the public sickness benefit insurance covers all non-retired Swedes aged over 16 years, who live in Sweden and have income from work or unemployment benefits. The prerequisite for receiving sickness benefit is when a person's work ability is reduced due to a disease or injury by at least 25 %. Although Swedish sickness absence scheme is universal, in reality, it covers only employed people with

a minimum wage that 24 % of the price base amount SEK 10272 in 2009. Around 10–15 % of the population who are presumably fit to work are not insured at all due to very low incomes. (Grees, 2015, p. 459; Lidwall and Marklund, 2011.) Certification is required after seven days of work incapacity. The employer covers the first fourteen days of work incapacity, after which sickness benefit is paid by the Social Insurance Agency. The Social Insurance Agency pays all sickness benefits for the self-employed and unemployed. The maximum duration of occupational insurance is 360 calendar days in general. Income above this ceiling is not covered by public insurance. (Försäkringskassan, 2019.)

Individuals with permanent work disability can receive a disability benefit from the public system. Since 2003, the disability pension was replaced by ‘sickness compensation’ (ages 30–64) and ‘activity compensation’ (ages 19–29) (Anderson, 2004). I will continue to refer to these as disability pension to avoid confusing the non-Swedish readers. All Swedish residents aged 19–64 whose work capacity is permanently reduced due to a disease or an injury, can receive a disability pension from the Social Insurance Agency. In addition, disability pension can be granted for full-time or part-time ordinary working hours. The first public pension system that included an invalidity pension, was introduced already in 1914 in Sweden. While many legislative changes have been made to sickness and disability benefits (Lidwall and Marklund, 2011), one important change was introduced in 2008. The eligibility requirements for disability benefit were made more stringent so that to qualify for the benefit, working capacity had to be permanently reduced in relation to job eligibility to the entire labour market (Försäkringskassan, 2019b; Jönsson et al., 2011).

2.2 Social disparities in work disability

2.2.1 Definition of socioeconomic position

The concept of social stratification refers to the social ordering of groups of people in society (Keister and Southgate, 2012). People within the same groups share common characteristics and behavioural patterns and they have access to similar levels of resources, such as prestige or income. The positions form a hierarchical order according to their level of resources. How people end up in certain positions vary between societies. In societies with low social mobility, changing one’s position is difficult due to different barriers. In societies with high social mobility and little structural restraints, acquiring any position mainly depends on each individual’s attributions, such as motivation. This is the basic idea of a meritocratic society (Rawls, 1999). The rules that define how to gain these positions and what is considered a desirable position differs in across societies and in time (Wright, 2015).

For example, education has become a more important predictor of an individual's access to resources, while it previously was the occupational class (Becker, 1993; Lenski, 2005). Socioeconomic position can be defined as a position, that enables access to different forms of resources and environments where the resources can be used (Carpiano et al., 2008). Individuals can be considered to be born with certain resources that provide different opportunities, and the possibility to use these resources is defined by the surrounding environment. Unequal distribution of these resources and structural settings that affect their potential for use can be viewed as the cause and the consequence of social inequalities (Mackenbach, 2019).

The resources can be classified into psychological, social, cultural and behavioural and economic resources. *Psychological resources* can refer to both inherited abilities, such as cognitive skills and personality, but also skills that are acquired later in life, like coping skills. *Cultural and behavioural resources* refer to health knowledge and behaviour that can damage — like smoking, unhealthy diet, high alcohol consumption — or improve health like healthy diet, exercise. (Galobardes, 2006a, 2006b), or to health literacy (Lastrucci et al., 2019; Rüegg and Abel, 2019; Stormacq et al., 2019). Health literacy literacy is one example of health knowledge. It can be defined as 'the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions (Mackenbach, 2006; Marmot et al., 1991). *Social resources*¹, often referred to as social capital, like kinship, friendships and relationships do not only boost life satisfaction and help to prevent loneliness; they also create a type of safety net that can protect the individual from adverse life events and marginalization. *Material resources* consist of things like income, wealth, and house ownership.

There is no single agreement to what constitutes a social class on a theoretical level, which makes it difficult to measure it on an empirical level. The most common ways of measuring socioeconomic position in health studies are income, education, and occupation. Each of them captures a divergent aspect of the socioeconomic position, and there is no single best indicator of socioeconomic position suitable or relevant for all situations.

Income is a direct measure of material resources (Galobardes, 2006a) that enables more opportunities to a healthier lifestyle and faster access to health care. A minimum level of material resources like income is required to provide necessities such as nutrition and housing. In terms of health, high material resources provide more possibilities in purchasing a healthier lifestyle, enhancing life satisfaction and

¹ In the research literature (e.g. Uphoff et al. 2013) it is common to use the term *social capital*. For the sake of coherent terminology, I use the term *resources* as I do in case of other types of resources.

preventing sickness and enabling quick access to high-quality health care. (Lynch, 2000.)

Education is considered the most stable measure of socioeconomic position since it is already acquired in early adulthood and does not usually change much during one's lifetime. It captures psychological, cultural and behavioural resources. For example, education captures features such as intelligence and problem-solving skills in two ways: first, more skills are required to achieve higher education, and second, education provides better skills. Education develops communication and problem-solving skills, complex thinking and promotes a sense of self-control, or human capital (Becker, 1993). In addition, a high educational level has a clear protective effect on poor health and mortality. However, little is known about what the highly educated do differently compared to those with lower education (Galama and van Kippersluis, 2019.) For example, high education is associated with better health literacy (Mantwill et al., 2015; Stormacq et al., 2019) and healthier lifestyle (Lynch et al., 1997; Stringhini, 2010). Since poor health behaviour is more common among those in lower socioeconomic positions, this contributes to the health gradient (Hanson and Chen, 2007; Pampel et al., 2010; Petrovic et al., 2018). Few explanations to why people in lower socioeconomic groups tend to adopt less healthy behaviours have been found (Pampel et al., 2010). They face more stress that encourages coping through poor health behaviour, and they often have poorer health literacy (Lastrucci et al., 2019; Rüegg and Abel, 2019; Stormacq et al., 2019). People with lower education (and often also in lower socioeconomic positions) may gain less in exchanging short-term risk behaviour for a long-term gain in longevity since their baseline life expectancy is already lower.

Occupation or occupational class reflects more directly an individual's prestige and work-related factors such as stress and occupational hazards (Galobardes, 2006a). Since occupational class changes over time, it is a more precise measure of an individual's situation in life at each point of time. However, it is also difficult to consider these changes while conducting research.

In terms of work disability, different measures of socioeconomic positions have been used in previous studies (Leinonen et al., 2012). These different domains of socioeconomic positions have an independent effect on disability retirement (Hagen et al., 2000; Krokstad et al., 2002), but they are also partially mediated through each other. In particular, education largely explains the effect of social class (Hagen et al., 2000; Leinonen et al., 2011) and income (Leinonen et al., 2012). Education is the best measure especially among young adults and occupational class is perhaps the most used one among the working-age population. Income, education, and occupational class are partially interrelated with each other (Leinonen et al. 2012). Income has the weakest association with disability retirement because it is strongly mediated through education and occupational class. Occupational class is a useful

measure in work disability research, as it simultaneously captures the status of the individual as well as the work environment and related work hazards.

2.2.2 Mechanisms behind the social gradient in work ability

Social health inequalities refer to systematic differences in health between socioeconomic groups stemming from social origins. Inequality in life expectancy, mortality, disability, self-rated health, health behaviour and use of health care services have been found to systematically vary between educational, income and occupational levels (Bartley, 2017; Berkman and Kawachi, 2000; Mackenbach, 2019; Marmot and Wilkinson, 2006). Low education, low income and low socioeconomic status are associated with poorer self-rated health and work ability, lower life expectancy, higher risk of mortality, poorer health behaviour, and a higher risk of having chronic and mental health problems (Lahelma et al., 2017; Ruokolainen et al., 2019; Tarkiainen et al., 2012). In general, those in lower socioeconomic positions have poorer health outcomes than those in higher socioeconomic positions. This gradual change in health is referred to as the social gradient in health. There is no consensus on what the main contributors to the health gradient are, or how they should be classified. The lack of a unified framework for the social disparities in health makes it difficult, for example, to understand underlying (causal) mechanisms in health disparities (Case and Deaton, 2005).

One of the first attempts to disentangle these mechanisms was the British Black Report, ordered by the Department of Health and Social Security in the UK and delivered by Sir Douglas Black (Townsend and Davidson, 1982). The report demonstrated that although overall health had improved after the introduction of the welfare state, health inequalities were still persistent. The report also included possible mechanisms producing health inequalities. The report presented mainly two mechanisms contributing to health inequalities: (social) causation (further divided into material and cultural explanations) and health selection. Since then, more complex mechanisms have been discovered among the researchers (e.g. Bartley, 2017; Mackenbach, 2019). Bartley (2017) lists six explanations for health inequality, where the first three derive from the Black Report: material interpretation, cultural interpretation and selection. The list is complemented with three contemporary explanations: psychosocial model, macro-social or political economy and life-course model. Additionally, Mackenbach (2019) lists similar six contributing factors to social inequality: life-course, genetics, childhood environment, material living conditions, psycho-social factors, health-related behaviour, and health care. The mechanisms of how these factors contribute to health inequalities are divided into four categories: selection into socioeconomic groups, differential health progress, social disadvantage and the social production of disease.

In the following chapter, I will start by presenting theories on the mechanisms behind social gradient in health. I will combine and regroup the mechanisms presented by previous scholars (Bartley, 2017; Mackenbach, 2019) in 1) social causation and health selection, 2) biological and social pathways.

Social causation and health selection

There are two competing causal explanations for the social gradient in health: social causation and health selection. Health selection refers to a mechanism where health affects socioeconomic status or social mobility and social causation to a mechanism where socioeconomic status affects health (see e.g. Mackenbach, 2019). It is important to note, that there is a common source of bias when trying to establish a causal relationship between socioeconomic position and health. Both health and socioeconomic status can be affected or explained by a third variable, a confounder, such as genetics or family background. This is often very difficult to test empirically.

Social causation refers to a mechanism where the individual's socioeconomic position causes health outcomes. This mechanism emphasizes the role of different resources: access to resources can promote better health whereas the lack of resources can lead to decreased health. People in less advantaged socioeconomic positions are more exposed to poverty, and hazardous working and living environment (Blane et al., 1993; Böckerman and Maczulskij, 2018; Cygan-Rehm et al., 2017; Haan and Myck, 2009; Mackenbach, 2019; McKee-Ryan et al., 2005; Schuring et al., 2013, 2007; Vaalavuo, 2016). They are also less equipped with different resources that would help to protect them from a hazardous environment, ease their access to health care or promote a healthier lifestyle. (Bartley, 2017, p. 47). For example, working in a physically and mentally strenuous work environment can increase or cause illness and eventually, work disability. The psychosocial work environment is estimated to account for 10–15 % of disability retirement risk (Christensen et al., 2008) and around 30 % of women's long-term sickness absence risk (Labriola et al., 2011).

Health selection mechanism can be divided into direct and indirect selection. Direct selection occurs when health and early life influence the direction of social mobility and health in adulthood and thus produce social class differences in health. Indirect selection, on the other hand, occurs when health affects first selection into certain educational level or occupational class, which in turn are predictors of adult socioeconomic class and health (Blane et al., 1993). In general, individuals who can obtain and maintain a job, are on average healthier ('healthy worker survivor effect') (Buckley et al., 2015; McMichael, 1976). Studies have found that health selection occurs in transiting from employment to unemployment and early retirement

(Böckerman and Maczulskij, 2018; Haan and Myck, 2009; Schuring et al., 2007), from unemployment to re-employment (Claussen, 1999; Nwaru et al., 2018) and occupational mobility (Ostlin, 1988). In other words, individuals with poor health are more likely to retire early and experience unemployment or downward occupational mobility. Poor health can also drive workers to work environments that are associated with a higher risk for work disability.

Evidence has been found for both health selection and social causation and no consensus among academics has been reached on which mechanism is more dominant (Kröger et al., 2015). Kröger et al. (2015) conducted a systematic literature review on studies that have tested these hypotheses between the years 1994 and 2013. They found rather equal support for both hypotheses; however, the preference over one hypothesis depended on the measure of socioeconomic status and the relative explanatory power varied during life-course (Hoffmann et al., 2019; Reinholdt et al., 2010). Health selection is a more prominent mechanism at younger ages, but less so at an older age. Hoffman et al. (2019) compared the explanatory power of health selection and social causation with different socioeconomic status outcomes at different stages of the life-course and found support for both mechanisms, however, the social causation had a much stronger effect across life-course. Especially in work life since work and health have a complex, two-way relationship, working conditions can cause deteriorating health, and poor health can prevent employment. Furthermore, a third variable can affect both the job environment and health, for example, low education is associated with a poor work environment and poor health.

Finally, Mackenbach (2019) raises health care as one of the mechanisms contributing to health inequalities. People in lower socioeconomic position have poorer access to high-quality healthcare, and they use less preventive services and effective treatment services. Finland, for example, has one of the most unequal health care systems within the OECD countries (Kangas and Blomgren, 2014). In particular, in Finland, the strong occupational health care sector creates a situation where the employed, already relatively healthy people, have faster access to high quality and 'free' health care, whereas the others, like the unemployed and pensioners, have more challenges in accessing health care (Blomgren and Virta, 2020).

Biological and social pathways

Life-course perspective, in the fields of health studies, refers to pathways that consist of critical periods and accumulation of events during the lifetime that can affect health (Ben-Shlomo and Kuh, 2002; Kuh et al., 2003). Life-course can be divided into biological and social pathways, although they are intertwined (see Kestilä,

2008). Both models propose that social inequalities derive from differences that can be observed as early as in the prenatal environment.

The biological pathway consists of the latency model and biological programming. For example, low birth weight is associated with several adverse health outcomes (Barker et al., 2002, 2001; Rich-Edwards et al., 1997). The latency model emphasizes the importance of critical periods during which exposure to specific events programmes the subsequent development of the disease. In other words, genetics and factors that are biological in nature can trigger a disease early in life that will have ramifications in later life. Later exposures can only modify the effect to a certain extent. Biological programming, on the other hand, refers to a similar situation where individuals are born with certain attributes; but they can trigger the development of disease risk also later in life. (Ben-Shlomo and Kuh, 2002; Pensola and Martikainen, 2004.)

The social pathway emphasizes the social environment during early childhood. Socioeconomic conditions, such as parental resources, social networks, neighbourhoods, schools, and hobbies can affect the future social outcomes, such as education and employment, which in turn affect health. These various social and biological factors can have independent, mediating or modifying effects on health throughout life. (Ben-Shlomo and Kuh, 2002; Duncan and Brooks-Gunn, 2000; Erola and Kilpi-Jakonen, 2017; Kuh et al., 2003; Merton, 1988). The *direct* effect implies that for example, high parental education can assure better health knowledge (Grossman, 2005) and that high parental income enables a better use of health care, health consumption and inhibits the stress of being poor (Marmot, 2004). Further, parents pass down their health literacy (de Buhr and Tannen, 2019; Lastrucci et al., 2019; Manganello, 2007; Sanders et al., 2009). Children can benefit from their parents' resources, investments and endowments, or suffer from a lack of them, and the accumulation of these (dis)advantages affect the future outcomes, for example, on health (Ben-Shlomo and Kuh, 2002; Erola and Kilpi-Jakonen, 2017b; Kuh et al., 2003).

The *indirect* effect of childhood socioeconomic status to adult health means that high socioeconomic status is inherited from childhood and that a high level of education, income or occupation in adulthood contributes to better health. This model emphasizes the role of education as a mediator of parental resources, such as income or social status. It claims that in addition to parental resources having a direct effect on child's outcomes, most of the intergenerational transmission of inequality passes through the child's education. (Bernardi and Ballarino, 2016 p. 257; Blau and Duncan, 1967.) Indirect effects can also refer to a situation where childhood socioeconomic status is associated with later social and health outcomes via the accumulation of other social events. For example, high parental social status is associated with a lower risk of mortality, divorce, and conflicts in the family

(Jalovaara, 2013; Stringhini et al., 2017), which themselves are factors that have a negative influence on the child's health and socioeconomic status.

3 Previous findings on long-term work disability

3.1 Socioeconomic position

Socioeconomic differences in disability retirement are relatively large in Finland and they have been recognized since the 1970s (Hytti, 1988; Leinonen et al., 2011; Notkola et al., 1995; Polvinen et al., 2016). Although socioeconomic differences in the incidence of disability retirement have steadily decreased during the last two decades, they are still evident (Leinonen et al., 2011). Previous studies have repeatedly reported a higher disability retirement risk among the low income (Claussen and Dalgard, 2009), low education (Bruusgaard et al., 2010; Krokstad et al., 2002; Samuelsson et al., 2012) and low social class (Leinonen et al., 2011; Månsson et al., 1998; Polvinen et al., 2014; Ropponen et al., 2011).

Among young adults, education is the best predictor of disability pension out of all socioeconomic measures. Particularly, those with low education have a high risk of disability pension (Sumanen et al., 2016). Although occupational and income differences become more important with age, educational differences are persistent also among older populations (Bruusgaard et al., 2010; Leinonen et al., 2012; Nilsen et al., 2012). Among adults, even when various occupational, psychosocial and behavioural factors, are taken into account, educational inequalities continue to exist in disability pension (Nilsen et al., 2012). In fact, the effect of occupation and income on the risk of disability retirement functions mainly through education (Leinonen et al., 2012).

Occupational class differences in sickness absence (Pekkala et al., 2017a; Sumanen et al., 2017) and disability retirement (Leinonen et al., 2011; Polvinen et al., 2016) are large. Manual workers have systematically higher incidence and risk of sickness absence and disability retirement compared to lower or higher non-manual employees due to different diagnoses (see for example Ervasti et al., 2016, 2013; Pekkala et al., 2017a; Polvinen et al., 2014; Virtanen et al., 2017). The largest occupational class differences in the risk of disability retirement are due to musculoskeletal diseases (Pekkala et al., 2017b; Polvinen et al., 2014). The results on socioeconomic differences in disability retirement due to mental disorders are less consistent: the socioeconomic differences are smaller and non-linear (Leinonen

et al., 2011; Sumanen et al., 2015; Virtanen et al., 2011). Little research has been made on socioeconomic differences due to other diagnoses.

Socioeconomic gradient in disability retirement is partly explained by the differences in the working conditions (Haukenes et al., 2011; Leinonen et al., 2011; Polvinen et al., 2013). Occupations with a physically demanding work environment are associated with a higher risk of long-term work disability. Results on the effect of psychosocial work environment on work disability have been mixed, varying from findings on no association (Aittomäki et al., 2003) to clear associations (Leinonen et al., 2011). Mixed results can be due to differences in the study populations and the measurements of psychosocial work environment and work. However, evidence on the impact of job control and job demands, on the socioeconomic differences in the risk of disability retirement has been rather clear (Leinonen et al., 2011; Polvinen et al., 2013).

The link between socioeconomic status and long-term disability is multidimensional, and the relationship between them varies depending on the definition of both socioeconomic status and disability. In the following chapters, I will present previous findings on the process of developing a long-term work disability, and the related socioeconomic disparities in these processes from the perspective of family background, sickness absence, and work environment.

3.2 Family background

Studies indicate that disadvantaged childhood increases the risk of disability retirement. For example, individual-related factors such as low birth weight, chronic illnesses, having been a former child welfare client, difficulties, and poor performance at school (Gravseth et al., 2007; Harkko et al., 2016; Kristensen et al., 2007; Upmark and Thundal, 2002; Vinnerljung et al., 2015; von Bondorff et al., 2015) are associated with a higher risk of disability retirement. Furthermore, conflicts in the family, parents' divorce, and financial difficulties are associated with an increased risk of disability retirement in young adulthood (Bratberg et al., 2015; Harkko et al., 2016; Kristensen et al., 2007; Rahkonen et al., 1997). Also, factors related to parents, such as parents' health-related risk behaviour and history of mental health problems are related to an increase in the risk of disability pension among their offspring (Merikukka et al., 2018; Upmark et al., 2001; Upmark and Thundal, 2002). An especially strong predictor of disability pension among young adults is their parents' history of disability pension (Boschman et al., 2019; Bratberg et al., 2015; Gravseth et al., 2007; Upmark and Thundal, 2002). In general, the higher the number of adversities in childhood, the higher the risk of disability retirement (Halonen et al., 2014; Harkkonmäki et al., 2007).

However, very little is known about the role of parental resources and how they are associated with the risk of disability pension among their offspring. Some studies have found that parents' education (Gravseth et al., 2007; Sumanen et al., 2016) and social class (Upmark and Thundal, 2002) are important predictors of their offspring's disability pension. Studies on parental resources and the association with their offspring's other health outcomes indicate that they can also play an important role in predicting work disability. Low parental socioeconomic resources predict poor health (Fahy et al., 2017; Rahkonen et al., 1997; Shuey and Willson, 2017). Additionally, the influence can vary according to the resources of the parents. For example, high parental education can assure better health awareness and health behaviour (Grossman, 2005; Huurre et al., 2003; Kestilä et al., 2006a, 2006b), whereas high parental income can lead to a better use of health care and health consumption and can inhibit the stress related to being poor (Case et al., 2002; Marmot, 2004; Reinhold and Jürges, 2012). Highly educated parents have faster access to specialized care than parents with lower education (Halldorsson et al., 2002; Paananen et al., 2013a, 2013b). These findings suggest that parental education may help in preventing their offspring from claiming disability pension by offering them support and care through better access to health care services.

Further, parental resources seem to have mainly an indirect effect on disability retirement since the young adult's education seems to attenuate the effect of parental education on health (Kestilä et al., 2006a, 2006b; Laaksonen et al., 2005; Mäkinen et al., 2006) and disability retirement (Gravseth et al., 2007; Salonsalmi et al., 2019). Thus, it is possible that the effect of parental resources and family background on disability retirement mainly functions indirectly, through their offspring's educational achievement. In other words, the factors that are related to young adults' educational achievement are also related to their disability retirement.

Studies have also found evidence of genetic inheritance of sickness absence and disability retirement (Gjerde et al., 2013; Harkonmäki et al., 2008; Seglem et al., 2019; Svedberg et al., 2010). Genetics may play a role in the association between family background and the young adults' disability retirement, and in the young adults' education. One study found only evidence for genetic effects on long-term work disability (sickness absence and disability pension), but no evidence for social transmission (e.g. that environmental factors shared by the twins would affect long-term work disability) (Ørstavik et al., 2019).

3.3 Sickness absence

Sickness absence is the strongest predictor of disability retirement (see for example Kivimäki et al., 2007; Lund et al., 2008; Samuelsson et al., 2012; Virtanen et al., 2006), even when considering the fact that year-long sickness absence is often

required before a disability pension can be granted. In fact, sickness absence can predict disability retirement even ten years in advance (Laaksonen et al., 2016). In particular, long sickness absence spells are associated with a further disability pension, although frequent short-term sick leaves also increase the risk of disability retirement (Stapelfeldt et al., 2014). The cumulative sickness duration is a more important predictor than a single sickness spell (Stapelfeldt et al., 2014; Wallman et al., 2009). There is no consensus on the exact limit for the length of sickness absence, which would mark the turning point after which the risk of disability retirement would significantly increase. Some studies have found that annual sickness absence needs to be for at least 245 days to reach a 50 % probability of transitioning to disability pension (Wallman et al. 2009), while Gjesdal & Bratberg (2003) found that 270 days were needed to reach a probability of 40 %. Furthermore, the risk of disability retirement does not increase linearly according to sickness absence days.

While a social gradient exists in the prevalence and incidence of sickness absence of various lengths (Pekkala et al., 2017a, 2017b; Piha et al., 2007) as well as in disability retirement (Polvinen et al., 2016). However, it is not known whether the social gradient in the risk of disability retirement exists in every length of sickness absence. A study on employees at a general hospital in the county of Copenhagen found that social gradient in sickness absence varied depending on the sickness absence duration and patterns (Kristensen et al., 2010). The sickness allowance trajectories preceding disability retirement have been also found to vary between socioeconomic groups (Laaksonen et al., 2016). So far, only one study has examined the social gradient in the risk of disability retirement after different lengths of sickness absence spells (Helgadóttir et al., 2019b). While the general finding of the study indicated that blue-collar workers had a higher risk of disability retirement than white-collar workers did, they also found a higher risk for white-collar workers when the sickness absence spell was longer than six months and was due to musculoskeletal diseases. However, this study did not, include information on other occupational classes.

The association between sickness absence and disability retirement does not only depend on the length, but also on the diagnosis of sickness absence and disability retirement (e.g. Kivimäki et al., 2007). Some diagnoses that cause sickness absence do not necessarily cause long-term work disability, such as pregnancy-related conditions or injuries (Gjesdal and Bratberg, 2003; Kivimäki et al., 2007). Prior studies have identified that long-term sickness absence due to mental diagnoses or sickness absence due to circulatory diagnoses, musculoskeletal diseases (Alexanderson et al., 2012; Gjesdal et al., 2011; Jansson and Alexanderson, 2013; Kivimäki et al., 2007), gastrointestinal diagnoses (Kivimäki et al., 2007), stress-related mental disorders (Ishtiak-Ahmed et al., 2014), and diseases of the nervous system (Gjesdal and Bratberg, 2003) strongly predict all-cause disability retirement.

Results on the effect of respiratory diagnoses have been inconsistent (Alexanderson et al., 2012; Gjesdal and Bratberg, 2003; Kivimäki et al., 2007). Some studies have found no significant differences between diagnoses in the sick leave progression towards disability pension (Wallman et al. 2009). Only a few studies have analysed both the diagnosis of sickness absence and the diagnosis of disability retirement (Dorner et al., 2015; Jansson and Alexanderson, 2013; Kivimäki et al., 2007). Mental disorders, diseases of the gastrointestinal system, diseases of the nervous system and musculoskeletal diseases have been found to strongly predict disability retirement due to the same diagnosis (Kivimäki et al. 2007). Sickness absence due to musculoskeletal diseases increases the risk of disability pension due to cancer, mental, circulatory and musculoskeletal diseases (Dorner et al., 2015; Jansson and Alexanderson, 2013).

However, research on what kind of role the occupational class plays in the transition from sickness absence to disability retirement due to different diagnostic causes is limited. Since socioeconomic differences are prevalent in both sickness absence and disability retirement due to different diagnoses, it is likely, that socioeconomic differences are also prevalent in the transition between the two. A recent Swedish study (Helgadóttir et al., 2019b) found that occupational class had an impact on the association between sickness absence due to musculoskeletal disease, but not due to mental disorders. As mentioned previously, white-collar workers were found to have a higher risk of disability retirement compared to blue-collar workers. However, this study did not, include information on other diagnostic groups of sickness absence, or diagnostic group of the disability retirement.

3.4 Psychosocial work environment

The work environment is one of the key factors in sustaining workers' health and wellbeing and an important contributor to health disparities (Burgard and Lin, 2013). It can be divided into physical and psychosocial elements. Physical working environment refers to jobs that involve for example heavy lifting, repetitive movement, and uncomfortable working positions. The psychosocial work environment is an umbrella term for factors varying from social and organisational aspects of work, such as the design and management of work with its social and organisational context, to workplace structures and conditions and individual-level experience (Cox et al., 2003; Rugulies, 2019). Two important models have guided research on psychosocial work environments and employee well-being: the Effort-Reward Imbalance (ERI) model (Siegrist et al., 1986) and the Job Demand-Control (JDC) model (Karasek and Theorell, 1990). The ERI model derives from medical sociology and is based on the idea that an employee's health is in a reciprocal relationship between efforts and rewards at work. Efforts represent the obligations and responsibilities set for the

employee and rewards consist of, salary, esteem, and job opportunities. A strong imbalance between these factors can activate a state of ‘active distress’ that can further lead to physical and mental diseases (Siegrist, 2002). This model has gained popularity and strong empirical support (van Vegchel et al., 2005).

JDC is another model that describes how workplace characteristics influence workers’ well-being and health (Karasek and Theorell, 1990). Job demands refer to factors related to time pressure, mental load and coordination responsibilities at work (Karasek and Theorell, 1990). Job control consists of two components: decision authority and skill discretion. The first refers to the worker’s ability to exercise control over job performance and how and when the task is done. Skill discretion refers to the workers’ control over the use of their initiative and skills in the job. These components are closely related and therefore are often combined into one measure. The core of Karasek and Theorell’s theory reveals that it is the interaction between job demands and control that matters the most. Different combinations of demands and control define four specific work situations: active (high demands and high job control), job strain (high demands and low job control), passive (low demands and low job control), and low strain (low demands and high job control). According to the two main hypotheses, high strain jobs precipitate psychological and physical strain and active jobs produce well-being, learning, and personal growth (Karasek & Theorell 1990). According to this model, the association between the two job dimensions is interactive rather than additive.

An individual’s poor health and high levels of stress can lead to overestimating the levels of job demands and underestimating the level of job control. One way to avoid self-reporting bias is to use objective measures such as Job Exposure Matrix (JEM). JEM is a common method used in occupational epidemiology since the 1980s (Hoar et al., 1980). To construct a JEM, workers are asked a series of questions on their work and work environment. The answers to these questions are scored, and a variable is calculated from them that measures the levels of job demands and job control. The JEM can then be aggregated to describe the level of job demands and job control in each occupation. This can be utilized to analyse occupational differences, for example, in the risk of long-term work disability. JEM is considered an efficient and easily reproducible methodology, although it cannot be claimed to be the perfect solution (Peters, 2020).

Job demands and job control are associated with subsequent sickness absence and disability pension (Aagestad et al., 2014; Albertsen et al., 2007; Clausen et al., 2014; Laaksonen et al., 2010; Labriola et al., 2011; Laine et al., 2009; Lund et al., 2005). In general, high levels of job demands lead to a higher risk of sickness absence (Aagestad et al., 2014; Allebeck and Mastekaasa, 2004; Clausen et al., 2014; Lund et al., 2005; Slany et al., 2014; Sundstrup et al., 2018) and disability retirement (Leineweber et al., 2019; Sundstrup et al., 2018). In addition, low job demands are

associated with high sickness absence (Sterid et al. 2013) although some have found no association between job demands and disability retirement (Croon et al. 2014). In some studies, low job control has also been associated with a higher risk of sickness absence (Laaksonen et al., 2010) and disability retirement (Clausen et al., 2014), while some other studies have found no evidence for this (Leineweber et al., 2012; Sundstrup et al., 2018.) It has been identified that the combination of job demands and control increased the risk of disability retirement. Especially high strain (high job demands and low job control) (Canivet et al., 2013; Clausen et al., 2014; Knardahl et al., 2017; Kondo et al., 2006; Mutambudzi et al., 2019) and passive jobs increase the risk of sickness absence and disability retirement (Christensen et al., 2008; Kondo et al., 2006; Mutambudzi et al., 2019).

Only a few studies have examined occupational disparities in long-term work disability using occupation-level JEM. A recent Swedish study found that men in occupations with either low demands, independently of the level of control, or low control, independently of levels of demands, had a higher risk of being on sickness absence or disability retirement (SA/DP). Whereas, women in occupations with low job demands had a higher risk of being on SA/DP. Especially low job control has been found to predict all-cause disability retirement (Boedeker et al., 2008), and disability retirement due to shoulder lesions (Sirén et al., 2019), and mental disorders (Samuelsson et al., 2013). Additionally, passive or high strain jobs are associated with an increased risk of disability retirement due to mental disorders and musculoskeletal diseases (Ropponen et al., 2013; Samuelsson et al., 2013). High job strain has been found to increase the risk of disability retirement due to depression among women (Mäntyniemi et al., 2012), while some have found no association (Samuelsson et al., 2013).

3.5 A summary of findings and gaps in previous research

Long-term work disability is a result of long processes driven by different mechanisms throughout the life-course. Previous studies have identified many risk factors that predict work disability; however they have often lacked a perspective on the developmental process of these factors. One of the earliest processes, the process of intergenerational inheritance has lately gained some attention in the field of work disability. While social origins and adverse childhood experiences are known to be associated with the risk of disability pension in young adulthood (Halonen et al., 2017; Harkonmäki et al., 2007), studies on the role of parental resources have not been investigated systematically. Since parental socioeconomic resources are known to be associated with other types of health outcomes among their offspring (Brännlund and Edlund, 2020), it is likely that this is also seen in disability

retirement. Further, there is a lack of knowledge on the mechanism that functions behind parental resources and their offspring's disability retirement or other similar outcomes. Parental resources can have a direct effect on the health outcome or they can primarily affect the offspring's educational achievement, which in itself is a strong predictor of disability retirement.

Another key process in the development of long-term work disability is sickness absence. Most previous studies have examined either the risk of sickness absence or disability retirement, however very little research has been conducted on the transition between the two. Prior studies that have examined the transition have treated socioeconomic variables mostly as confounding variables (Dorner et al., 2015; Alexanderson et al. 2012, Jansson & Alexanderson 2013). Studies on socioeconomic differences in this transition are limited. For example, how the length and the diagnosis of sickness absence predict disability retirement in different occupational classes is unknown. Only one study has investigated the social gradient in the transition from sickness absence to disability retirement (Helgadóttir et al., 2019b). However, this study had some shortcomings as they only included information on sickness absences due to two diagnostic groups that lasted under or over six months. Further, they lacked information on the diagnosis of the disability retirement and only included two occupational groups.

Finally, research on the effect of psychosocial working environment long-term work disability is relatively scarce and little is known about how sickness absence and disability retirement days develop across time. In addition, empirical research in this field has had several shortcomings — the lack of longitudinal settings and well-validated and objective rather than subjective measures of job demands and control. (Fila, 2016; Kain and Jex, 2010). Cross-sectional studies and studies measuring job demands and control with self-reported questions cannot distinguish the direction of the causal chain (De Lange et al., 2004; Kolstad et al., 2011; Rugulies, 2012). A longitudinal study setting would help to clarify the causal relationship between health and a psychosocial work environment, although it does not resolve it completely. In fact, recent longitudinal studies have not been able to repeat some of the previous findings, for example, high strain jobs as the strongest predictors of long-term work disability (Norberg et al., 2019). Most studies have used a combination of dichotomised low and high job demands (Blank and Diderichsen, 1995; Canivet et al., 2013; Knardahl et al., 2017; Mutambudzi et al., 2019; Sundstrup et al., 2018). Few studies (Kondo et al., 2006; Laine et al., 2009) have also divided them into quartiles, tertiles or quintiles, and then used them as separate variables, as one combined variable or as a matrix variable. These studies, however, have combined the job demands and job control scores and then divided them into, for example, quartiles, thus they are unable to distinguish the effect of job demands and job control.

4 Research design

4.1 Research objectives and questions

The research questions are:

1. How parental resources and a young adult's education are associated with disability retirement in young adulthood? (Article I)
2. How are the length and diagnosis of sickness absence associated with the disability retirement of different diagnostic groups in different occupational classes among women and men? (Articles II and III)
3. How are occupation-level job demands and job control associated with sickness absence and disability retirement trajectories? (Article IV)

The first article examines the association between family background and disability pension. More precisely, the articles focuses on the association between parental resources (education and income) and disability retirement in young adulthood. The role of the young adult's education on the risk of disability pension is also studied. Lastly, the article studies the variation in the young adult's socioeconomic status two years after the first disability pension event by the level of parental resources. Here the process of developing long-term work disability is studied from an intergenerational perspective. The article uses Finnish register data and utilizes discrete-time event history analysis.

The second article examines how different lengths of sickness absence spells predict disability retirement in different occupational classes. The third article further investigates the role of diagnosis and the occupational class in transfer from sickness absence to disability retirement. Here the process of developing long-term is studied from the perspective of transition between sickness absence and disability retirement. The development of sickness absence and its association with disability retirement among women and men of different occupational classes is followed for eight years. The second and third articles both use Finnish register data and Cox proportional hazards analysis with hazard ratios.

The fourth article examines the relationship between occupation-specific job demands and control and the sickness absence and disability retirement trajectories. The psychosocial work environment is one of the most important factors that can

contribute to the risk of long-term work disability. Here, the process of developing a long-term work disability is studied with the accumulation of work disability days. The article uses group-based trajectory analysis and multinomial regression analysis to analyse a unique dataset combining data from Swedish registers and Swedish Living Conditions Surveys.

A summary of the research questions, data, methods, and main results are presented in table 1.

Table 1. Summary of research designs of the studies.

Research question	Article	Study sample	Measures	Method
How are family background and a young adult's education associated with disability retirement in young adulthood?	I	Finnish register data, based on a 10 % population sample. Finnish cohort born during 1985–1989 were followed during 2004–2012	Dependent variable: Disability retirement Independent variable: Parental education, parental income, offspring's level of education	Discrete time event history, average marginal effects
How are the length and diagnosis of sickness absence associated with the disability retirement due to different diagnostic groups in different occupational classes among women and men?	II & III	Finnish register data, 70 % population sample. 25–62 years old, non-retired Finns in 2006 were followed during 2005–2014	Dependent variable: All-cause disability retirement (Articles II & III) and disability retirement due to the same or other diagnostic group than previous sickness absence (Article III) Independent variable: Sickness absence due to different diagnostic groups, occupational class, gender	Cox proportional hazards regression
How are occupation-level job demands and job control associated with sickness absence and disability retirement trajectories?	IV	Swedish register data, population sample. Employed Swedes aged 30–55 years old employed Swedes in 2001 were followed during 2001–2012	Dependent variable: combined days of sickness absence and disability pension. Independent variable: (Occupational level) Job Exposure Matrix, gender	Group-based trajectory model, logistic and multinomial regression analysis

4.2 Data

Three different high-quality population-based register data sets are used in this dissertation. The first article used the Finnish Growth Environment Panel (FinGEP) derived from Statistics Finland. The FinGEP data are based on a 10 % representative random sample of the population residing in Finland in 1980. The data are further extended to include information on the sample persons' children, partners, and partner's parents. The FinGEP data follow the same individuals in 1980, 1985, and 1987 and from there on annually until 2010. In the article, the study sample consisted of those born between 1980 and 1985. The parental resources were measured when the sample person was between 12 and 18 years old.

The second and third articles use the Finnish register data provided by Kela, ETK and Statistics Finland. The data set are based on 70 % random representative population sample of Finnish residents during the 2000s. The data used in the articles included date-specific information on sickness absence and disability retirement during 2005–2014. Both articles analysed non-retired Finnish residents aged 25–62 at the end of 2006.

The fourth article uses a unique combination of the total population of the Swedish residents and aggregate-level data from the annual Swedish Living Conditions Survey collected between 1977 and 1979. The latter data were used to calculate sex-, age-, and occupation-level scores of job demands and job control. For precise information on these calculations, please refer to the 'Psychosocial work environment' in the Measures-section.

4.3 Measures

Sickness absence and disability retirement

Different measures of long-term work disability are used (for a description of long-term work disability see chapter 2.1.). In the first article, disability retirement was used as the outcome variable. The variable was derived from Statistic Finland. The information on a person's disability retirement was measured on the last day of the year. The outcome variable in the second and third articles was also disability retirement. Here the data were derived from the Finnish Centre for Pensions and the Social Insurance Institution of Finland, and the information for disability retirement was measured with a specific start and end dates. In these two article, sickness absence was used as a predictive variable, and it was also measured with precise starting and ending days. In the fourth article the outcome variable consisted of work disability days, measured as the combined days of sickness absence and disability retirement. The information was derived from the Swedish register database LISA.

Socioeconomic measures

In the first article, data on own education, parental resources, i.e. completed education and the average income, and on the main activity after disability retirement was derived from Statistics Finland. Parental resources were measured between the ages of 12 and 18. Parental income was calculated as an average of parents' total gross income (adjusted for the cost-of-living index in 2014). Information on own education and occupational class in the second and third articles were derived from Statistics Finland.

Statistics Finland utilizes socioeconomic status as a generic indicator of the economic and social environment (Statistics Finland, 2019). The classification captures the person's stage of life and occupation, and to some extent, the nature of the occupation and work. The classification was created in 1983, after which it has been revised and updated, for example, to match European Union and international standards. The latest classification is from 2010. The classification can be considered as highly valid and comparable.

The classification is divided into eight main groups: self-employed, upper level employees, lower level employees, manual workers, students, pensioners, and others. All groups have varying numbers of subgroups. Examples of self-employed include farmers, employers and other self-employed. Upper non-manual employees include employees with administrative, managerial, professional, and related occupations and senior officials. Lower non-manual employees include administrative and clerical occupations, supervisors and sales workers. Manual workers include workers in agriculture, forestry and fishing, manufacturing, and production workers; students include those other than elementary school students. Pensioners include old age, unemployment and work disability pensions and others include long-term unemployed (longer than six months), persons living on property or savings, individuals living in institutions, prisoners and those with no information in registers.

The fourth article utilizes occupation-specific scores of job demands and job control and asks how occupations with certain levels of job demands and job control are associated with work disability. Thus, here, occupations are measured by their psychosocial work environment.

Psychosocial work environment

To measure the psychosocial work environment, the Job Exposure Matrix (JEM) was used. A Swedish JEM was originally constructed by Johnson et al. in 1990, based on data from the annual Swedish Living Conditions Survey (ULF) 1977 and 1979, which included 12 000 randomly selected participants aged 25–74 years (Fredlund et al., 2000). Later the JEM was reconstructed with new data from the

Swedish Work Environment Survey 1989–1997 (N=48,894). The surveys included various questions on psychological demands and control, and these questions were then categorized into job demands, control and support by using factor analysis. From these, a separate estimate of demand and control was provided for each age- and sex-adjusted 320 occupations. Occupational categories were based on the Nordic Classification of Occupations (SCB, 1982).

Job demands and control were explored with the following items. All items were scored using a scale from 1 to 10, where 10 indicates a high level of job demand or control.

Questions on job demands: (*Fredlund et al., 2000*)

1. Is it at times so stressful that you do not have time to talk or even think about anything other than work?
2. Do you sometimes have so much to do that you have to skip lunches, work overtime, or bring your work home?
3. Does your work demand all your attention and concentration?
4. To what degree of your working time do you have such difficult tasks that you need help?

Questions on job control:

1. Are you partly able to determine yourself when different tasks are to be done (e.g. by choosing to work a little faster some days and a bit easier other days?)
2. Do you have the possibility to determine your own pace at work?
3. Are you able to take short breaks essentially any time to talk?
4. Are you ever part of deciding your working arrangements (e.g. what shall be done, how it shall be done, or who shall work with you)?

4.4 Methods

Regression analysis

In general, regression analysis examines the association between an independent and dependent variable — i.e. how much the value or probability of the dependent variable changes when the value of the independent variable changes (Kutner, 2005). In linear regression, the outcome is a continuous variable, in logistic regression it is a binary variable and in multinomial regression, the outcome variable consists of more than two groups. In the fourth article, multinomial logistic regression analysis

was used to predict belonging to one of three trajectory groups in women and two trajectory groups in men.

Regression analysis also allows for interaction effects. For example, in the first article, an interaction term between parental resources and young adults own education was added to predict disability pension. This demonstrates how parental resources moderate or mediate the effect of own education.

Two main ways of interpreting the results of logistic regression analysis are with ratios or marginal effects. Odds ratios describe the ratio of odds of an outcome happening in group A divided by the odds of an outcome happening in group B. Marginal effects describe the percentage point increase in the probability of an outcome when the dependent variable increases by one unit (Mood, 2010).

Event history analysis

Event history analysis can be considered as an extension of regression analysis, where information on time is also included (Cleves et al., 2010). Event history analysis or also called survival analysis, is a commonly used term for methods that are widely used in analysing longitudinal data. This analysis holds an advantage because it can include both static and time-variant variables to study transitions between events or states, duration to and occurrence of events (Allison, 2004). Here the outcome can be the risk or probability of an event or the time to an event. The beauty of the event history analysis is that it easily captures the first occurrence of a wanted event (for example, disability retirement), simultaneously taking into account censoring events (such as death or old age retirement).

The first article used discrete-time event history analysis, which is a specific case of event history analysis (Cleves et al., 2010). The follow-up is measured as discrete time points. Combined with marginal effects it enables us to study how much the predictive variables increased or decreased the probability of an event (disability pension) to happen.

Cox proportional hazards analysis is a special case of event history analysis. The method does not assume any baseline shape as do the continuous-time and discrete-time event history (Box-Steffensmeier and Jones, 2004; Cox, 1972; Cox and Oakes, 1984). The second and third studies used Cox proportional hazards models to analyse the risk of disability retirement after different lengths and diagnoses of sickness absence. The results of Cox proportional hazards analyses are usually reported as hazard ratios, which is an exponentiated regression coefficient. The hazard ratio assumes that the ratio stays constant in time, and it conveys the difference between the groups in the odds of an event happening.

Group-based trajectory analysis

Group-based trajectory modelling (GBTM) is a statistical approach designed to identify a group of individuals following a similar progression of some behaviour (in this case, work disability trajectories) over time (Nagin et al., 2018). This method can be used to identify distinct subpopulations that have a unique sickness absence trajectory over time. Group-based modelling assumes that the population is composed of finite distinct groups. One of the main decisions when identifying trajectory groups in a population is determining the number of groups that best fit the data. Then, the shape of the groups' trajectory needs to be modelled. Each trajectory can have a distinct shape — linear (increasing/decreasing), quadratic polynomial (increasing, then decreasing or vice versa e.g. one change in the direction), cubic polynomial (two changes in directions) or quartic polynomial (three changes in directions). Different models with a varying number of groups and shapes have to be compared to find the model that best fits the data. The most commonly used model-fit indication is the Bayesian information criterion (BIC). In the fourth article, we started first with a model consisting of one group with a quartic degree polynomial, and then increased the number of groups until the number that best fit the data was identified using a combination of BIC and Bayes factors. Finally, the polynomial orders were reduced until the highest order polynomial for each group was significant.

5 Results

5.1 Family background, own education and disability pension in young adulthood

The first article analysed the association between parental socioeconomic resources (education and income), young adult's own education and their risk of all-cause disability pension between the ages of 19 and 27. Further, the association between family background and the young adults' socioeconomic status two years after their first disability pension was examined. Those who had continuous disability retirement from the age of 16 or 17 were excluded from the sample since the majority of them comprise those diagnosed with malformations, deformations and chromosomal abnormalities. The number of young adults on disability pension has increased lately, and the research has only recently started to tackle the issue. While it is recognized that parental socioeconomic status is an important risk factor for young adult's health outcomes, fewer studies have been conducted on a disability pension.

In general, high parental income and education, and high own education were associated with a lower risk of disability pension. However, interaction analysis on the family background and a young adult's education revealed that the story is more complex. Those with high parental education and low own education had the highest risk of disability pension. No such effect was found between parental income and own education. Lastly, those with high parental income or education were more often employed or studying two years after the first disability pension, whereas those with low parental income or education were more often on pension or unemployed.

Our findings are in agreement with previous studies, for the most part. The results indicate, however, that there could be differences in the way in which young adults who have work disability are either recognized or taken care of, and that parental education can play a big role in it. Unobserved variables, such as health behaviour, subjective health and hospital admissions can explain part of the effect, and they should be investigated further in future studies.

In summary, the findings indicate that own education is one of the most important factors in a young adult's disability retirement, nevertheless parental background plays a role in it too. Childhood seems to be an important phase for the development of long-term work disability as well as the socioeconomic differences in it.

5.2 The length and diagnosis of sickness absence, occupational class and disability retirement

The second article studied the effect of the length of sickness absence on the risk of disability retirement and how the effect varies across occupational classes in women and men. Cox proportional hazards regression results reveals that in men, those outside employment, and in women, manual workers had the highest risk of disability retirement independently of the length of sickness absence. The occupational class differences in the risk of disability retirement were the widest in shorter sickness absence spells, and they narrowed as the duration of sickness absence spell increased.

In general, the results emphasized that the longer the sickness absence spells, the higher the risk of disability retirement. However, in upper non-manual employees, the increasing length of sickness absence increased the risk of disability retirement more strongly than other occupational classes.

When adjusting for the diagnosis of disability retirement, the association between sickness absence and occupational class changed slightly. The effect of increasing length of sickness absence was slightly stronger when it was due to mental and behavioural disorders, especially in upper non-manual employees. The diagnostic profiles vary between occupational classes and partly explain the association between the length of sickness absence and disability retirement. These results suggest that there are occupational class differences in the pathways from sickness absence to disability retirement.

The third article focused on the role of diagnosis in the transfer from sickness absence to disability retirement in different occupational classes in women and men. More precisely, the article examined how sickness absence due to different diagnostic groups was associated with all-cause disability retirement and disability retirement due to different diagnostic groups.

Manual workers had the highest proportion and upper non-manual employees had the lowest of new disability retirement events due to any diagnostic group in men and women. However, the results of the Cox proportional hazards models proved that the association between sickness absence due to different diagnostic groups and disability retirement due to different diagnostic groups was the strongest among upper non-manual employees and weakest among manual workers. The associations were not statistically significant in every category — for example, no occupational class differences were found in the association between sickness absence due to respiratory diseases and disability retirement due to any diagnostic group in men.

The largest occupational class differences in all-cause disability retirement were found among those with sickness absence due to mental disorders between upper non-manual employees and manual workers. In men, sickness absence due to mental

disorders increased the risk of all-cause disability retirement the most, especially in upper non-manual employees, whereas in women the strongest association was with sickness absence due to musculoskeletal diseases. In women, sickness absence due to musculoskeletal diseases increased the risk of all-cause disability retirement the most in lower non-manual employees and manual workers, while among upper non-manual employees and the self-employed the strongest associations were with sickness absence due to mental disorders.

In general, sickness absence due to musculoskeletal diseases and mental disorders were most strongly associated with the risk of disability retirement due to all-cause disability retirement, especially with the risk of retirement due to the same diagnostic group. Those with sickness absence due to respiratory or circulatory diseases transferred more often to disability retirement due to some other diagnostic group.

These results indicate that there is a complex interplay between gender and occupational class when studying the role of sickness absence length and diagnosis in the transition to disability retirement. The risk of developing a long-term work disability is clearly higher among manual workers and those outside employment, despite the length or the diagnosis of sickness absence. However, probably due to differences at the 'baseline risk', receiving sickness allowance increases the risk of disability retirement more in non-manual employees. Sickness absence due to musculoskeletal diseases and mental disorders seem to be most detrimental in terms of long-term work disability. However, sickness absence due to circulatory diseases and respiratory diseases were also important predictors of disability retirement due to some other diagnostic group. This indicates that comorbidity should be considered when planning for preventive measures to tackle disability retirement.

5.3 Job demands and job control and subsequent sickness absence and disability pension trajectories

The fourth article studied how occupational level exposures of job demands and job control are associated with subsequent sickness absence and disability pension (SA/DP) trajectories among 30 to 53 years old male and female employees in Sweden. A combination of low, medium and high levels of job demands and job control was used to create a nine-category job exposure matrix.

Three SA/DP trajectories for women were found: low stable, medium stable and high increasing, and while there were two trajectories for men: low stable and high increasing. In general, low job demands were independently associated with adverse SA/DP trajectories. Similarly, low job control was independently associated with adverse SA/DP trajectories. In women, low job demands and low job control were

particularly associated with medium stable or high increasing SA/DP trajectories, and in men, the association was the strongest among those with a combination of low job demands and low or medium job control. In women and men, high job demands and high job control were associated with the most favourable SA/DP trajectories, respectively. These results did not confirm previous findings on high job demands and low job control being the strongest predictor of adverse SA/DP outcomes. It is possible that this difference in results is due to the use of different reference groups. However, our multinomial regression results also indicated that in women, this combination was equally likely to belong to medium stable and high increasing SA/DP trajectories. Thus, the association between this combination and the SA/DP trajectory is also dependent on the severity of the outcome.

Due to the observational nature of this study, no causal effects can be established. Mainly two mechanisms could explain these associations: people with poorer health are more likely to be selected for jobs with low demands, or the level of job demands and job control affect the risk of SA/DP.

5.4 Summary of the main findings

The results of the research articles prove that process of developing long-term work disability is associated with family background, sickness absence, and psychosocial work environment (see main results summarized in table 2). The results demonstrate that socioeconomic environment in childhood already forms the basis for the development of the long-term work disability and the associated socioeconomic disparities. Both the socioeconomic status of the parent and the young adult were predictors of disability retirement, and an interactive effect between them was also established.

Among the working-age population, the pathway from sickness absence to disability retirement varies between occupational classes. The long-term unemployed and workers in particular are at high risk of disability retirement. However, increasing duration of sickness absence increases the risk of disability retirement in particular among non-manual employees. In general, the length of sickness absence is one of the most important risk markers of disability retirement, but the diagnostic group of the sickness absence and disability retirement were also important predictive factors. Sickness absence due to musculoskeletal diseases or mental disorders is linked to the disability retirement, in particular when the disability retirement is due to same diagnosis as the sickness absence. Instead, sickness absence due to respiratory diseases or circulatory diseases is linked to a disability retirement due to a diagnosis other than that of sickness absence. Furthermore, the role of the length and diagnosis of sickness absence varies between the occupational classes. Sickness absence due to mental disorders increase the risk

of disability retirement especially among upper non-manual employees, while musculoskeletal disorders are more important predictor among manual workers. On the other hand, in lower non-manual women, sickness absence due to musculoskeletal disorders in particular is an important predictor of disability retirement.

Finally, in work life, an important element in the development of long-term disability retirement is the work environment. The level of occupation-level job demands and job control available plays a role in predicting future sickness absence and disability retirement trajectories. In particular, occupations with low levels of job demands and job control have a high risk of long-term work disability while occupations with high levels of job demands and job control have the lowest risk.

Table 2. Main results.

Research question	Article	Main results
How are family background and a young adult's education associated with disability retirement in young adulthood?	I	Low parental income and education, and low own education increased the risk of DR. The risk was particularly high among those with high parental education and low own education.
How are the length and diagnosis of sickness absence associated with the disability retirement due to different diagnostic groups in different occupational classes among women and men?	II & III	Increasing length of sickness absence increased the risk of DR the most among upper non-manual employees, especially in men and among those who had DR due to mental disorders. DR due to musculoskeletal diseases and mental disorders increased the risk of all-cause DR and DR due to same diagnostic group, especially in upper non-manual employees. Sickness absence due to respiratory and circulatory diseases had the strongest association with DR due to a different diagnostic group.
How are occupation-level job demands and job control associated with sickness absence and disability retirement trajectories?	IV	Occupations with low job demands and low job control in women, and low job demands and low or medium job control in men, had the strongest association with adverse SA/DP trajectory.

DP = disability pension. DR = disability retirement. SA=sickness absence.

6 Discussion

6.1 Interpretation of the results

Family background

Children are born into different socioeconomic environments and they inherit their parents' socioeconomic resources that affect their health and socioeconomic outcomes later in life. (Duncan and Brooks-Gunn, 2000; Erola and Kilpi-Jakonen, 2017b; Heckman, 2006; Kuh et al., 2003; Power and Hertzman, 1997). While childhood is a critical period from this perspective, young adulthood is also important. Not being able to enter to the labour market, or exiting early from it due to health problems at a young age increases the risk of poor health, work disability and unemployment also later in life (Hakulinen et al., 2019; Myrskylä, 2011; OECD, 2013).

The first article demonstrated that half of the young adults who had a received disability pension only had basic level education. A young adult's own education was also the strongest predictor of disability retirement, confirming previous findings (Gravseth et al., 2007; Salonsalmi et al., 2019). A majority of these disability pensions were most likely due to mental disorders since it is the most common diagnostic groups among young adults who receive disability pension (calculated from the statistics of ETK and Kela, 2019). This was also likely to be the case in the first article since we excluded those who had disability retirement starting at age 16 or 17, among whom the most receive disability pension due to malformations, deformations and chromosomal abnormalities. Previous studies have established that poor mental health in childhood and adolescence are negatively associated with educational attainment (Brännlund et al., 2017; Rothon et al., 2009). Thus, the young adults who only had basic level education and received a disability pension were probably unable to continue their studies and were more likely to receive disability pension in adulthood.

Parental socioeconomic resources also had an effect on the young adult's disability retirement risk. The main effect of the parental socioeconomic status was positive, i.e. the higher the level of parental education or income was the smaller was the risk of disability retirement among young adults. Family background can affect

the risk of disability retirement due to the accumulation of biological and social risks through the mechanisms of biological and social pathways (see chapter 2.2.2.). It is possible that parents with a higher socioeconomic position have access to more resources and are able to recognize their offspring's work disability, thereby assisting in rehabilitation. For example, parents with higher income have better health literacy (see for example de Buhr and Tannen 2019, and chapter 2.2. of this dissertation), which can help to provide faster access to preventive health and curative care services. Highly educated parents can ensure they parents recognize their child's condition that cause the work disability and know how to navigate the system to get help (Halldorsson et al., 2002; Paananen et al., 2013a, 2013b; Sørensen et al., 2015). Previous studies have also suggested that young adults experiencing downward mobility can be affected by increased level of stress, as they are unable to meet the expectations of highly educated parents. This stress can then turn into poor health and work disability (Gravseth et al., 2007).

The results further revealed an interaction effect between parental socioeconomic resources and the young adult's own education on their disability retirement risk. Young adults with basic education and high parental education (but not income) had the highest risk of disability retirement. Previous studies have shown that parental socioeconomic resources can moderate the association between poor mental health and educational achievement (Brännlund and Edlund, 2020). However, adjusting for the level of the young adult's own education largely attenuated this association. The effect of a young adult's own education on disability retirement was much stronger than parental education or income. It is likely that the effect of parental socioeconomic status on a young adult's disability retirement goes mainly through education. Similar findings have been made in previous studies on education (Gravseth et al., 2007; Salonsalmi et al., 2019).

Thus, there can be two interpretations of the results. First, disability retirement can be interpreted as a negative outcome, where the lack of parental resources is associated with their offspring's poor health outcome. The role of childhood environment and parental resources in childhood on later health outcomes is well established in literature: adverse events in childhood and lack of resources increase the risk of poor health outcomes in later life. Second, disability retirement can be interpreted as a positive outcome, a sign of rehabilitation instead of poor health, and parents with high education or income are able to perceive it as such and/or help more to achieve it in case of need.

Finally, twin studies have revealed that the effect of family background on disability retirement is mainly due to genetic, and not environmental factors (Gjerde et al., 2013). In other words, whether the association between parental socioeconomic status and a young adult's disability retirement is due to genetic factors, childhood environment, psychosocial or cultural resources remains unclear.

Further research should be conducted on the causal relationship between family background and a young adult's health and labour market outcomes later in life. Additionally, research is also required on the socioeconomic differences in parental help-seeking behaviour.

Sickness absence

While sickness absence is one of the strongest predictors of disability retirement, most sickness absence spells do not lead to disability retirement. Furthermore, while socioeconomic differences are clear in sickness absence (Pekkala et al., 2017a) and in disability retirement (Leinonen et al., 2018; Polvinen et al., 2016, 2014), not much is known on how the transition from the former to the latter varies by occupational class. The second and third articles of this dissertation add to the literature by analysing the occupational class differences in the transfer from sickness absence to disability retirement, which has only lately gained research (Helgadóttir et al., 2019a, 2019b).

The results of the second article confirm previous findings by revealing that the risk of disability retirement varies especially according to the length of sickness absence – the longer the sickness absence spell the higher the risk of disability retirement (Alexanderson et al., 2012; Gjesdal et al., 2011; Kivimäki et al., 2004; Lund et al., 2008). This reflects accumulated health problems and work hazards. The results of the third article also confirmed previous findings by establishing that musculoskeletal diseases and mental disorders are the largest diagnostic groups both in sickness absence and in disability retirement. As a novel finding, sickness absence due to these diagnoses was strongly associated with all-cause disability retirement but especially with disability retirement due to the same diagnostic group. However, sickness absence due to circulatory and respiratory diseases was more strongly associated with disability retirement due to a different diagnostic group than due to the same diagnostic group, hinting of possible multimorbidity.

The result of the second article confirms the previous findings that those outside employment and manual workers have the highest and non-manual employees the lowest risk of disability retirement after any length of sickness absence spell. Similarly, the results of the third article confirmed that manual workers had the highest, and upper non-manual employees the lowest proportion of new disability retirements.

Occupational class differences in disability retirement can be explained by an unequal distribution of resources (see chapters 2.2.1–2.2.2.), such as work environment, health behaviour and differences in the use of health care services (Blomgren and Virta, 2020; Leinonen et al., 2011; Polvinen et al., 2013). Previous health problems drive individuals to disadvantaged environments (see health

selection theory in chapter 2.2.2.), which, in turn, increase the risk of disability retirement. In particular, the long-term unemployed have a high risk of disability retirement since many have become unemployed due to work disability, or disability problems have developed during the unemployment spell. The self-employed also had a high risk of disability retirement and the increasing length of sickness absence amplified the risk of disability retirement strongly. Little attention has been paid to the use of sickness allowance and disability pension among self-employed, which makes it difficult to compare our results with the previous findings. However, some studies have shown that the self-employed are healthier (Stephan and Roesler, 2010), less often on sickness absence (Lechmann and Schnabel, 2014; Rosta et al., 2014) and they transit to disability retirement less often (Pedersen et al., 2012) than employees. It is difficult to determine, whether the self-employed are healthier due to the selection effect or because their nature of work affects their health behaviour. For example, the self-employed might have an economic incentive to avoid the accumulation of sickness absence as long as possible. Long working hours can make it difficult to arrange time for a physician's visit. Health problems can drive people to unemployment, and as discussed in chapter 2.2., the unemployed suffer more often from health problems and work disability. (Kerätär et al., 2016; Laaksonen & Blomgren, 2020.)

The results of the second article also established that the increasing length of sickness absence increased the risk of disability retirement the most among non-manual employees. In other words, while upper non-manual employees had a very low risk of disability retirement if they had no or only short-term sickness absence spell, their risk grew strongly as the length of sickness absence spell increased. The effect of the length of sickness absence was not as strong among other occupational classes. Further, the results of the third article revealed that upper non-manual employees had the highest risk of disability retirement after a sickness absence spell, independently of the diagnostic groups. These results indicate that the baseline risk of disability retirement among upper non-manual employees is low, but receiving sickness allowance increases the risk of disability retirement more among other occupational classes. Further, the risk increases especially when the sickness absence spell is very long or due to mental disorders. Somewhat similar findings have been made in a recent Swedish study (Helgadóttir et al., 2019b). This study found that white-collar workers, who had a sickness absence spell longer than six months which was due to musculoskeletal diseases, had a higher risk of disability retirement than blue-collar workers did.

These 'inverse' occupational class differences can be due to differences in the work environment and other work-related practices that can permit non-manual employees to work with partial work ability for a longer time without taking sickness absence. Only when the condition is severe enough, would they be forced to take

sickness absence, in which case it is more likely that they will later transfer to disability retirement. Very highly skilled specialists can be difficult to replace, so the employers are likely to prolong their employee's sickness absence rather than replace them with new employees (Ekberg et al., 2015). Manual workers can be forced to take more short-term sickness absences since their jobs often require a higher level of physical work ability. Those with a lower income levels can be forced to return to work faster and take shorter sickness absence spells due to their decreased income during the sickness absence. This can lead to poorer health, but not necessarily to disability retirement. In addition, the pension applications of manual workers or the unemployed are more likely to be rejected than employees' applications (Perhoniemi et al., 2019, 2015), which partly decreases their disability retirement risk compared to upper non-manual employees.

The largest differences in all-cause disability retirement were found among those with sickness absence due to mental disorders between upper non-manual employees and manual workers. Occupational class differences in the risk of all-cause disability retirement were also strong after sickness absence due to musculoskeletal diseases, confirming the previous findings. (Polvinen et al., 2013). However, this association was also gender-specific. In general, the occupational class differences were larger in men than in women. In men, sickness absence due to mental disorders increased the risk of all-cause disability retirement and disability retirement due to the same diagnostic group, which was slightly more in upper non-manual employees than other occupational classes. In women, among manual workers and among lower non-manual employees, sickness absence due to musculoskeletal diseases was a more important predictor of disability retirement, whereas among upper non-manual employees and among the self-employed, having sickness absence due to mental disorders was a more important predictor of all-cause disability retirement. These are likely to reflect the features of the working environment. For example, many lower non-manual employee women work in a physically restraining health care sector.

Psychosocial work environment

The results of the fourth article proved that occupation-, age- and sex-adjusted low job demands and low job control were associated with adverse sickness absence and disability pension trajectories (e.g. medium stable or high increasing trajectories, instead of the low stable trajectory). Occupations with low levels of job demands, independently of levels of job control, were associated with adverse SA/DP trajectories. Similarly, occupations with low levels of job control, independently of levels of job demands, were associated with adverse SA/DP trajectories. There were some gender differences in the association between the combination of job demands

and job control and SA/DP trajectories. In men, occupations with low or medium levels of job demands and low levels of job control had the strongest association with adverse SA/DP trajectories. In women, the strongest association with this trajectory was found in occupations with low job demands and job control. In both men and women, occupations with high job demands and high job control were associated with favourable SA/DP trajectories. Previous findings have established that the combination of high job demands and low control would be the most detrimental in terms of health and work disability outcomes. While this combination was associated with an adverse SA/DP trajectory, the association was not as strong when compared with the previously mentioned combinations.

It is difficult to state, whether the association between job demands and job control are due to the selection effect, or the effect of the work environment. As the health selection effect suggests (chapter 2.2.2.), individuals with health problems are selected into occupations with lower levels of job demands and job control (Ostlin, 1988), and healthier individuals are appointed to occupations with higher levels of job demands and job control. Consequently, individuals with poor health have a higher risk of sickness absence and disability pension independent of the working environment (Böckerman and Maczulskij, 2018). This combination — a high prevalence of individuals with a heightened risk of sickness absence and a disability pension at the baseline level in occupations with low levels of job demands and job control — materializes into a high risk of sickness absence and disability pension in this occupation.

The other mechanism, which is the work environment itself, contains elements that at least partially deteriorate workers health, which ultimately leads to sickness absence and/or disability pension (see the social causation theory in chapter 2.2.2.). Previous studies have found that favourable psychosocial working conditions support the maintenance of health functioning (Lallukka et al., 2020) and health (Barnay, 2016; Henseke, 2018), which reinforces the theory that working conditions can affect work ability. High job control also provides more possibilities to regulate the demands at work and outside work life. High job demands and high job control are typically found to protect against health risks by increasing performance, learning, and motivation (Karasek 1990).

However, these two mechanisms are not necessarily mutually exclusive, but rather complementary. A combination of decreased work ability and lack of job control is associated with productivity loss at work (van den Berg et al., 2011). A recent review (Oakman et al., 2017) concluded that workplace interventions had a moderate effect on work ability at best. However, most of the workplace interventions were individual-focused, that were mainly aimed at changing behaviour through education or physical activity. The impact of individual-focused interventions is likely to remain limited if they are not combined with other

workplace changes. The review also included a few multilevel interventions. Although even they did not result in a significant improvement to work ability, the authors argued that further development of such interventions are required and could lead to different results.

The key is to find a balance between the individuals work ability and the levels of demands and control at the workplace (Barnay, 2016) (see definition of work ability in chapter 2.1). A growing literature on sustainable employment proposes that employees' work capacity is met in the context of the organization (van der Klink et al., 2016). So-called job carving and job crafting aim to design and rearrange work tasks according to the employee's capabilities. Job carving is implemented by managers and consultants, whereas in job crafting, the employee is given the freedom to redesign their own tasks (Scoppetta et al., 2019). Job crafting interventions have delivered promising results on employee well-being and performance. (Demerouti et al., 2019).

Future studies should aim to distinguish the importance between health selection and social causation mechanisms in the association between the work environment and health outcomes. This would enhance our understanding of this association and help to create better-allocated intervention measures.

6.2 Methodological considerations

Strengths

The data used in the substudies of this dissertation is derived from national administrative registers, with representative samples of Finnish and Swedish populations. All studies used population-based longitudinal data and prospective design. This type of data enables the use of long follow-up time with no loss to follow-up, little missing information and no reporting bias.

The availability of data with long follow-ups for both parents and their children has become common only within recent years. In the first article, children were followed until their young adulthood. Retrospectively self-reported childhood conditions or information on parental socioeconomic status often suffer from a recall bias or result in incorrect information (Brown, 2014; Sudman and Bradburn, 1973). The second and third studies were able to use date-specific data for diagnosis-specific sickness absence and disability pension. In the third study, by including information on all sickness absence spells during the measurement year, we did not have to choose the first, last or the longest sickness absence spell arbitrarily.

The fourth article linked the Swedish register data with the annual Swedish Living Conditions Survey. These surveys were cross-sectional surveys collected repeatedly across the years. The data were used to calculate the level of job demands

and job control in each occupation in Sweden. This was one step closer to an objective measuring of job demands and job control, which are usually subjectively assessed. Subjective assessments are often measured at the same time as the outcome variable, making it difficult to assess the causal direction (Farrants et al., 2018; Kolstad et al., 2011). Finally, one strength of this study is the use of a more detailed, nine combinations approach of job demands and job control. Trajectory analysis gives a more detailed insight into how sickness absence and disability pension develop across time, and which trajectories are more detrimental in terms of labour market outcomes.

Limitations

As a common feature in all of the studies, there was no information on subjective health and health behaviour, history of illness, work trajectories, or physical work conditions. As all the analyses were conducted using Finnish or Swedish data, the results are not necessarily generalizable to other countries. In the first three articles, no information on work environment was available.

The lack of statistical power in the first article did not allow for a more sophisticated analysis on the effect of parental resources on young adult's labour market outcomes after their first disability pension. The lack of information on health-seeking behaviour prevented us from drawing any conclusions for example on whether parental resources were associated with a stronger help-seeking behaviour or success in it. Furthermore, information on the disability pension was not date-specific and lacked information on diagnosis.

The second and third articles only used information on the main diagnostic groups and not diagnosis-specific information, which could provide more detailed results. Patients can also get a secondary diagnosis, and control for this could have given a more detailed picture of the association between diagnostic groups. Since the analysis was heavily stratified – by gender, occupational class and diagnostic groups of sickness absence and disability retirement, – the number of cases in some diagnostic group was small. Hence, caution must be applied when interpreting the magnitude of the results. In both studies, the data lacked information on short-term sickness absence (less than 10 days) which can explain some of the observed associations.

In the fourth article, it was impossible to distinguish between individual variation in the job demands and job control in the same occupation by using the JEM methodology. The downside of JEM is that it is unable to account for inter-individual variance as it allocates the same exposure estimates to all workers with the same job titles (Kromhout et al., 1993). Further, JEM is not sensitive to temporal variation (Peters, 2020) Further, JEM values at a detailed level were not available for all

occupations, and that information on occupation was only measured once and not updated in LISA for all individuals every year. Furthermore, due to the observational nature of the data used in all studies, causal effects cannot be established. For example, in the fourth article, it was impossible to identify the mechanisms between psychosocial work environment and sickness absence and disability pension trajectories. Individuals with poor health might be prone to select occupations with lower demands or to switch to occupations with lower job demands. These individuals are in turn, more prone to transit to sickness absence or disability pension. Finally, although the identified SA/DP trajectories were found reliable, the possibility of misclassification cannot be dismissed as the trajectory memberships are only approximations. Further, the trajectories can vary between the members of the trajectories.

7 Conclusions

This dissertation was set out to study the processes that lead to developing a long-term work disability, and the socioeconomic disparities in them. To understand the development of long-term work disability and social gradient in it, requires an examination from multiple perspectives. The articles of the dissertation approached this topic from three perspectives: family background, sickness absence, and psychosocial work environment. Each of these is an important factor in the development of long-term work disability, and in the socioeconomic disparities related to it. The results provide new insights on how long-term work disability is a result of multiple complex processes driven by different mechanisms during the life-course.

The process leading to the development of a long-term work disability starts right from childhood. Family background is an important factor that influences the development of long-term work disability even in Nordic countries with a strong welfare state and generous sickness insurance system. In addition, the onset of socioeconomic disparities in health and work disability starts from childhood. Serious health problems at a young age are associated with poor labour market attachment and educational outcomes (Brännlund et al., 2017; Hakulinen et al., 2019) and exclusion from education and employment present major long-term challenges to the individual and to the society (Hakulinen et al., 2019; Myrskylä, 2011; OECD, 2013).

This study provided new insights into the role of family background in long-term work disability by focusing on the effect of parental resources. The results revealed that parents could have an important role in the development of their offspring's long-term work disability. High parental resources can help in seeking and receiving help for their offspring's health problems. Therefore, early support should be provided not only to young people who suffer from health problems but also to their parents, especially among socioeconomically vulnerable groups. For example, providing low-threshold services, and increasing and equalizing the accessibility to health care can help to moderate the long-term consequences of health problems in young adulthood.

Other important processes in terms of long-term work disability take place later in work life. The development of sickness absence is considered an important factor that can influence the risk of long-term work disability. While socioeconomic disparities are well documented in sickness absence, the findings in this dissertation provide a new understanding of how the transitioning from sickness absence to disability retirement takes place among occupational classes.

In general, the long-term unemployed and manual workers have a particularly high risk of disability retirement independent of the length or diagnosis of sickness absence. Work disability should be better recognized and prevented especially in these groups. However, the results also established that transitioning from sickness absence to disability retirement differs between occupational classes. The accumulation of sickness absence days increases the risk of disability retirement more strongly among upper non-manual employees than other occupational classes, especially due to mental disorders. Whether this is due to differences in medical history, workplace cultures or occupational health care use remains a subject for further investigation.

In general, sickness absence due to musculoskeletal diseases, and long-term sickness absence due to mental and behavioural disorders have the strongest association with disability retirement. The results also revealed a strong association between sickness absence due to respiratory diseases and circulatory diseases, and a disability retirement due to some other diagnostic group. This hints that among these diagnostic groups, comorbidity can have an important role in the transition from sickness absence to disability retirement. Therefore, clinical practitioners should consider more a comprehensive care approach when creating plans for rehabilitation.

Another important risk factor for long-term work disability, that takes place in work life, derives from the psychosocial work environment. Occupation-specific levels of job demands and job control play an important role in predicting the development of sickness absence and disability retirement trajectories. Modifying the psychosocial work environment can help in tackling long-term work disability and the socioeconomic disparities in it. Adequate levels of job demands combined with sufficient job control can help to promote better work ability. For example, updating the skill level of employees can give them more control over their work, which, together with suitable levels of job demands, can increase job satisfaction and help to maintain good work ability. Workplace interventions can reduce the time it takes to first return-to-work and reduce the cumulative duration of sickness absence (van Vilsteren et al., 2015). These interventions need to be tailored for different occupations. Specifically targeting occupations with low levels of job demands and job control can result in overall decreased levels of work disability, and reduced socioeconomic disparities as well.

Overall, the results of this dissertation highlight the importance of a comprehensive health and workplace policy evaluation which accounts for social and economic returns in terms of disability retirement incidence. Support for young adults should be provided as early as possible to enhance their health, and to enhance their later educational attainment and labour market attachment. Preventative measures should be applied more strongly to avoid the accumulation of sickness absence days. Finally, enhancing the psychosocial working environment could help to prevent long-term work disability.

Abbreviations

DP	Disability pension
DR	Disability retirement
ERI	Effort-Reward Imbalance
ETK	Finnish Centre for Pensions
FinGEP	Finnish Growth Environment Panel
JDC	Job Demands-Control
JEM	Job Exposure Matrix
Kela	The Social Insurance Institution of Finland
LISA	Longitudinal Integration Database for Health Insurance and Labour Market Studies
SA	Sickness absence

List of References

- Aagestad, C., Johannessen, H.A., Tynes, T., Gravseth, H.M., Sterud, T., 2014. Work-Related Psychosocial Risk Factors for Long-Term Sick Leave: A Prospective Study of the General Working Population in Norway. *Journal of Occupational and Environmental Medicine* 56, 787–793. <https://doi.org/10.1097/JOM.0000000000000212>
- Ahola, K., Gould, R., Virtanen, M., Honkonen, T., Aromaa, A., Lonnqvist, J., 2009. Occupational burnout as a predictor of disability pension: a population-based cohort study. *Occupational and Environmental Medicine* 66, 284–290. <https://doi.org/10.1136/oem.2008.038935>
- Ahola, K., Virtanen, M., Honkonen, T., Isometsä, E., Aromaa, A., Lönnqvist, J., 2011. Common mental disorders and subsequent work disability: A population-based Health 2000 Study. *Journal of Affective Disorders* 134, 365–372. <https://doi.org/10.1016/j.jad.2011.05.028>
- Aittomäki, A., Lahelma, E., Roos, E., 2003. Work conditions and socioeconomic inequalities in work ability. *Scandinavian Journal of Work, Environment & Health* 159–165. <https://doi.org/10.5271/sjweh.718>
- Albertsen, K., Lund, T., Christensen, K.B., Kristensen, T.S., Villadsen, E., 2007. Predictors of disability pension over a 10-year period for men and women. *Scand J Public Health* 35, 78–85. <https://doi.org/10.1080/14034940600858474>
- Alexanderson, K., Kivimäki, M., Ferrie, J.E., Westerlund, H., Vahtera, J., Singh-Manoux, A., Melchior, M., Zins, M., Goldberg, M., Head, J., 2012. Diagnosis-specific sick leave as a long-term predictor of disability pension: a 13-year follow-up of the GAZEL cohort study. *Journal of Epidemiology & Community Health* 66, 155–159. <https://doi.org/10.1136/jech.2010.126789>
- Allebeck, P., Mastekaasa, A., 2004. Chapter 5. Risk factors for sick leave - general studies. *Scandinavian Journal of Public Health* 32, 49–108. <https://doi.org/10.1080/14034950410021853>
- Allison, P., 2004. Event History Analysis, in: *Handbook of Data Analysis*. SAGE Publications, Ltd, 1 Oliver's Yard, 55 City Road, London England EC1Y 1SP United Kingdom, pp. 369–385. <https://doi.org/10.4135/9781848608184.n16>
- Anderson, B.-M., 2004. Social insurance in Sweden 2004. The National Social Insurance Board, Stockholm.
- Bakker, A.B., Demerouti, E., 2007. The Job Demands-Resources model: state of the art. *Journal of Managerial Psychology* 22, 309–328. <https://doi.org/10.1108/02683940710733115>
- Barker, D.J.P., Forsén, T., Eriksson, J.G., Osmond, C., 2002. Growth and living conditions in childhood and hypertension in adult life: a longitudinal study. *Journal of Hypertension* 20, 1951–1956. <https://doi.org/10.1097/00004872-200210000-00013>
- Barker, D.J.P., Forsen, T., Uutela, A., Osmond, C., Eriksson, J.G., 2001. Size at birth and resilience to effects of poor living conditions in adult life: longitudinal study. *BMJ* 323, 1273–1273. <https://doi.org/10.1136/bmj.323.7324.1273>
- Barnay, T., 2016. Health, work and working conditions: a review of the European economic literature. *Eur J Health Econ* 17, 693–709. <https://doi.org/10.1007/s10198-015-0715-8>
- Bartley, M., 2017. *Health inequality: an introduction to concepts, theories and methods*, Second edition. ed. Polity.
- Becker, G.S., 1993. *Human capital: a theoretical and empirical analysis with special reference to education*, Third Edition. ed. The University of Chicago Press, United States of America.

- Beehr, T. 1986. The process of retirement: a review and recommendations for future investigation. *Personnel psychology* 39(1), 31–55. <http://doi.wiley.com/10.1111/j.1744-6570.1986.tb00573.x>
- Ben-Shlomo, Y., Kuh, D., 2002. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. *International Journal of Epidemiology* 31, 285–293.
- Berkman, L.F., Kawachi, I. (Eds.), 2000. *Social Epidemiology*.
- Bernardi, F., Ballarino, G., 2016. Education as the great equalizer; a theoretical framework, in: *Education, Occupation and Social Origin: A Comparative Analysis of the Transmission of Socio-Economic Inequalities*. Cheltenham: Edward Elgar.
- Björklund, A., Jäntti, M., 2011. *Intergenerational Income Mobility and the Role of Family Background*. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199606061.013.0020>
- Blane, D., Smith, G.D., Bartley, M., 1993. Social selection: what does it contribute to social class differences in health? *Sociology of Health & Illness* 15, 1–15. <https://doi.org/10.1111/j.1467-9566.1993.tb00328.x>
- Blank, N., Diderichsen, F., 1995. Short-term and long-term sick-leave in Sweden: Relationships with social circumstances, working conditions and gender. *Scandinavian Journal of Social Medicine* 23, 265–272. <https://doi.org/10.1177/140349489502300408>
- Blau, P., M., Duncan, O.D., 1967. *The American Occupational Structure*. Wiley, New York.
- Blomgren, J., 2018. Sairauspoissaolot kääntyneet kasvuun – mielenterveysperusteiset sairauspäiväraha-kaudet yleistyneet. Kelan tutkimusblogi. URL <http://tutkimusblogi.kela.fi/arkisto/4473> (accessed 6.5.19).
- Blomgren, J., 2017. Kun työttömyys vähenee, sairauspoissaolot yleistyvät. Kelan tutkimusblogi. URL <http://tutkimusblogi.kela.fi/arkisto/4305> (accessed 6.5.19).
- Blomgren, J., Virta, L.J., 2020. Socioeconomic differences in use of public, occupational and private health care: A register-linkage study of a working-age population in Finland. *PLOS ONE* 15, e0231792. <https://doi.org/10.1371/journal.pone.0231792>
- Bloom, D.E., Canning, D., Fink, G., 2010. Implications of population ageing for economic growth. *Oxford Review of Economic Policy* 26, 583–612. <https://doi.org/10.1093/oxrep/grq038>
- Böckerman, P., Maczulskij, T., 2018. Unfit for work: Health and labour-market prospects. *Scand J Public Health* 46, 7–17. <https://doi.org/10.1177/1403494817720871>
- Boedeker, W., Friedel, H., Friedrichs, M., Röttger, C., 2008. The impact of work on morbidity-related early retirement. *J Public Health* 16, 97–105. <https://doi.org/10.1007/s10389-007-0146-9>
- Boschman, S., Maas, I., Kristiansen, M.H., Vrooman, J.C., 2019. The reproduction of benefit receipt: Disentangling the intergenerational transmission. *Social Science Research* 80, 51–65. <https://doi.org/10.1016/j.ssresearch.2019.02.009>
- Box-Steffensmeier, J.M., Jones, B.S., 2004. *Event history modeling: a guide for social scientists*. Cambridge University Press, Cambridge ; New York.
- Brännlund, A., Edlund, J., 2020. Educational achievement and poor mental health in Sweden: the role of family socioeconomic resources. *Education Inquiry* 11, 69–87. <https://doi.org/10.1080/20004508.2019.1687079>
- Brännlund, A., Strandh, M., Nilsson, K., 2017. Mental-health and educational achievement: the link between poor mental-health and upper secondary school completion and grades. *Journal of Mental Health* 26, 318–325. <https://doi.org/10.1080/09638237.2017.1294739>
- Bratberg, E., Nilsen, O.A., Vaage, K., 2015. Assessing the intergenerational correlation in disability pension reciprocity. *Oxford Economic Papers* 67, 205–226. <https://doi.org/10.1093/oep/gpu028>
- Brown, M., 2014. Assessing recall of early life circumstances: evidence from the National Child Development Study. *LLCS* 5, 64–78. <https://doi.org/10.14301/llcs.v5i1.232>
- Bruusgaard, D., Smeby, L., Claussen, B., 2010. Education and disability pension: A stronger association than previously found. *Scandinavian Journal of Public Health* 38, 686–690. <https://doi.org/10.1177/1403494810378916>
- Buckley, J.P., Keil, A.P., McGrath, L.J., Edwards, J.K., 2015. Evolving Methods for Inference in the Presence of Healthy Worker Survivor Bias: *Epidemiology* 26, 204–212. <https://doi.org/10.1097/EDE.0000000000000217>

- Burgard, S.A., Lin, K.Y., 2013. Bad Jobs, Bad Health? How Work and Working Conditions Contribute to Health Disparities. *American Behavioral Scientist* 57, 1105–1127. <https://doi.org/10.1177/0002764213487347>
- Cadiz, D.M., Brady, G., Rineer, J.R., Truxillo, D.M., 2019. A Review and Synthesis of the Work Ability Literature. *Work, Aging and Retirement* 5, 114–138. <https://doi.org/10.1093/workar/way010>
- Canivet, C., Choi, B., Karasek, R., Moghaddassi, M., Staland-Nyman, C., Östergren, P.-O., 2013. Can high psychological job demands, low decision latitude, and high job strain predict disability pensions? A 12-year follow-up of middle-aged Swedish workers. *International Archives of Occupational and Environmental Health* 86, 307–319. <https://doi.org/10.1007/s00420-012-0766-4>
- Carpiano, R.M., Link, B.G., Phelan, J.C., 2008. Social Inequality and Health: Future Directions for the Fundamental Cause Explanation, in: Lareau, A., Conley, D. (Eds.), *Social Class: How Does It Work?* Russell Sage Foundation, New York, pp. 232–263.
- Case, A., Deaton, A., 2005. Broken down by work and sex: how our health declines, *Analyses in the Economic of Aging*. University of Chicago Press, Chicago.
- Case, A., Lubotsky, D., Paxson, C., 2002. Economic Status and Health in Childhood: The Origins of the Gradient. *American Economic Review* 92, 1308–1334.
- Cerdas, S., Härenstam, A., Johansson, G., Nyberg, A., 2019. Development of job demands, decision authority and social support in industries with different gender composition – Sweden, 1991–2013. *BMC Public Health* 19, 758. <https://doi.org/10.1186/s12889-019-6917-8>
- Christensen, K.B., Feveile, H., Labriola, M., Lund, T., 2008. The impact of psychosocial work environment factors on the risk of disability pension in Denmark. *The European Journal of Public Health* 18, 235–237. <https://doi.org/10.1093/eurpub/ckm130>
- Clausen, T., Burr, H., Borg, V., 2014. Do psychosocial work conditions predict risk of disability pensioning? An analysis of register-based outcomes using pooled data on 40,554 observations. *Scandinavian Journal of Public Health* 42, 377–384. <https://doi.org/10.1177/1403494814527187>
- Claussen, B., 1999. Health and re-employment in a five-year follow-up of long-term unemployed. *Scandinavian Journal of Public Health* 27, 94–100. <https://doi.org/10.1177/14034948990270020801>
- Claussen, B., Dalgard, O.S., 2009. Disability pensioning: The gender divide can be explained by occupation, income, mental distress and health. *Scandinavian Journal of Public Health* 37, 590–597.
- Cleves, M., Gould, W., Gutierrez, R.G., Marchenko, Y.V., 2010. *An Introduction to Survival Analysis Using Stata*, 3rd ed. Stata Press, Texas.
- Cox, D.R., 1972. Regression Models and Life-Tables. *Journal of the Royal Statistical Society. Series B (Methodological)* 34, 187–220.
- Cox, D.R., Oakes, D., 1984. *Analysis of Survival Data*, Monographs on Statistics and Applied Probability. Chapman & Hall/CRC.
- Cox, T., Griffiths, A., Randall, R., 2003. A Risk Management Approach to the Prevention of Work Stress, in: Schabracq, M., Winnubst, J.A.M., Cooper, C.L. (Eds.), *The Handbook of Work and Health Psychology*. John Wiley & Sons., Chichester, pp. 191–206.
- Cygan-Rehm, K., Kuehnle, D., Oberfichtner, M., 2017. Bounding the causal effect of unemployment on mental health: Nonparametric evidence from four countries. *Health Econ.* 26, 1844–1861. <https://doi.org/10.1002/hec.3510>
- de Buhr, E., Tannen, A., 2019. Parental health literacy and health behaviors in children: a 2017 cross-sectional survey in Germany. *European Journal of Public Health* 29, ckz187.181. <https://doi.org/10.1093/eurpub/ckz187.181>
- De Lange, A.H., Taris, T.W., Kompier, M.A.J., Houtman, I.L.D., Bongers, P.M., 2004. The relationships between work characteristics and mental health: examining normal, reversed and reciprocal relationships in a 4-wave study. *Work & Stress* 18, 149–166. <https://doi.org/10.1080/02678370412331270860>
- Demerouti, E., Peeters, M.C.W., van den Heuvel, M., 2019. Job Crafting Interventions: Do They Work and Why?, in: Van Zyl, L.E., Rothmann, S. (Eds.), *Positive Psychological Intervention*

- Design and Protocols for Multi-Cultural Contexts. Springer International Publishing, Cham, pp. 103–125. https://doi.org/10.1007/978-3-030-20020-6_5
- Dorner, T.E., Alexanderson, K., Svedberg, P., Ropponen, A., Stein, K.V., Mittendorfer-Rutz, E., 2015. Sickness absence due to back pain or depressive episode and the risk of all-cause and diagnosis-specific disability pension: A Swedish cohort study of 4,823,069 individuals. *European Journal of Pain* 19, 1308–1320. <https://doi.org/10.1002/ejp.661>
- Duncan, G.J., Brooks-Gunn, J., 2000. Family Poverty, Welfare Reform, and Child Development. *Child Development* 71, 188–196.
- Ekberg, K., Wåhlin, C., Persson, J., Bernfort, L., Öberg, B., 2015. Early and Late Return to Work After Sick Leave: Predictors in a Cohort of Sick-Listed Individuals with Common Mental Disorders. *Journal of Occupational Rehabilitation* 25, 627–637. <https://doi.org/10.1007/s10926-015-9570-9>
- Erola, J., Jalonen, S., Lehti, H., 2016. Parental education, class and income over early life course and children’s achievement. *Research in Social Stratification and Mobility* 44, 33–43. <https://doi.org/10.1016/j.rssm.2016.01.003>
- Erola, J., Kilpi-Jakonen, E., 2017a. Compensation and other forms of accumulation in intergenerational social inequality., in: Erola, J., Kilpi-Jakonen, E. (Eds.), *Social Inequality across the Generations: The Role of Compensation and Multiplication in Resource Accumulation*. Edward Elgar Publishing, Cheltenham, UK, pp. 3–26.
- Erola, J., Kilpi-Jakonen, E. (Eds.), 2017b. *Social inequality across the generations: the role of compensation and multiplication in resource accumulation*. Edward Elgar Publishing, Cheltenham, UK.
- Ervasti, J., Kivimäki, M., Dray-Spira, R., Head, J., Goldberg, M., Pentti, J., Jokela, M., Vahtera, J., Zins, M., Virtanen, M., 2016. Socioeconomic gradient in work disability in diabetes: evidence from three occupational cohorts. *J Epidemiol Community Health* 70, 125–131. <https://doi.org/10.1136/jech-2015-205943>
- Ervasti, J., Vahtera, J., Pentti, J., Oksanen, T., Ahola, K., Kivimäki, M., Virtanen, M., 2013. Depression-Related Work Disability: Socioeconomic Inequalities in Onset, Duration and Recurrence. *PLoS ONE* 8, e79855. <https://doi.org/10.1371/journal.pone.0079855>
- ETK, Kela, 2019. Tilasto Suomen eläkkeensaajista 2018. *Eläketurvakeskuksen tilastoja* 9, 26.
- ETK, Kela, 2019. Työ- ja kansaneläkejärjestelmän työkyvyttömyyseläkkeensaajat sairauspääryhmittäin.
- Eurostat, 2019. Duration of working life - annual data.
- Fahy, A.E., Stansfeld, S.A., Smuk, M., Lain, D., van der Horst, M., Vickerstaff, S., Clark, C., 2017. Longitudinal associations of experiences of adversity and socioeconomic disadvantage during childhood with labour force participation and exit in later adulthood. *Social Science & Medicine* 183, 80–87. <https://doi.org/10.1016/j.socscimed.2017.04.023>
- Farrants, K., Friberg, E., Sjölund, S., Alexanderson, K., 2018. Work Disability Trajectories Among Individuals with a Sick-Leave Spell Due to Depressive Episode \geq 21 Days: A Prospective Cohort Study with 13-Month Follow Up. *Journal of Occupational Rehabilitation* 28, 678–690. <https://doi.org/10.1007/s10926-017-9751-9>
- Feldman, D.C., Beehr T. 2011. A three-phase model of retirement decision making. *American Psychologist* 66(3), 193–203. <http://doi.apa.org/getdoi.cfm?doi=10.1037/a0022153>
- Fila, M.J., 2016. The job demands, control, support model: Where are we now? *International Journal for Research in Management* 1, 15–44.
- Försäkringskassan, 2019a. Financial security in the event of illness, in: *Social Insurance in Figures 2019*. Stockholm, Sweden, pp. 46–61.
- Försäkringskassan, 2019b. Disability allowance, in: *Social Insurance in Figures 2019*. Stockholm, Sweden, pp. 40–41.
- Fredlund, P., Hallqvist, J., Diderichsen, F., 2000. Psykosocial yrkesexponeringsmatris. En uppdatering av ett klassifikationssystem för yrkesrelaterade psykosociala exponeringar (No. 11), *Arbete och hälsa. Vetenskaplig skriftserie*. Arbetslivsinstitutet & författarna, Stockholm.
- Galama, T.J., van Kippersluis, H., 2019. A Theory of Socio-economic Disparities in Health over the Life Cycle. *The Economic Journal* 129, 338–374. <https://doi.org/10.1111/ecoj.12577>

- Galobardes, B., 2006a. Indicators of socioeconomic position (part 1). *Journal of Epidemiology & Community Health* 60, 7–12. <https://doi.org/10.1136/jech.2004.023531>
- Galobardes, B., 2006b. Indicators of socioeconomic position (part 2). *Journal of Epidemiology & Community Health* 60, 95–101. <https://doi.org/10.1136/jech.2004.028092>
- Ganzeboom, H.B.G., Luijckx, R., Treiman, D.J., 1989. Intergenerational Class Mobility in Comparative Perspective. *Research in Social Stratification and Mobility* 8, 3–34.
- Gjerde, L.C., Knudsen, G.P., Czajkowski, N., Gillespie, N., Aggen, S.H., Røysamb, E., Reichborn-Kjennerud, T., Tambs, K., Kendler, K.S., Ørstavik, R.E., 2013. Genetic and Environmental Contributions to Long-Term Sick Leave and Disability Pension: A Population-Based Study of Young Adult Norwegian Twins. *Twin Research and Human Genetics* 16, 759–766. <https://doi.org/10.1017/thg.2013.36>
- Gjesdal, S., Bratberg, E., 2003. Diagnosis and duration of sickness absence as predictors for disability pension: Results from a three-year, multi-register based and prospective study. *Scandinavian Journal of Public Health* 31, 246–254. <https://doi.org/10.1080/14034940210165154>
- Gjesdal, S., Bratberg, E., Mæland, J.G., 2011. Gender differences in disability after sickness absence with musculoskeletal disorders: five-year prospective study of 37,942 women and 26,307 men. *BMC Musculoskeletal Disorders* 12. <https://doi.org/10.1186/1471-2474-12-37>
- Gravseth, H.M., Bjerkedal, T., Irgens, L.M., Aalen, O.O., Selmer, R., Kristensen, P., 2007. Life course determinants for early disability pension: a follow-up of Norwegian men and women born 1967–1976. *European Journal of Epidemiology* 22, 533–543. <https://doi.org/10.1007/s10654-007-9139-9>
- Grees, N., 2015. Stratification in Changing Swedish Sickness Insurance. *European Journal of Social Security* 17, 453–480. <https://doi.org/10.1177/138826271501700404>
- Grossman, M., 2005. Education and Nonmarket Outcomes (No. w11582). National Bureau of Economic Research, Cambridge, MA. <https://doi.org/10.3386/w11582>
- Haan, P., Myck, M., 2009. Dynamics of health and labor market risks. *Journal of Health Economics* 28, 1116–1125. <https://doi.org/10.1016/j.jhealeco.2009.09.001>
- Hagen, K.B., Holte, H.H., Tambs, K., Bjerkedal, T., 2000. Socioeconomic Factors and Disability Retirement From Back Pain: A 1983–1993 Population-Based Prospective Study in Norway. *Spine* 25, 2480–2487.
- Hakulinen, C., Elovainio, M., Arffman, M., Lumme, S., Pirkola, S., Keskimäki, I., Manderbacka, K., Böckerman, P., 2019. Mental disorders and long-term labour market outcomes: nationwide cohort study of 2 055 720 individuals. *Acta Psychiatr Scand.* <https://doi.org/10.1111/acps.13067>
- Halldorsson, M., Kunst, A.E., Köhler, L., Mackenbach, J.P., 2002. Socioeconomic differences in children's use of physician services in the Nordic countries. *Journal of Epidemiology & Community Health* 56, 200–204. <https://doi.org/10.1136/jech.56.3.200>
- Halonen, J.I., Kivimäki, M., Vahtera, J., Pentti, J., Virtanen, M., Ervasti, J., Oksanen, T., Lallukka, T., 2017. Childhood adversity, adult socioeconomic status and risk of work disability: a prospective cohort study. *Occupational and Environmental Medicine* 74, 659–666. <https://doi.org/10.1136/oemed-2017-104319>
- Halonen, J.I., Solovieva, S., Pentti, J., Kivimäki, M., Vahtera, J., Viikari-Juntura, E., 2016. Effectiveness of legislative changes obligating notification of prolonged sickness absence and assessment of remaining work ability on return to work and work participation: a natural experiment in Finland. *Occupational and Environmental Medicine* 73, 42–50. <https://doi.org/10.1136/oemed-2015-103131>
- Halonen, J.I., Vahtera, J., Kivimäki, M., Pentti, J., Ichiro Kawachi, Subramanian, S.V., 2014. Adverse experiences in childhood, adulthood neighbourhood disadvantage and health behaviours. *Journal of Epidemiology & Community Health* 68, 741–746.
- Hanson, M.D., Chen, E., 2007. Socioeconomic Status and Health Behaviors in Adolescence: A Review of the Literature. *Journal of Behavioral Medicine* 30, 263–285. <https://doi.org/10.1007/s10865-007-9098-3>
- Harkko, J., Kouvonen, A., Virtanen, M., 2016. Educational attainment, labour market position and mental ill health as pathways from adversities in adolescence to disability pension in early

- adulthood: A Finnish cohort study using register data. *Scandinavian Journal of Public Health* 44, 678–687. <https://doi.org/10.1177/1403494816655945>
- Harkonmäki, K., Korkeila, K., Vahtera, J., Kivimäki, M., Suominen, S., Sillanmäki, L., Koskenvuo, M., 2007. Childhood adversities as a predictor of disability retirement. *J Epidemiol Community Health* 61, 479–484. <https://doi.org/10.1136/jech.2006.052670>
- Harkonmäki, K., Silventoinen, K., Levälahti, E., Pitkänieniemi, J., Huunan-Seppälä, A., Klaukka, T., Koskenvuo, M., Kaprio, J., 2008. The Genetic Liability to Disability Retirement: A 30-Year Follow-Up Study of 24,000 Finnish Twins. *PLoS ONE* 3, e3402. <https://doi.org/10.1371/journal.pone.0003402>
- Haukenes, I., Mykletun, A., Knudsen, A., Hansen, H.-T., Mæland, J., 2011. Disability pension by occupational class - the impact of work-related factors: The Hordaland Health Study Cohort. *BMC Public Health* 11, 406. <https://doi.org/10.1186/1471-2458-11-406>
- Heckman, J.J., 2006. Skill Formation and the Economics of Investing in Disadvantaged Children. *Science* 312, 1900–1902. <https://doi.org/10.1126/science.1128898>
- Helgadóttir, B., Mather, L., Narusyte, J., Ropponen, A., Blom, V., Svedberg, P., 2019a. Transitioning from sickness absence to disability pension—the impact of poor health behaviours: a prospective Swedish twin cohort study. *BMJ Open* 9, e031889. <https://doi.org/10.1136/bmjopen-2019-031889>
- Helgadóttir, B., Narusyte, J., Ropponen, A., Bergström, G., Mather, L., Blom, V., Svedberg, P., 2019b. The role of occupational class on the association between sickness absence and disability pension: A Swedish register-based twin study. *Scandinavian Journal of Work, Environment & Health*. <https://doi.org/10.5271/sjweh.3816>
- Henseke, G., 2018. Good jobs, good pay, better health? The effects of job quality on health among older European workers. *Eur J Health Econ* 19, 59–73. <https://doi.org/10.1007/s10198-017-0867-9>
- Hiilamo, A., Shiri, R., Kouvonen, A., Mänty, M., Butterworth, P., Pietiläinen, O., Lahelma, E., Rahkonen, O., Lallukka, T., 2019. Common mental disorders and trajectories of work disability among midlife public sector employees – A 10-year follow-up study. *Journal of Affective Disorders* 247, 66–72. <https://doi.org/10.1016/j.jad.2018.12.127>
- Hinkka, K., Niemelä, M., Autti-Rämö, I., Palomäki, H., 2019. Physicians’ experiences with sickness absence certification in Finland. *Scandinavian Journal of Public Health* 47, 859–866. <https://doi.org/10.1177/1403494818758817>
- Hoar, S., Morrison, A., Cole, P., Silverman, D., 1980. An occupation and exposure linkage system for the study of occupational carcinogenesis. *Journal of Occupational Medicine* 22, 722–6.
- Hoffmann, R., Kröger, H., Geyer, S., 2019. Social Causation Versus Health Selection in the Life Course: Does Their Relative Importance Differ by Dimension of SES? *Social Indicators Research* 141, 1341–1367. <https://doi.org/10.1007/s11205-018-1871-x>
- Huurte, T., Aro, H., Rahkonen, O., 2003. Well-being and health behaviour by parental socioeconomic status. *Social Psychiatry and Psychiatric Epidemiology* 38, 249–255. <https://doi.org/10.1007/s00127-003-0630-7>
- Hytti, H., 2006. Why are Swedes sick but Finns unemployed?: Why are Swedes sick but Finns unemployed? *International Journal of Social Welfare* 15, 131–141. <https://doi.org/10.1111/j.1468-2397.2006.00412.x>
- Hytti, H., 1988. Ammatilliset työkyvyttömyysriskit 1976–80 (No. T9: 32), Kansaneläkelaitoksen julkaisuja. Kansaneläkelaitos. Laskenta- ja tilasto-osasto., Helsinki.
- Ilmarinen, J., Gould, R., Järviskoski, A., Järvisalo, J., 2006. Työkyvyn moninaisuus, in: Gould, R., Ilmarinen, J., Järvisalo, J., Koskinen, S. (Eds.), *Työkyvyn Ulottuvuudet. Terveys 2000 - Tutkimuksen Tuloksia*. Hakapaino Oy, Helsinki.
- Ishtiak-Ahmed, K., Perski, A., Mittendorfer-Rutz, E., 2014. Risk markers of all-cause and diagnosis-specific disability pension - a prospective cohort study of individuals sickness absent due to stress-related mental disorders. *BMC Public Health* 14. <https://doi.org/10.1186/1471-2458-14-805>

- Jalovaara, M., 2013. Socioeconomic Resources and the Dissolution of Cohabitations and Marriages. *European Journal of Population / Revue européenne de Démographie* 29, 167–193. <https://doi.org/10.1007/s10680-012-9280-3>
- Jansson, C., Alexanderson, K., 2013. Sickness absence due to musculoskeletal diagnoses and risk of diagnosis-specific disability pension: A nationwide Swedish prospective cohort study: *Pain* 154, 933–941. <https://doi.org/10.1016/j.pain.2013.03.001>
- Jönsson, L., Palme, M., Svensson, I., 2011. Disability Insurance, Population Health and Employment in Sweden (No. w17054). National Bureau of Economic Research, Cambridge, MA. <https://doi.org/10.3386/w17054>
- Kain, K., Jex, S., 2010. Karasek's (1979) job demands-control model: A summary of current issues and recommendations for future research, in: Perrewe, P.L., Ganster, D.C. (Eds.), *New Developments in Theoretical and Conceptual Approaches to Job Stress*. Emerald Group Publishing Limited, Bingley, UK, pp. 237–268.
- Kangas, O., 2006. Poliitiikka ja sosiaaliturva Suomessa, in: Paavonen, T., Kangas, O. (Eds.), *Eduskunta Hyvinvointivaltion Rakentajana*. Suomen eduskunta, Helsinki, pp. 190–366.
- Kangas, O., 2004. Institutional Development of Sickness Cash-benefit Programmes in 18 OECD Countries. *Social Policy and Administration* 38, 190–203. <https://doi.org/10.1111/j.1467-9515.2004.00385.x>
- Kangas, O., Blomgren, J., 2014. Socio-economic differences in health, income inequality, unequal access to care and spending on health: A country-level comparison of Finland and 16 other European countries. *Research on Finnish Society* 7, 51–63.
- Karasek, R., Theorell, T., 1990. *Healthy Work: Stress, Productivity, and the Reconstruction of Working Life*. Basic Books, New York.
- Keister, L., Southgate, D., 2012. *Inequality. A Contemporary Approach to Race, Class, and Gender*. Cambridge University Press, New York.
- Kela, 2019. *Statistical Yearbook of the Social Insurance Institution 2018*. Kela, Helsinki.
- Kerätär, R., Taanila, A., Jokelainen, J., Soukainen, J., Ala-Mursula, L., 2016. Work disabilities and unmet needs for health care and rehabilitation among jobseekers: a community-level investigation using multidimensional work ability assessments. *Scandinavian Journal of Primary Health Care* 34, 343–351. <https://doi.org/10.1080/02813432.2016.1248632>
- Kestilä, L., 2008. Pathways to health determinants of health, health behaviour and health inequalities in early adulthood. University of Helsinki : National Public Health Institute, Helsinki.
- Kestilä, L., Koskinen, S., Martelin, T., Rahkonen, O., Pensola, T., Aro, H., Aromaa, A., 2006a. Determinants of health in early adulthood: what is the role of parental education, childhood adversities and own education? *European Journal of Public Health* 16, 306–315.
- Kestilä, L., Koskinen, S., Martelin, T., Rahkonen, O., Pensola, T., Pirkola, S., Patja, K., Aromaa, A., 2006b. Influence of parental education, childhood adversities, and current living conditions on daily smoking in early adulthood. *European Journal of Public Health* 16, 617–626.
- Kivimäki, M., Ferrie, J.E., Hagberg, J., Head, J., Westerlund, H., Vahtera, J., Alexanderson, K., 2007. Diagnosis-specific sick leave as a risk marker for disability pension in a Swedish population. *Journal of Epidemiology and Community Health* 61, 915–920. <https://doi.org/10.1136/jech.2006.055426>
- Kivimäki, M., Forma, P., Wikström, J., Halmeenmäki, T., Pentti, J., Elovainio, M., Vahtera, J., 2004. Sickness absence as a risk marker of future disability pension: the 10-town study. *Journal of Epidemiology & Community Health* 58, 710–711. <https://doi.org/10.1136/jech.2003.015842>
- Knardahl, S., Johannessen, H.A., Sterud, T., Härmä, M., Rugulies, R., Seitsamo, J., Borg, V., 2017. The contribution from psychological, social, and organizational work factors to risk of disability retirement: a systematic review with meta-analyses. *BMC Public Health* 17. <https://doi.org/10.1186/s12889-017-4059-4>
- Kohli, M., Rein, M., 1991. The changing balance of work and retirement, in: Kohli, M., Rein, M., Guillemard, A.-M., van Gunstern, H. (Eds.), *Time for Retirement. Comparative Studies of Early Exit from the Labour Force*. Cambridge University Press, Cambridge, pp. 1–35.
- Kolstad, H.A., Hansen, A.M., Kaergaard, A., Thomsen, J.F., Kaerlev, L., Mikkelsen, S., Grynderup, M.B., Mors, O., Rugulies, R., Kristensen, A.S., Andersen, J.H., Bonde, J.P., 2011. Job Strain

- and the Risk of Depression: Is Reporting Biased? *American Journal of Epidemiology* 173, 94–102. <https://doi.org/10.1093/aje/kwq318>
- Kondo, K., Kobayashi, Y., Hirokawa, K., Tsutsumi, A., Kobayashi, F., Haratani, T., Araki, S., Kawakami, N., 2006. Job strain and sick leave among Japanese employees: a longitudinal study. *International Archives of Occupational and Environmental Health* 79, 213–219. <https://doi.org/10.1007/s00420-005-0027-x>
- Kristensen, P., Bjerkedal, T., Irgens, L.M., 2007. Early life determinants of musculoskeletal sickness absence in a cohort of Norwegians born in 1967–1976. *Social Science & Medicine* 64, 646–655. <https://doi.org/10.1016/j.socscimed.2006.09.032>
- Kristensen, T.R., Jensen, S.M., Kreiner, S., Mikkelsen, S., 2010. Socioeconomic status and duration and pattern of sickness absence. A 1-year follow-up study of 2331 hospital employees. *BMC Public Health* 10. <https://doi.org/10.1186/1471-2458-10-643>
- Kröger, H., Pakpahan, E., Hoffmann, R., 2015. What causes health inequality? A systematic review on the relative importance of social causation and health selection. *The European Journal of Public Health* 25, 951–960. <https://doi.org/10.1093/eurpub/ckv111>
- Krokstad, S., Johnsen, R., Westin, S., 2002. Social determinants of disability pension: a 10-year follow-up of 62 000 people in a Norwegian county population. *International Journal of Epidemiology* 31, 1183–1191. <https://doi.org/10.1093/ije/31.6.1183>
- Kromhout, H., Synanski, E., Rappaport, S., 1993. A comprehensive evaluation of within- and between-worker components of occupational exposure to chemical agents. *Annals Occupational Hygiene* 37, 253–70.
- Kuh, D., Ben-Shlomo, Y., Lynch, J., Hallqvist, J., Power, C., 2003. Life course epidemiology. *Journal of Epidemiology and Community Health* 57, 778–783. <https://doi.org/10.1136/jech.57.10.778>
- Kutner, M.M., 2005. *Applied Linear Statistical Models*, 5th ed. McGraw-Hill Irwin, Boston.
- Laaksonen, M., Blomgren, J., 2020. The Level and Development of Unemployment before Disability Retirement: A Retrospective Study of Finnish Disability Retirees and Their Controls. *IJERPH* 17, 1756. <https://doi.org/10.3390/ijerph17051756>
- Laaksonen, M., Blomgren, J., Gould, R., 2016. Sickness allowance trajectories preceding disability retirement: a register-based retrospective study. *The European Journal of Public Health* 26, 1050–1055. <https://doi.org/10.1093/eurpub/ckw081>
- Laaksonen, M., Pitkäniemi, J., Rahkonen, O., Lahelma, E., 2010. Work Arrangements, Physical Working Conditions, and Psychosocial Working Conditions as Risk Factors for Sickness Absence: Bayesian Analysis of Prospective Data. *Annals of Epidemiology* 20, 332–338. <https://doi.org/10.1016/j.annepidem.2010.02.004>
- Laaksonen, M., Rahkonen, O., Martikainen, P., Lahelma, E., 2005. Socioeconomic Position and Self-Rated Health: The Contribution of Childhood Socioeconomic Circumstances, Adult Socioeconomic Status, and Material Resources. *American Journal of Public Health* 95, 1403–1409. <https://doi.org/10.2105/AJPH.2004.047969>
- Labriola, M., Holte, K.A., Christensen, K.B., Feveile, H., Alexanderson, K., Lund, T., 2011. The attribution of work environment in explaining gender differences in long-term sickness absence: results from the prospective DREAM study. *Occupational and Environmental Medicine* 68, 703–705. <https://doi.org/10.1136/oem.2010.060632>
- Lahelma, E., Pentala, O., Helldán, A., Helakorpi, S., Rahkonen, O., 2017. 36-year trends in socioeconomic differences in self-rated health among Finnish adults. *European Journal of Public Health* 27. <https://doi.org/10.1093/eurpub/ckx187.289>
- Lahelma, E., Pietiläinen, O., Rahkonen, O., Lallukka, T., 2015. Common mental disorders and cause-specific disability retirement. *Occupational and Environmental Medicine* 72, 181–187. <https://doi.org/10.1136/oemed-2014-102432>
- Laine, S., Gimeno, D., Virtanen, M., Oksanen, T., Vahtera, J., Elovainio, M., Koskinen, A., Pentti, J., Kivimäki, M., 2009. Job strain as a predictor of disability pension: the Finnish Public Sector Study. *Journal of Epidemiology & Community Health* 63, 24–30. <https://doi.org/10.1136/jech.2007.071407>

- Lallukka, T., Hiilamo, A., Pietiläinen, O., Mänty, M., Kouvonen, A., Rahkonen, O., 2020. Who maintains good health functioning? The contribution of social, work-related and behavioural factors to mental and physical health functioning trajectories in ageing employees. *Occup Environ Med* oemed-2019-106324. <https://doi.org/10.1136/oemed-2019-106324>
- Lastrucci, V., Lorini, C., Caini, S., Florence Health Literacy Research Group, Bonaccorsi, G., 2019. Health literacy as a mediator of the relationship between socioeconomic status and health: A cross-sectional study in a population-based sample in Florence. *PLoS ONE* 14, e0227007. <https://doi.org/10.1371/journal.pone.0227007>
- Lechmann, D.S.J., Schnabel, C., 2014. Absence from Work of the Self-Employed: A Comparison with Paid Employees: Absence from Work of the Self-Employed. *Kyklos* 67, 368–390. <https://doi.org/10.1111/kykl.12059>
- Leineweber, C., Marklund, S., Aronsson, G., Gustafsson, K., 2019. Work-related psychosocial risk factors and risk of disability pension among employees in health and personal care: A prospective cohort study. *International Journal of Nursing Studies* 93, 12–20. <https://doi.org/10.1016/j.ijnurstu.2018.10.009>
- Leineweber, C., Westerlund, H., Hagberg, J., Svedberg, P., Alexanderson, K., 2012. Sick leave presenteeism is more than an alternative to sickness absence: results from the population-based SLOSH study. *International Archives of Occupational and Environmental Health* 85, 905–914. <https://doi.org/10.1007/s00420-012-0735-y>
- Leinonen, T., 2014. Disability retirement. Socioeconomic differences and health outcomes. University of Helsinki, Helsinki.
- Leinonen, T., Martikainen, P., Lahelma, E., 2012. Interrelationships between education, occupational social class, and income as determinants of disability retirement. *Scandinavian Journal of Public Health* 40, 157–166. <https://doi.org/10.1177/1403494811435492>
- Leinonen, T., Pietiläinen, O., Laaksonen, M., Rahkonen, O., Lahelma, E., Martikainen, P., 2011. Occupational social class and disability retirement among municipal employees – the contribution of health behaviors and working conditions. *Scandinavian Journal of Work, Environment & Health* 37, 464–472. <https://doi.org/10.5271/sjweh.3182>
- Leinonen, T., Viikari-Juntura, E., Husgafvel-Pursiainen, K., Solovieva, S., 2018. Cause-specific sickness absence trends by occupational class and industrial sector in the context of recent labour market changes: a Finnish panel data study. *BMJ Open* 8, e019822. <https://doi.org/10.1136/bmjopen-2017-019822>
- Lenski, G., 2005. *Ecological-Evolutionary Theory: Principles and Applications*. Paradigm, London.
- Lidwall, U., Marklund, S., 2011. Trends in long-term sickness absence in Sweden 1992–2008: the role of economic conditions, legislation, demography, work environment and alcohol consumption: Trends in long-term sickness absence in Sweden. *International Journal of Social Welfare* 20, 167–179. <https://doi.org/10.1111/j.1468-2397.2010.00744.x>
- Loppela, K., 2004. *Ihminen ja työ - keskustellen työ kuntoon. Työyhteisön kehittäminen työkykyä ylläpitävän toiminnan viitekehyksessä* (Doctoral dissertation). University of Tampere, Tampere.
- Lund, T., Kivimäki, M., Labriola, M., Villadsen, E., Christensen, K.B., 2008. Using administrative sickness absence data as a marker of future disability pension: the prospective DREAM study of Danish private sector employees. *Occupational and Environmental Medicine* 65, 28–31. <https://doi.org/10.1136/oem.2006.031393>
- Lund, T., Labriola, M., Christensen, K.B., Bøltmann, U., Villadsen, E., Burr, H., 2005. Psychosocial Work Environment Exposures as Risk Factors for Long-Term Sickness Absence Among Danish Employees: Results From DWECS/DREAM: *Journal of Occupational and Environmental Medicine* 47, 1141–1147. <https://doi.org/10.1097/01.jom.0000174301.80318.f2>
- Lynch, J.W., 2000. Income inequality and mortality: importance to health of individual income, psychosocial environment, or material conditions. *BMJ* 320, 1200–1204. <https://doi.org/10.1136/bmj.320.7243.1200>
- Lynch, J.W., Kaplan, G.A., Salonen, J.T., 1997. Why do poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic life-course. *Social Science & Medicine* 44, 809–819. [https://doi.org/10.1016/S0277-9536\(96\)00191-8](https://doi.org/10.1016/S0277-9536(96)00191-8)

- Mackenbach, J.P., 2019. Health inequalities: persistence and change in European welfare states. Oxford University Press, United Kingdom.
- Mackenbach, J.P., 2006. Health inequalities: Europe in profile, An independent expert report commissioned by the UK presidency of the EU. Department of Health, London.
- Mäkinen, T., Laaksonen, M., Lahelma, E., Rahkonen, O., 2006. Associations of childhood circumstances with physical and mental functioning in adulthood. *Social Science & Medicine* 62, 1831–1839. <https://doi.org/10.1016/j.socscimed.2005.08.040>
- Manganello, J.A., 2007. Health literacy and adolescents: a framework and agenda for future research. *Health Education Research* 23, 840–847. <https://doi.org/10.1093/her/cym069>
- Månsson, N.O., Råstam, L., Eriksson, K.F., Israelsson, B., 1998. Socioeconomic inequalities and disability pension in middle-aged men. *Int J Epidemiol* 27, 1019–1025.
- Mantwill, S., Monestel-Umaña, S., Schulz, P.J., 2015. The Relationship between Health Literacy and Health Disparities: A Systematic Review. *PLoS ONE* 10, e0145455. <https://doi.org/10.1371/journal.pone.0145455>
- Mäntyniemi, A., Oksanen, T., Salo, P., Virtanen, M., Sjösten, N., Pentti, J., Kivimäki, M., Vahtera, J., 2012. Job strain and the risk of disability pension due to musculoskeletal disorders, depression or coronary heart disease: a prospective cohort study of 69 842 employees. *Occupational and Environmental Medicine* 69, 574–581. <https://doi.org/10.1136/oemed-2011-100411>
- Marmot, M., 2004. Status syndrome. *Significance* 1, 150–154. <https://doi.org/10.1111/j.1740-9713.2004.00058.x>
- Marmot, M., Wilkinson, R. (Eds.), 2006. *Social Determinants of Health*. Second Edition. Oxford University Press, New York.
- Marmot, M.G., Stansfeld, S., Patel, C., North, F., Head, J., White, I., Brunner, E., Feeney, A., Marmot, M.G., Smith, G.D., 1991. Health inequalities among British civil servants: the Whitehall II study. *The Lancet* 337, 1387–1393. [https://doi.org/10.1016/0140-6736\(91\)93068-K](https://doi.org/10.1016/0140-6736(91)93068-K)
- McKee-Ryan, F., Song, Z., Wanberg, C.R., Kinicki, A.J., 2005. Psychological and Physical Well-Being During Unemployment: A Meta-Analytic Study. *Journal of Applied Psychology* 90, 53–76. <https://doi.org/10.1037/0021-9010.90.1.53>
- McMichael, A.J., 1976. Standardized Mortality Ratios and the “Healthy Worker Effect”: Scratching Beneath the Surface. *Journal of Occupational and Environmental Medicine* 18, 165–168. <https://doi.org/10.1097/00043764-197603000-00009>
- Merikukka, M., Ristikari, T., Tuulio-Henriksson, A., Gissler, M., Laaksonen, M., 2018. Childhood determinants for early psychiatric disability pension: A 10-year follow-up study of the 1987 Finnish Birth Cohort. *International Journal of Social Psychiatry* 64, 715–725. <https://doi.org/10.1177/0020764018806936>
- Merton, R., K., 1988. The Matthew Effect in Science, II Cumulative Advantage and the Symbolism of Intellectual Property, *ISIS*.
- Mood, C., 2010. Logistic Regression: Why We Cannot Do What We Think We Can Do, and What We Can Do About It. *European Sociological Review* 26, 67–82. <https://doi.org/10.1093/esr/jcp006>
- Mutambudzi, M., Theorell, T., Li, J., 2019. Job Strain and Long-Term Sickness Absence From Work: A Ten-Year Prospective Study in German Working Population. *Journal of Occupational and Environmental Medicine* 6. <https://doi.org/10.1097/JOM.0000000000001525>
- Myrskylä, P., 2011. Nuoret työmarkkinoiden ja opiskelun ulkopuolella [Youth outside the labour market and education (No. 12), Työ- ja elinkeinoministeriön julkaisuja: Työ ja yrittäjyys [Publications of the Ministry of Employment and the Economy, Finland: Work and entrepreneurship].
- Nagin, D.S., Jones, B.L., Passos, V.L., Tremblay, R.E., 2018. Group-based multi-trajectory modeling. *Statistical Methods in Medical Research* 27, 2015–2023. <https://doi.org/10.1177/0962280216673085>
- National Research Council, 2002. *The Dynamics of Disability: Measuring and Monitoring Disability for Social Security Programs*. National Academies Press, Washington, D.C. <https://doi.org/10.17226/10411>

- Niemelä, H., 2014. Yhteiskuntavastuuta ja valinnanvapautta. Sairausvakuutus 50 vuotta. The Social Insurance Institution of Finland, Helsinki.
- Nilsen, S.M., Ernsten, L., Krokstad, S., Westin, S., 2012. Educational inequalities in disability pensioning – the impact of illness and occupational, psychosocial, and behavioural factors: The Nord-Trøndelag Health Study (HUNT). *Scandinavian Journal of Public Health* 40, 133–141. <https://doi.org/10.1177/1403494811435494>
- Norberg, J., Alexanderson, K., Framke, E., Rugulies, R., Farrants, K., 2019. Job demands and control and sickness absence, disability pension and unemployment among 2,194,692 individuals in Sweden. *Scandinavian Journal of Public Health* 140349481984636. <https://doi.org/10.1177/1403494819846367>
- Notkola, V., Pajunen, A., Leino-Arjas, P., Finland, Tilastokeskus, 1995. Telineet, tehdas vai toimistotutkimus ammattiryhmittäisestä kuolleisuudesta ja työkyvyttömyydestä. SVT, Helsinki.
- Nwaru, C.A., Kivimäki, M., Pentti, J., Vahtera, J., Virtanen, P., 2018. Sickness absence in a re-employment program as a predictor of labor market attachment among long-term unemployed individuals: A 6-year cohort study in Finland. *Scandinavian Journal of Work, Environment & Health* 44, 496–502. <https://doi.org/10.5271/sjweh.3742>
- Oakman, J., Neupane, S., Proper, K.L., Kinsman, N., Nygård, C.-H., 2017. Workplace interventions to improve work ability: A systematic review and meta-analysis of their effectiveness. *Scand J Work Environ Health*. <https://doi.org/10.5271/sjweh.3685>
- OECD, 2013. The OECD action plan for youth – giving youth a better start in the labour market. OECD, Paris.
- OECD, 2011. Pensionable Age and Life Expectancy, 1950-2050, in: *Pensions at Glance 2011: Retirement-Income Systems in OECD and G20 Countries*. OECD Publishing, Paris.
- Ørstavik, R., Seglem, K., Gjerde, L.C., Torvik, F., Røysamb, E., Reichborn-Kjennerud, T., Vollrath, M., 2019. Studies from the Norwegian Twin Registry on risk factors for health related work incapacity. *European Journal of Public Health* 29, ckz185.696. <https://doi.org/10.1093/eurpub/ckz185.696>
- Ostlin, P., 1988. Negative health selection into physically light occupations. *Journal of Epidemiology & Community Health* 42, 152–156. <https://doi.org/10.1136/jech.42.2.152>
- Paananen, R., Ristikari, T., Merikukka, M., Gissler, M., 2013a. Social determinants of mental health: a Finnish nationwide follow-up study on mental disorders. *Journal of Epidemiology and Community Health* 67, 1025–1031. <https://doi.org/10.1136/jech-2013-202768>
- Paananen, R., Santalhti, P., Merikukka, M., Rämö, A., Wahlbeck, K., Gissler, M., 2013b. Socioeconomic and regional aspects in the use of specialized psychiatric care—a Finnish nationwide follow-up study. *European Journal of Public Health* 23, 372–377. <https://doi.org/10.1093/eurpub/cks147>
- Pampel, F.C., Krueger, P.M., Denney, J.T., 2010. Socioeconomic Disparities in Health Behaviors. *Annu. Rev. Sociol.* 36, 349–370. <https://doi.org/10.1146/annurev.soc.012809.102529>
- Pedersen, J., Bjoerner, J.B., Burr, H., Christensen, K.B., 2012. Transitions between sickness absence, work, unemployment, and disability in Denmark 2004–2008. *Scandinavian Journal of Work, Environment & Health* 38, 516–526. <https://doi.org/10.5271/sjweh.3293>
- Pekkala, J., Blomgren, J., Pietiläinen, O., Lahelma, E., Rahkonen, O., 2017a. Occupational class differences in long sickness absence: a register-based study of 2.1 million Finnish women and men in 1996–2013. *BMJ Open* 7, e014325. <https://doi.org/10.1136/bmjopen-2016-014325>
- Pekkala, J., Blomgren, J., Pietiläinen, O., Lahelma, E., Rahkonen, O., 2017b. Occupational class differences in diagnostic-specific sickness absence: a register-based study in the Finnish population, 2005–2014. *BMC Public Health* 17. <https://doi.org/10.1186/s12889-017-4674-0>
- Pensola, T., Martikainen, P., 2004. Life-course experiences and mortality by adult social class among young men. *Social Science & Medicine* 58, 2149–2170. <https://doi.org/10.1016/j.socscimed.2003.08.014>
- Perhoniemi, R., Blomgren, J., Laaksonen, M., 2019. Determinants of disability pension applications and awarded disability pensions in Finland, 2009 and 2014. *Scandinavian Journal of Public Health* 140349481984377. <https://doi.org/10.1177/1403494819843778>

- Perhoniemi, R., Sohlman, P., Heino, S., Lundell, K., Pekkarinen, L., 2015. Työkyvyttömyyseläkkeen hylkäävät päätökset julkisella sektorilla - tutkimus hylkäävän päätöksen 2009-2013 saaneista. Keva, Kevan tutkimuksia.
- Peters, S., 2020. Although a valuable method in occupational epidemiology, job-exposure -matrices are no magic fix. *Scand J Work Environ Health*. <https://doi.org/10.5271/sjweh.3894>
- Petrovic, D., de Mestral, C., Bochud, M., Bartley, M., Kivimäki, M., Vineis, P., Mackenbach, J., Stringhini, S., 2018. The contribution of health behaviors to socioeconomic inequalities in health: A systematic review. *Preventive Medicine* 113, 15–31. <https://doi.org/10.1016/j.ypmed.2018.05.003>
- Pichler, S., 2015. Sickness Absence, Moral Hazard, and the Business Cycle: SICKNESS ABSENCE, MORAL HAZARD, AND THE BUSINESS CYCLE. *Health Economics* 24, 692–710. <https://doi.org/10.1002/hec.3054>
- Piha, K., Martikainen, P., Rahkonen, O., Roos, E., Lahelma, E., 2007. Trends in socioeconomic differences in sickness absence among Finnish municipal employees 1990-99. *Scandinavian Journal of Public Health* 35, 348–355. <https://doi.org/10.1080/14034940601160706>
- Polvinen, A., Gould, R., Lahelma, E., Martikainen, P., 2013. Socioeconomic differences in disability retirement in Finland: the contribution of ill-health, health behaviours and working conditions. *Scand J Public Health* 41, 470–478. <https://doi.org/10.1177/1403494813482400>
- Polvinen, A., Laaksonen, M., Gould, R., Lahelma, E., Leinonen, T., Martikainen, P., 2016. Socioeconomic Differences in Cause-Specific Disability Retirement in Finland, 1988 to 2009: *Journal of Occupational and Environmental Medicine* 58, 840–845. <https://doi.org/10.1097/JOM.0000000000000808>
- Polvinen, A., Laaksonen, M., Gould, R., Lahelma, E., Martikainen, P., 2014. The contribution of major diagnostic causes to socioeconomic differences in disability retirement. *Scandinavian Journal of Work, Environment & Health* 40, 353–360. <https://doi.org/10.5271/sjweh.3411>
- Power, C., Hertzman, C., 1997. Social and biological pathways linking early life and adult disease. *British Medical Bulletin* 53, 210–221. <https://doi.org/10.1093/oxfordjournals.bmb.a011601>
- Rahkonen, O., Lahelma, E., Huuhka, M., 1997. Past or present? Childhood living conditions and current socioeconomic status as determinants of adult health. *Social Science & Medicine* 44, 327–336. [https://doi.org/10.1016/S0277-9536\(96\)00102-5](https://doi.org/10.1016/S0277-9536(96)00102-5)
- Rantanen, J., 1995. Tutkimuksesta työkyvyn ylläpitoon - tutkimuslaitoksen mahdollisuudet, in: Martikainen, E., Aro, T., Kalimo, R., Ilmarinen, J., Torstila, I. (Eds.), Hyvä työkyky. Työkyvyn ylläpidon malleja ja keinoja. Työterveyslaitos ja Eläkevakuutusyhtiö Ilmarinen, Helsinki, pp. 17–24.
- Rawls, J., 1999. *A Theory of Justice*. Harvard University Press, Cambridge.
- Reinhold, S., Jürges, H., 2012. Parental income and child health in Germany. *Health Economics* 21, 562–579. <https://doi.org/10.1002/hec.1732>
- Reinholdt, S., Upmark, M., Alexanderson, K., 2010. Health-selection mechanisms in the pathway towards a disability pension. *Work* 41–51. <https://doi.org/10.3233/WOR-2010-1055>
- Rich-Edwards, J.W., Stampfer, M.J., Manson, J.E., Rosner, B., Hankinson, S.E., Colditz, G.A., Hennekens, C.H., Willet, W.C., 1997. Birth weight and risk of cardiovascular disease in a cohort of women followed up since 1976. *BMJ* 315, 396–400. <https://doi.org/10.1136/bmj.315.7105.396>
- Ropponen, A., Samuelsson, Å., Alexanderson, K., Svedberg, P., 2013. Register-based data of psychosocial working conditions and occupational groups as predictors of disability pension due to musculoskeletal diagnoses: a prospective cohort study of 24 543 Swedish twins. *BMC Musculoskeletal Disorders* 14. <https://doi.org/10.1186/1471-2474-14-268>
- Ropponen, A., Silventoinen, K., Svedberg, P., Alexanderson, K., Koskenvuo, K., Huunan-Seppälä, A., Koskenvuo, M., Kaprio, J., 2011. Health-related risk factors for disability pensions due to musculoskeletal diagnoses: A 30-year Finnish twin cohort study. *Scandinavian Journal of Public Health* 39, 839–848. <https://doi.org/10.1177/1403494811418283>
- Rosta, J., Tellnes, G., Aasland, O.G., 2014. Differences in sickness absence between self-employed and employed doctors: a cross-sectional study on national sample of Norwegian doctors in 2010. *BMC Health Serv Res* 14, 199. <https://doi.org/10.1186/1472-6963-14-199>

- Rothon, C., Head, J., Clark, C., Klineberg, E., Cattell, V., Stansfeld, S., 2009. The impact of psychological distress on the educational achievement of adolescents at the end of compulsory education. *Soc Psychiat Epidemiol* 44, 421–427. <https://doi.org/10.1007/s00127-008-0452-8>
- Rüegg, R., Abel, T., 2019. The relationship between health literacy and health outcomes among male young adults: exploring confounding effects using decomposition analysis. *Int J Public Health* 64, 535–545. <https://doi.org/10.1007/s00038-019-01236-x>
- Rugulies, R., 2019. What is a psychosocial work environment? *Scand J Work Environ Health* 45, 1–6. <https://doi.org/10.5271/sjweh.3792>
- Rugulies, R., 2012. Studying the effect of the psychosocial work environment on risk of ill-health: towards a more comprehensive assessment of working conditions. *Scand J Work Environ Health* 38, 187–192. <https://doi.org/10.5271/sjweh.3296>
- Ruokolainen, O., Heloma, A., Jousilahti, P., Lahti, J., Pentala-Nikulainen, O., Rahkonen, O., Puska, P., 2019. Thirty-eight-year trends of educational differences in smoking in Finland. *International Journal of Public Health* 64, 853–860. <https://doi.org/10.1007/s00038-019-01228-x>
- Salonsalmi, A., Pietiläinen, O., Lahelma, E., Rahkonen, O., 2019. Childhood adversities, parental education and disability retirement among Finnish municipal employees. *PLOS ONE* 14, e0219421. <https://doi.org/10.1371/journal.pone.0219421>
- Samuelsson, Å., Ropponen, A., Alexanderson, K., Lichtenstein, P., Svedberg, P., 2012. Disability Pension Among Swedish Twins—Prevalence Over 16 Years and Associations With Sociodemographic Factors in 1992: *Journal of Occupational and Environmental Medicine* 54, 10–16. <https://doi.org/10.1097/JOM.0b013e31823d86d5>
- Samuelsson, Å., Ropponen, A., Alexanderson, K., Svedberg, P., 2013. Psychosocial working conditions, occupational groups, and risk of disability pension due to mental diagnoses: a cohort study of 43 000 Swedish twins. *Scandinavian Journal of Work, Environment & Health* 39, 351–360. <https://doi.org/10.5271/sjweh.3338>
- Sanders, L.M., Shaw, J.S., Guez, G., Baur, C., Rudd, R., 2009. Health Literacy and Child Health Promotion: Implications for Research, Clinical Care, and Public Policy. *Pediatrics* 124, S306–S314. <https://doi.org/10.1542/peds.2009-1162G>
- SCB, 1982. Yrkesklassificeringar i Fob 85 (No. 4), MIS. Statistiska centralbyrån, Stockholm, Sweden.
- Schuring, M., Burdorf, L., Kunst, A., Mackenbach, J., 2007. The effects of ill health on entering and maintaining paid employment: evidence in European countries. *Journal of Epidemiology & Community Health* 61, 597–604. <https://doi.org/10.1136/jech.2006.047456>
- Schuring, M., Robroek, S.J., Otten, F.W., Arts, C.H., Burdorf, A., 2013. The effect of ill health and socioeconomic status on labor force exit and re-employment: a prospective study with ten years follow-up in the Netherlands. *Scand J Work Environ Health* 39, 134–143. <https://doi.org/10.5271/sjweh.3321>
- Scoppetta, A., Earmonn, D., Geyer, L., 2019. Job carving and job crafting : a review of practices. Directorate-General for Employment, Social Affairs and Inclusion (European Commission).
- Seglem, K.B., Torvik, F.A., Røysamb, E., Gjerde, L.C., Magnus, P., Reichborn-Kjennerud, T., Svedberg, P., Ørstavik, R., 2019. A Life Course Study of Genetic and Environmental Influences on Work Incapacity. *Twin Res Hum Genet* 1–7. <https://doi.org/10.1017/thg.2019.116>
- Shuey, K.M., Willson, A.E., 2017. Trajectories of Work Disability and Economic Insecurity Approaching Retirement. *The Journals of Gerontology: Series B*. <https://doi.org/10.1093/geronb/gbx096>
- Siegrist, J., 2002. Effort-reward imbalance at work and health, in: Perrewé, P.L., Ganster, D.C. (Eds.), *Historical and Current Perspectives on Stress and Health*. JAI Elsevier, Amsterdam, pp. 261–291.
- Siegrist, J., Siegrist, K., Weber, I., 1986. Sociological concepts in the etiology of chronic disease: the case of ischemic heart disease. *Social Science & Medicine* 22, 247–253.
- Sirén, M., Viikari-Juntura, E., Arokoski, J., Solovieva, S., 2019. Physical and psychosocial work exposures as risk factors for disability retirement due to a shoulder lesion. *Occup Environ Med* 76, 793–800. <https://doi.org/10.1136/oemed-2019-105974>

- Slany, C., Schütte, S., Chastang, J.-F., Parent-Thirion, A., Vermeulen, G., Niedhammer, I., 2014. Psychosocial work factors and long sickness absence in Europe. *International Journal of Occupational and Environmental Health* 20, 16–25. <https://doi.org/10.1179/2049396713Y.0000000048>
- Sørensen, K., Pelikan, J.M., Röthlin, F., Ganahl, K., Slonska, Z., Doyle, G., Fullam, J., Kondilis, B., Agrafiotis, D., Uiters, E., Falcon, M., Mensing, M., Tchamov, K., Broucke, S. van den, Brand, H., 2015. Health literacy in Europe: comparative results of the European health literacy survey (HLS-EU). *The European Journal of Public Health* 25, 1053–1058. <https://doi.org/10.1093/eurpub/ckv043>
- Stapelfeldt, C.M., Nielsen, C.V., Andersen, N.T., Krane, L., Borg, V., Fleten, N., Jensen, C., 2014. Sick leave patterns as predictors of disability pension or long-term sick leave: a 6.75-year follow-up study in municipal eldercare workers. *BMJ Open* 4, e003941–e003941. <https://doi.org/10.1136/bmjopen-2013-003941>
- Statistics Finland, 2019. Classification of Socio-economic Groups 1989. URL https://tilastokeskus.fi/en/luokitukset/sosioekon_asema/ (accessed 6.17.19).
- Stephan, U., Roesler, U., 2010. Health of entrepreneurs versus employees in a national representative sample. *Journal of Occupational and Organizational Psychology* 83, 717–738. <https://doi.org/10.1348/096317909X472067>
- Stormacq, C., Van den Broucke, S., Wosinski, J., 2019. Does health literacy mediate the relationship between socioeconomic status and health disparities? Integrative review. *Health Promotion International* 34, e1–e17. <https://doi.org/10.1093/heapro/day062>
- Stringhini, S., 2010. Association of Socioeconomic Position With Health Behaviors and Mortality. *JAMA* 303, 1159. <https://doi.org/10.1001/jama.2010.297>
- Stringhini, S., Carmeli, C., Jokela, M., Avendaño, M., Muennig, P., Guida, F., Ricceri, F., d’Errico, A., Barros, H., Bochud, M., Chadeau-Hyam, M., Clavel-Chapelon, F., Costa, G., Delpierre, C., Fraga, S., Goldberg, M., Giles, G.G., Krogh, V., Kelly-Irving, M., Layte, R., Lasserre, A.M., Marmot, M.G., Preisig, M., Shipley, M.J., Vollenweider, P., Zins, M., Kawachi, I., Steptoe, A., Mackenbach, J.P., Vineis, P., Kivimäki, M., Alenius, H., Avendano, M., Barros, H., Bochud, M., Carmeli, C., Carra, L., Castagné, R., Chadeau-Hyam, M., Clavel-Chapelon, F., Costa, G., Courtin, E., Delpierre, C., D’Errico, A., Dugué, P.-A., Elliott, P., Fraga, S., Gares, V., Giles, G., Goldberg, M., Greco, D., Hodge, A., Irving, M.K., Karisola, P., Kivimäki, M., Krogh, V., Lang, T., Layte, R., Lepage, B., Mackenbach, J., Marmot, M., McCrory, C., Milne, R., Muennig, P., Nusselder, W., Panico, S., Petrovic, D., Polidoro, S., Preisig, M., Raitakari, O., Ribeiro, A.I., Ribeiro, A.I., Ricceri, F., Robinson, O., Valverde, J.R., Sacerdote, C., Satolli, R., Severi, G., Shipley, M.J., Stringhini, S., Tumino, R., Vineis, P., Vollenweider, P., Zins, M., 2017. Socioeconomic status and the 25 × 25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1·7 million men and women. *The Lancet* 389, 1229–1237. [https://doi.org/10.1016/S0140-6736\(16\)32380-7](https://doi.org/10.1016/S0140-6736(16)32380-7)
- Sudman, S., Bradburn, N.M., 1973. Effects of Time and Memory Factors on Response in Surveys. *Journal of the American Statistical Association* 68, 805–815. <https://doi.org/10.1080/01621459.1973.10481428>
- Sumanen, H., Lahelma, E., Pietiläinen, O., Rahkonen, O., 2017. The Magnitude of Occupational Class Differences in Sickness Absence: 15-Year Trends among Young and Middle-Aged Municipal Employees. *International Journal of Environmental Research and Public Health* 14, 625. <https://doi.org/10.3390/ijerph14060625>
- Sumanen, H., Lahti, J., Lahelma, E., Pietiläinen, O., Rahkonen, O., 2015. 12-year trends in occupational class differences in short sickness absence among young women. *Scandinavian Journal of Social Medicine* 43, 441–444. <https://doi.org/10.1177/1403494815577460>
- Sumanen, H., Rahkonen, O., Pietiläinen, O., Lahelma, E., Roos, E., Lahti, J., 2016. Educational differences in disability retirement among young employees in Helsinki, Finland. *The European Journal of Public Health* 26, 318–322. <https://doi.org/10.1093/eurpub/ckv226>
- Sundstrup, E., Hansen, Å.M., Mortensen, E.L., Poulsen, O.M., Clausen, T., Rugulies, R., Møller, A., Andersen, L.L., 2018. Retrospectively assessed psychosocial working conditions as

- predictors of prospectively assessed sickness absence and disability pension among older workers. *BMC Public Health* 18. <https://doi.org/10.1186/s12889-018-5047-z>
- Svedberg, P., Salmi, P., Hagberg, J., Lundh, G., Linder, J., Alexanderson, K., 2010. Does multidisciplinary assessment of long-term sickness absentees result in modification of sick-listing diagnoses? *Scandinavian Journal of Public Health* 38, 657–663. <https://doi.org/10.1177/1403494810373674>
- Tarkiainen, L., Martikainen, P., Laaksonen, M., Valkonen, T., 2012. Trends in life expectancy by income from 1988 to 2007: decomposition by age and cause of death. *Journal of Epidemiology and Community Health* 66, 573–578. <https://doi.org/10.1136/jech.2010.123182>
- Tengland, P.-A., 2011. The Concept of Work Ability. *Journal of Occupational Rehabilitation* 21, 275–285. <https://doi.org/10.1007/s10926-010-9269-x>
- Thorlacius, S., Olafsson, S., 2012. From unemployment to disability? Relationship between unemployment rate and new disability pensions in Iceland 1992–2007. *The European Journal of Public Health* 22, 96–101. <https://doi.org/10.1093/eurpub/ckq186>
- Toivonen, L., 2012. Statutory and occupational sickness benefits in Finland in 2011 (No. 34), Online working papers. The Social Insurance Institution of Finland, Helsinki.
- Townsend, P., Davidson, N., 1982. *Inequalities in Health: The Black Report*. Harmondsworth: Penguin.
- Upmark, M., Lundberg, I., Sadigh, J., Bigert, C., 2001. Conditions during childhood and adolescence as explanations of social class differences in disability pension among young men. *Scandinavian Journal of Public Health* 29, 96–103. <https://doi.org/10.1177/14034948010290020601>
- Upmark, M., Thundal, K.-L., 2002. An explorative, population-based study of female disability pensioners: the role of childhood conditions and alcohol abuse/dependence. *Scandinavian Journal of Public Health* 30, 191–199. <https://doi.org/10.1177/140349480203000305>
- Vaalavuo, M., 2016. Deterioration in health: What is the role of unemployment and poverty? *Scand J Public Health* 44, 347–353. <https://doi.org/10.1177/1403494815623654>
- Vahtera, J., Kivimäki, M., Forma, P., Wikström, J., Halmeenmäki, T., Linna, A., Pentti, J., 2005. Organisational downsizing as a predictor of disability pension: the 10-town prospective cohort study. *Journal of Epidemiology & Community Health* 59, 238–242. <https://doi.org/10.1136/jech.2004.021824>
- van den Berg, T.I., Robroek, S.J., Plat, J.F., Koopmanschap, M.A., Burdorf, A., 2011. The importance of job control for workers with decreased work ability to remain productive at work. *Int Arch Occup Environ Health* 84, 705–712. <https://doi.org/10.1007/s00420-010-0588-1>
- van der Klink, J.J., Bültmann, U., Burdorf, A., Schaufeli, W.B., Zijlstra, F.R., Abma, F.I., Brouwer, S., van der Wilt, G.J., 2016. Sustainable employability – definition, conceptualization, and implications: A perspective based on the capability approach. *Scand J Work Environ Health* 42, 71–79. <https://doi.org/10.5271/sjweh.3531>
- van Vegchel, N., de Jonge, J., Bosma, H., Schaufeli, W., 2005. Reviewing the effort–reward imbalance model: drawing up the balance of 45 empirical studies. *Social Science & Medicine* 60, 1117–1131. <https://doi.org/10.1016/j.socscimed.2004.06.043>
- van Vilsteren, M., van Oostrom, S.H., de Vet, H.C., Franche, R.-L., Boot, C.R., Anema, J.R., 2015. Workplace interventions to prevent work disability in workers on sick leave. *Cochrane Database of Systematic Reviews*. <https://doi.org/10.1002/14651858.CD006955.pub3>
- Vinnerljung, B., Brännström, L., Hjern, A., 2015. Disability pension among adult former child welfare clients: A Swedish national cohort study. *Children and Youth Services Review* 56, 169–176. <https://doi.org/10.1016/j.childyouth.2015.07.001>
- Virtanen, M., Kawachi, I., Oksanen, T., Salo, P., Tuisku, K., Pulkki-Raback, L., Pentti, J., Elovainio, M., Vahtera, J., Kivimäki, M., 2011. Socio-economic differences in long-term psychiatric work disability: prospective cohort study of onset, recovery and recurrence. *Occupational and Environmental Medicine* 68, 791–798. <https://doi.org/10.1136/oem.2010.061101>
- Virtanen, M., Kivimäki, M., Vahtera, J., Elovainio, M., Sund, E.R., Virtanen, P., Ferrie, J.E., 2006. Sickness absence as a risk factor for job termination, unemployment, and disability pension

- among temporary and permanent employees. *Occupational and Environmental Medicine* 63, 212–217. <https://doi.org/10.1136/oem.2005.020297>
- Virtanen, M., Lallukka, T., Ervasti, J., Rahkonen, O., Lahelma, E., Pentti, J., Pietiläinen, O., Vahtera, J., Kivimäki, M., 2017. The joint contribution of cardiovascular disease and socioeconomic status to disability retirement: A register linkage study. *International Journal of Cardiology* 230, 222–227. <https://doi.org/10.1016/j.ijcard.2016.12.166>
- von Bondorff, M.B., Törmäkangas, T., Salonen, M., von Bonsdorff, M.E., Osmond, C., Kajantie, E., Eriksson, J.G., 2015. Early Life Origins of All-Cause and Cause-Specific Disability Pension: Findings from the Helsinki Birth Cohort Study. *PLOS ONE* 10, e0122134. <https://doi.org/10.1371/journal.pone.0122134>
- Wallman, T., Wedel, H., Palmer, E., Rosengren, A., Johansson, S., Eriksson, H., Svärdsudd, K., 2009. Sick-leave track record and other potential predictors of a disability pension. A population based study of 8,218 men and women followed for 16 years. *BMC Public Health* 9. <https://doi.org/10.1186/1471-2458-9-104>
- Wright, E.O., 2015. *Understanding class*. Verso, London, New York.



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