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FACULTY OF MEDICINE  
UNIVERSITY OF HELSINKI

**WORK DISABILITY  
AMONG YOUNG EMPLOYEES  
CHANGES OVER TIME AND  
SOCIOECONOMIC DIFFERENCES**

Hilla Sumanen

ACADEMIC DISSERTATION

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## Supervisors

Professor Ossi Rahkonen  
Department of Public Health  
University of Helsinki  
Helsinki, Finland

Professor Eero Lahelma  
Department of Public Health  
University of Helsinki  
Helsinki, Finland

PhD Jouni Lahti  
Department of Public Health  
University of Helsinki  
Helsinki, Finland

## Reviewers

Associate Professor Ellenor Mittendorfer-Rutz  
Department of Clinical Neuroscience  
Karolinska Institutet  
Stockholm, Sweden

Docent Pekka Virtanen  
School of Health Sciences  
University of Tampere  
Tampere, Finland

## Opponent

Professor Clas-Håkan Nygård  
School of Health Sciences  
University of Tampere  
Tampere, Finland

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- IV Sumanen H, Lahti J, Lahelma E, Pietiläinen O, Rahkonen O. 12-year trends in occupational class differences in short sickness absence among young women. *Scandinavian Journal of Public Health*, 2015;43:441-444.
- V Sumanen H, Rahkonen O, Pietiläinen O, Lahelma E, Roos E, Lahti J. Educational differences in disability retirement among young employees. *European Journal of Public Health*, 2015 Dec 17, [Epub ahead of print].

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## ABBREVIATIONS

CI	Confidence interval
DR	Disability retirement
HR	Hazard ratio
RII	Relative Index of Inequality
RR	Relative risk
SA	Sickness absence
SEP	Socioeconomic position
WAI	Work Ability Index

## ABSTRACT

Work disability among young employees is a major risk for future employment and for extending working careers. Current sickness absence and disability retirement rates indicate a rising trend in reported ill health among young adults, but still they are considered a minority in health-related research and further details are lacking. Moreover, socioeconomic differences in work disability are widely recognised among older adults, but studies among younger cohorts are scarce. The aim of this study was to examine changes in sickness absence, and socioeconomic differences in sickness absence and disability retirement among young, 18-34-year-old female and male employees between 2002 and 2013.

This research is register-based and is part of the Helsinki Health Study. The City of Helsinki's personnel and sickness absence registers were used to obtain socio-demographic characteristics and individual-level information on sickness absence. Information on education was obtained from Statistics Finland's register of completed education and degrees, and information on disability retirement was derived from the national register of the Finnish Centre for Pensions. Employees under the age of 35 were considered young. Those aged 35-54 comprised the reference group in two of the sub-studies. All appropriately aged members of staff permanently and temporarily employed by the City of Helsinki between 2002 and 2013 were included in the analyses. Annual sickness absence days, overall spells and spells of 1-3, 4-14 and 15+ days, as well as disability retirement events were used as outcome variables. Education was classified on four levels annually according to the highest qualification. Occupational class was assigned to one of four categories on the basis of the job title, and income quartiles were based on the monthly salary. Joinpoint regression modelling, quasi-likelihood Poisson regression, the relative index of inequality (RII) and Cox proportional hazard models were used for the statistical analyses.

The results showed an initial increase and then a decrease in sickness-absence trends during the study period of 2002-2013. The turning points were predominantly between 2007 and 2010, depending on the groups under investigation and the length of the sickness absence. Young employees had more short and intermediate spells, but less long sickness absence, than older employees. Education turned out to be the strongest determinant of sickness absence among young employees, and followed a clear gradient. The

magnitude of educational differences in sickness absence spells remained broadly stable in 2002-2013 among the young women, but increased with regard to days of absence. There was a slight decrease in the magnitude of educational differences in sickness absence among the young men. The occupational class differences in short sickness absence spells were not fully consistent in that routine non-manual workers had more than the lowest occupational class, in other words manual workers. Disability retirement due to any cause, and to mental and non-mental causes, followed a clear educational gradient, and mental disorders in particular led to disability retirement among young employees.

This study yields new and important knowledge on work disability among young employees. There were changes in sickness absence trends among young employees during this study period. These young employees had a considerable amount of sickness absence, although the bulk of it was taken in short and intermediate spells, and less in long spells: this distinguishes the younger employees from the older ones. Findings on socioeconomic differences in work disability among young employees mainly supported the previous knowledge received among older employees. The results showed that young employees should be taken into account in the design and implementation of measures for preventing work disability. Workplace and job demands should be better matched with employees' work abilities. Planned and systematic health check-ups, which exemplify the efficient use of resources, should also cover young employees, not just those who are aging or who already have disabilities. Young employees in lower socioeconomic positions are in particular need of such extra efforts. Changes in work disability among young employees should be studied and monitored more effectively, and the resulting information should be used to evaluate earlier preventive measures and to further develop efficient ways of reducing work disability.



## TIIVISTELMÄ

### **Nuorten työntekijöiden työkyvyttömyys. Muutokset ajassa ja sosioekonomiset erot.**

Nuorten työntekijöiden työkyvyttömyys muodostaa suuren riskin tulevaisuuden työnteolle ja työurien pidentämiselle. Sairauspoissaolo- ja työkyvyttömyyseläketilastot näyttävät, että sairastaminen on lisääntynyt nuorten aikuisten keskuudessa. Silti kyseinen ryhmä on vähemmistönä terveyteen liittyvissä tutkimuksissa. Työkyvyttömyyden sosioekonomiset erot ovat pitkälti tunnettuja vanhemman väestön keskuudessa, mutta huonosti tunnistettuja nuoremmilla aikuisilla. Tämän tutkimuksen tarkoituksena oli tutkia sairauspoissaolojen muutoksia sekä sairauspoissaolojen ja työkyvyttömyyseläkkeiden sosioekonomisia eroja nuorilla, 18–34 -vuotiailla nais- ja miespuolisilla työntekijöillä vuosina 2002–2013.

Tutkimus on rekisteritutkimus ja osa Helsinki Health Studya. Helsingin kaupungin henkilöstö- ja sairauspoissaolorekistereistä saatiin tiedot sosiodemografisista tekijöistä sekä sairauspoissaaloista. Koulutustiedot saatiin Tilastokeskuksen tutkintorekisteristä. Tiedot työkyvyttömyyseläkkeistä saatiin Eläketurvakeskuksen ylläpitämästä rekisteristä. Alle 35 -vuotiaat katsottiin tässä tutkimuksessa nuoriksi, ja 35–54 -vuotiaita käytettiin vertailuryhmänä kahdessa osatutkimuksessa. Kaikki tutkimuksen kannalta oikean ikäiset Helsingin kaupungin vakituiset ja määräaikaiset työntekijät vuosilta 2002–2013 otettiin mukaan analyysiin. Vuosittaiset sairauspoissaolopäivät, yhteenlasketut sairauspoissaalojaksot sekä 1–3, 4–14, 15+ päivän pituiset sairauspoissaalojaksot ja työkyvyttömyyseläkkeet toimivat vastemuuttujina. Koulutustaso jaettiin neljään ryhmään korkeimman saavutetun tutkinnon perusteella. Ammattiasema jaettiin neljään ryhmään ammattinimikkeiden perusteella. Kuukausipalkka jaettiin kvartiileihin. Aineisto analysoitiin joinpoint regressiolla, Poissonin regressiolla, relatiivisella eriarvoisuusindeksillä ja Coxin suhteellisten riskien mallilla.

Tulokset osoittavat, että sairauspoissaolotrendit ensin nousivat ja sitten laskivat aikavälillä 2002–2013. Trendien käännekohdat sijoittuivat enimmäkseen vuosiin 2007–2010 tarkastelun alla olevasta ryhmästä ja sairauspoissaolon pituudesta riippuen. Nuorilla työntekijöillä oli enemmän lyhyitä ja keskipitkiä sairauspoissaaloja, mutta vähemmän pitkiä sairauspoissaaloja, kuin vanhemmilla työntekijöillä. Koulutustaso osoittautui vahvimaksi ja johdonmukaisimmaksi sairauspoissaolojen määrittäjäksi nuorilla työntekijöillä. Koulutustasojen välisen eron suuruus

sairauspoissaolajaksoissa pysyi melko tasaisena nuorilla naisilla tutkimusjakson ajan, mutta ero kasvoi kun tarkasteltiin sairauspoissaolopäiviä. Nuorilla miehillä koulutustasojen välisten erojen suuruus sairauspoissaoloissa väheni hieman. Ammattiasemien väliset erot lyhyissä sairauspoissaoloissa olivat epäjohdonmukaisia, sillä alemmilla toimihenkilöillä oli enemmän lyhyitä sairauspoissaoloja kuin alimmalla ammattiasemaryhmällä, eli manuaalista työtä tekeville. Kaikista syistä johtuvat, sekä mielenterveys- että muut kuin mielenterveyssyistä johtuvat työkyvyttömyyseläkkeet lisääntyivät johdonmukaisesti koulutustason laskiessa. Varsinkin mielenterveysongelmat aiheuttivat työkyvyttömyyseläkkeitä nuorilla työntekijöillä.

Tämä tutkimus antoi uutta ja tärkeää tietoa nuorten työntekijöiden työkyvyttömyydestä. Nuorten työntekijöiden sairauspoissaolotrendeissä on ollut muutoksia tutkimusjakson aikana. Nuorilla työntekijöillä on paljon sairauspoissaoloja, vaikkakin sairauspoissaolojen pituus on erilainen vanhempiin työntekijöihin verrattuna. Nuorilla painottuvat lyhyet ja keskipitkät ja vanhemmilla työntekijöillä pitkät sairauspoissaolot. Tulokset työkyvyttömyyden sosioekonomisia eroja koskien noudattavat pitkälti vanhempien työntekijöiden parissa tehtyjen tutkimusten tuloksia. Tämä tutkimus osoitti, että myös nuoret työntekijät tulisi huomioida kun työkyvyttömyyttä ennaltaehkäiseviä toimia suunnitellaan ja toteutetaan. Työolot ja työn vaatimukset pitäisi saada paremmin sovitettua työntekijöiden olemassa olevaan työkykyyn. Suunnitellut ja systemaattiset, resursseja tehokkaasti hyödyntävät terveystarkastukset tulisi ulottaa myös nuoriin, eikä vain heihin jotka ovat ikääntymässä tai osoittavat työkyvyttömyyden merkkejä. Erityisesti matalan sosioekonomisen aseman omaavat nuoret työntekijät ovat erityistuen tarpeessa. Nuorten työkyvyttömyyden muutoksia tulisi jatkossa tutkia ja tarkkailla enemmän, koska kerätty tieto auttaa aikaisempien ennaltaehkäisevien toimien tehokkuuden arvioinnissa ja uusien työkyvyttömyyttä vähentävien toimien suunnittelussa.

# 1 INTRODUCTION

Young employees play a key role in extending working careers in the light of the projected labour shortage attributable to demographic changes (Burdorf, Jarvholm & Härmä 2014). Work disability at an early age is a challenge for future employment, and ill health among young adults is increasing in many countries, Finland being no exception (Kaltenbrunner Bernitz et al. 2013; The Social Insurance Institution of Finland 2014). This trend is alarming, but given the focus in previous studies mainly on older age groups, little is known about work disability among young employees, and there is a knowledge gap with regard to age differences. Young employees are generally in the minority in health-related research, although many environmental and behavioural factors that contribute to health settle during early adulthood as young people are finishing their education, starting employment and building their lives (Bartley, Blane & Montgomery 1997; Koskinen et al. 2005).

Sickness absence and disability retirement are used as measures of work disability in this study. Work disability is related to the incapacity to perform one's own work, and individual causes, workplace factors and societal aspects contribute to its severity. The length of sickness absence spell reflects different stages of work disability: short spells may not relate only to ill health, and longer spells indicate more severe problems (Vahtera et al. 1999a). There is evidence that sickness absence patterns are different among younger and older employees: younger ones are more likely to be absent for short spells, whereas older ones tend to have longer spells (Allebeck & Mastekaasa 2004). However, thus far knowledge on age differences in sickness absence has been limited to this detail. Sickness absence may lead to disability retirement, which is the ultimate consequence of work disability. The age of the retiree is a highly relevant aspect in that most younger persons would have more opportunities to continue working after rehabilitation and possible vocational retraining (Laaksonen & Gould 2014b).

Socioeconomic position is a key concept in dividing populations into ordered groups. It is widely used in health-related research because of the wide, increasing and global differences, but still quite poorly understood explanatory factors. Previous studies on socioeconomic differences in sickness absence and disability retirement have rarely covered younger employees, whereas there is an extensive amount of research focusing on older age groups. Socioeconomic position is measured in many studies in terms of education, occupational class and income, all of which refer to material and non-material

resources (Lahelma & Rahkonen 2011). These measures are interrelated, but also have independent effects on work disability (Lahelma et al. 2004). Given the increasing amount of work disability among the young, there is a need for further knowledge about socioeconomic differences in this context and their likely significance in terms of disability prevention.

Work disability among young adults is a substantial economic burden for society in terms of sickness absence allowances, and in cases of early disability retirement the costs are enormous considering the years of lost working time. The number of sickness allowance days among 20-34-year-olds increased in Finland by 34 per cent between 2002 and 2013, and the number of paid sickness allowance days per recipient also increased by 20 per cent (The Social Insurance Institution of Finland 2014). The number of disability retirees among 20-34-year-olds also increased by 29 per cent during the same period (The Social Insurance Institution of Finland 2015). This trend has been widely recognised, and the prevention of disability retirement among young persons is high on the Finnish political agenda (State Treasury 2014). In addition, work disability among young employees has assumed increasing importance for employers in recent years for a variety of reasons, including the cost. The increased proneness among the young to short spells of sickness absence constitutes an economic burden for employers in terms of salary and temporary replacement costs, and overtime costs for existing staff (Barham & Leonard 2002). However, work disability in all its forms also has many unfortunate consequences for the employees concerned given that it may limit their social and material resources (Karlsson et al. 2008; Laaksonen & Gould 2014b; Norder et al. 2012).

This study examines recent changes and socioeconomic differences in work disability among young employees. As the workforce ages and working careers are being prolonged, there is a need for research on this topic that will facilitate the targeting of preventive measures and the effective focusing of resources at an early stage. The focus in the study is on changes in sickness absence trends, and socioeconomic differences in sickness absence and disability retirement among young, 18-34-year-old employees from the City of Helsinki, the largest municipal employer in Finland.

## **2 THE MAIN CONCEPTS OF THE STUDY**

### **2.1 Work disability**

Work disability is a wide concept encompassing several theories and models. The main conceptual views converge in a multifactorial etiology and the problem is seen as attributable to a combination of individual, environmental and societal causes (Durand et al. 2002; Ilmarinen et al. 2008; Nastasia, Coutu & Tcaciuc 2014; Pransky, Loisel & Anema 2011). In theory, work disability and work ability reflect the same phenomenon from two different perspectives.

The evaluation of work disability may be problematic because of the complex nature of the concepts, and it requires objective criteria, and expert application and estimation by the individual (Ilmarinen et al. 2008). Work disability in general is related to a reduction in task performance and a restricted ability or incapacity to perform normal work. However, identical impairments may result in different degrees of disability. The fit between employee health and abilities and the work environment defines the severity of work disability: in some cases impairment may have no incapacitating effects, whereas in others it may have severe consequences on the ability to perform work tasks. Aspects of the social environment such as available support, personal connections and relationships, also affect this relationship. (Ilmarinen et al. 2008; Labriola 2008; Stattin 2005.)

Work disability is not a dichotomous phenomenon or a permanent state. On the contrary, it should be seen as dimensional, ranging from temporary impairment in performing work-related tasks through varying lengths of sickness absence to permanent disability (Labriola 2008; Roos 2014). Different lengths of sickness absence and eventual disability retirement are used in this study to measure the severity of work disability.

#### ***Sickness absence***

Sickness absence generally means temporary absence from work due to illness that affects one's ability to do one's work (Gjesdal & Bratberg 2003; Kivimäki et al. 2008; Marmot et al. 1995; Selander & Buys 2010), and may be used as an integrated measure of physical, psychological and social

functioning among working populations (Kivimäki et al. 2003; Marmot et al. 1995). Sickness absence is a complex phenomenon influenced by a variety of factors, including general health, work-environment exposures, and demographic and other details such as organisational aspects, the availability of substitutes and social life (Barham & Leonard 2002; Labriola 2008; Lund, Labriola & Villadsen 2007; Siukola et al. 2011; Siukola, Nygård & Virtanen 2013). Theories about sickness absence as well as previous studies suggest that satisfaction with the company, work situation itself (Ås 1962), the amount of workload (Hultin et al. 2012) and the workplace absence culture, i.e. the shared views of absence in the work community (Nicholson & Johns 1985; Allebeck & Mastekaasa 2004; Väänänen et al. 2008) likely influence the decision-making whether or not take absence from work. All these factors are subject to change, if the organisational structure and culture, staff, personnel resources or society at large undergo changes for example because of cyclical fluctuations of the economy. Such changes may influence sickness absence trends as well. Age-related psychosocial and behavioural factors and their impacts on sickness absence are equally important and introduced in the next chapter.

The duration of sickness absence is often viewed as a measure of the severity of the illness or condition, and is also a key feature in related research (Gjesdal & Bratberg 2003). The length of sickness-absence spells depends on the medical condition and diagnosis, and also on work-related problems, the social atmosphere at the workplace and the employee's personal factors (Beemsterboer et al. 2009; Gjesdal & Bratberg 2003). Sickness absence is commonly divided into short, usually self-certified spells and long, medically certified absence, although definitions vary. Nevertheless, previous research indicates that these two measures represent different causes of absence (Vahtera et al. 1999a).

Shorter sickness absence may, to some extent, reflect employees' perceptions of their health and their behaviour in response to illness rather than actual physical disease (Janssen et al. 2003; Marmot et al. 1995; Moncada et al. 2002; Stapelfeldt et al. 2013; Vahtera et al. 1999a; Verhaeghe et al. 2003). Short spells of absence may be related to motivational issues (Janssen et al. 2003; Vahtera et al. 2004), and could be considered a type of coping behaviour (Verhaeghe et al. 2003), potentially used to exert practical self-control over working times (Ala-Mursula et al. 2006; Moncada et al. 2002). From the employer's viewpoint short absences could be considered annoying in terms of lost working hours and difficulties in finding replacements at short notice (Roelen et al. 2014). However, frequent short spells in particular predict

longer sickness absence, and consequently are not trivial in terms of health and work ability (Hultin et al. 2012; Laaksonen, He & Pitkaniemi 2013).

Longer sickness absence is likely to relate to actual medical illness (Kivimäki et al. 2003; Marmot et al. 1995; North et al. 1993), and results in high productivity losses for employers. Medical expenses, sickness allowances and the potential onset of other disorders such as depression also make long sickness absence a societal problem in countries in which it is compensated by the state, as in Finland (Henderson, Glozier & Holland Elliott 2005; Roelen et al. 2014; Vingard, Alexanderson & Norlund 2004). There are also potential consequences for the employee, such as a weakened financial position, social isolation and exit from working life (Bryngelson 2009; Henderson et al. 2005; Roelen et al. 2014).

The frequency of sickness absence, meaning the number of spells of absence an employee has in a year (Beemsterboer et al. 2009), is another significant aspect in terms of employee health. Indeed, it has been seen as an indicator of voluntary absence, younger employees tending to have more sickness absence than older ones (Martocchio 1989). It is strongly connected to employee motivation, attitudes towards work and job satisfaction on the one hand, but also reflects serious illness on the other (Beemsterboer et al. 2009). However, a history of sickness absence is associated with sickness absence in the future (Borg, Hensing & Alexanderson 2004; Roelen et al. 2011), which implies that frequency is a strong indicator of an employee's future sickness absence behaviour. Sickness presenteeism, which means working despite not being well and thereby a reduced level of performance (Vanni et al. 2012), is a further risk factor for future sickness absence (Bergstrom et al. 2009), especially related to mental health (Taloyan et al. 2012).

The Finnish Social Insurance Institution pays sickness allowance as compensation for the loss of earnings through illness. All 16-67-year-olds who are in employment during the three months preceding the illness are eligible for the allowance if they are unfit for work for medical reasons. It is paid when work incapacity lasts over 10 working days, but less than one year, and is based on taxed earnings. If the employee receives a salary while on sick absence, the allowance is paid to the employer. (Social Insurance Institution 2012.)

## ***Disability retirement***

Disability retirement is a major problem in Western work life and public health as it is a burden on the national economy, and has adverse consequences for the individual given that work is an important source of material and mental wellbeing (Karlsson et al. 2008; Laaksonen & Gould 2014b).

All 16-64-year-olds in Finland are eligible for disability retirement if their ability to undertake gainful employment has deteriorated over at least a year on account of a diagnosed psychiatric or physical illness. The disability pension is determined in accordance with the national pension system and the earnings-related pension. Earnings-related pensions are based on the employee's history of paid work or self-employment, and are managed by the earnings-related pension insurance companies, as well as industry-wide and company pension funds. The pension insurance company through which the employee was last insured pays the disability pension. For example, the Keva pension insurance company handles earnings-related pensions in the municipal sector. The disability pension is paid until the person concerned qualifies for an old-age pension. (Finnish Centre for Pensions 2015; Keva 2014) In the case of young people, however, the disability pension is usually based on the national pension system because the young do not usually have a sufficiently long working history to accrue an earnings-related pension (Gould & Nyman 2010).

The evaluation of a person's work ability comprises an overall assessment of diagnosed illness, occupation, work experience, age and other social factors. Disability retirement is granted when the applicant cannot find a suitable job, or his or her work ability does not meet the requirements of any job. (Laaksonen & Gould 2014a.)

Disability retirement may be granted as permanent, part-time or temporary (Finnish Centre for Pensions 2013). Permanent or part-time retirement is granted if work ability has been lowered by at least three fifths or two fifths, respectively, for at least a year. Temporary retirement, e.g. rehabilitation benefit is granted if there is a possibility that work ability will be restored through medical and vocational rehabilitation, and return to work is possible. It is often granted to younger disability retirees in particular.



## 2.2 Work disability among young employees

Differences in the ability to work are evident even among young employees. Nevertheless, research on work disability thus far has tended to focus on older age groups rather than the young. Although most younger adults have better health than older people (Donders et al. 2012; Griffiths 2000; Taimela et al. 2007), 25 per cent of 18-29-year-olds in Finland have a chronic illness such as a mental disorder, musculoskeletal problems, asthma or skin disease, and one third of them estimate their physical fitness to be average at best (Kestilä et al. 2006; Koskinen et al. 2005).

Many factors contribute to perceived work ability among young employees, including self-perceived and physical health, family-related factors, lifestyle, quality of life and workplace aspects such as decision latitude, job security, support from supervisors and respect gained in one's own job (Donders et al. 2012; Schou, Storvoll & Moan 2014). Moreover, the labour-market situation has become more problematic during the 2000s and the proportion of fixed-term and periodic contracts has increased, as has unemployment (Seitsamo, Tuomi & Ilmarinen 2008). Factors such as these may constitute a disability risk in that prolonged unemployment may decrease functional capacity even among the young, and therefore contribute to later work disability (Helgesson et al. 2013; Seitsamo et al. 2008).

Work disability, measured in terms of sickness absence, is patterned differently among younger and older employees. Several studies report that the amount of short sickness absence is higher among young employees and decreases as they get older (Arola et al. 2003; Barham & Leonard 2002; Hultin et al. 2012; Laaksonen, Mastekaasa et al. 2010; Moncada et al. 2002; Nielsen et al. 2006; Thomson, Griffiths & Davison 2000; Thorsen et al. 2015; Vahtera, Pentti & Kivimäki 2004). It has also been shown that age has a positive relationship with medically certified sickness absence (Alavinia et al. 2009; Barham & Leonard 2002; Hensing et al. 2000; Hussey et al. 2012; Lund et al. 2007; Moncada et al. 2002; Nielsen et al. 2006; Rhodes 1983; Thomson et al. 2000; Vahtera et al. 2004). In other words, young employees have fewer long sickness absence spells than their older counterparts, and the total burden of sickness absence increases with age.

Younger employees might stay away from work because of minor health complaints, such as headaches, fatigue and nausea, more easily than older employees, or just suffer from them more often (Donders et al. 2012; Taimela

et al. 2007; Thomson et al. 2000). Moreover, unlike older employees, they may recover more rapidly from illnesses and therefore have more short than long absences (Tenhiälä et al. 2013). In addition, self-perceived work disability is more strongly connected to sickness absence among the under-40-year-olds than among employees who are older (Nygård et al. 2005).

There may be some psychosocial and behavioural differences between younger and older employees, and their attitudes towards work and values might be different (Taimela et al. 2007; Thomson et al. 2000). Explanations reflect employee motivation, overall job satisfaction and work attitudes. The person-environment fit helps to explain the inverse relationship between age and sickness absence: a poor fit means that younger employees have not yet found a working environment that is compatible with their behavioural tendencies, and might decide to stay away from work in what could be considered avoidable absences (Sneider 1983). There is ample evidence that older employees are more satisfied with and attached to their work (Rhodes 1983), which reflects the development of a person-environment fit over time as people seek a better fit for themselves (Martocchio 1989). It also implies higher satisfaction in terms of job demands, occupational class, income and other things that usually develop over time and with experience (Rhodes 1983). Young employees may also find the work environment more demanding than older employees (Winding et al. 2015). This could reflect the novelty of the work, but on the other hand it may also make it more interesting, and thus satisfaction levels may decrease with experience (Rhodes 1983). Moreover, young employees might have chosen their occupation based on the labour-market situation rather than on their own preferences (Krane et al. 2014). In such cases their desire to work could be low and therefore their personal threshold for calling in sick could also be lower, which reflects the person-environment fit and its outcomes.

The ultimate consequence of work disability is disability retirement, which is less common among younger employees than their older counterparts (Gjesdal, Lie & Maeland 2004; Karlsson et al. 2008; Månsson et al. 1994; Pedersen et al. 2012; Polvinen, Laaksonen et al. 2013). In fact, a young age is a major protective factor against disability retirement, and the risk increases continuously with age among the over-30s (Gjesdal & Bratberg 2003). Previous sickness absence is nevertheless a risk factor for disability retirement among young adults (Borg, Hensing & Alexanderson 2001), which corresponds to the requirement that retirement is granted only after a long period of sickness absence (one year in Finland). The continuum from sickness absence to disability retirement may be visible at quite an early stage

among the young. It was reported in a Swedish study that there was already a difference in sickness absence between those who were granted disability retirement later on and those who were not during the first two years of an 11-year follow-up (Festin & Alexanderson 2009). One explanation for this is that being on sickness absence for long periods of time early in one's life or working career may enhance the tendency to assume the role of a sick person (Borg et al. 2001).

Disability retirement granted at a young age is a serious problem in terms of the potential loss of decades of working time (Lund et al. 2008; Mykletun et al. 2006). The most commonly diagnosed reason for disability retirement among young adults in Finland and in many other Western countries is a mental disorder, and musculoskeletal reasons are rare. (Gould & Nyman 2010; Kaltenbrunner Bernitz et al. 2013.) This aspect differentiates younger adults from older people, among whom the leading reason for disability retirement has been musculoskeletal diseases, followed by mental disorders (Knudsen et al. 2013).

Up to 90 per cent of disability retirement among 18-34-year-olds is granted on a temporary basis. This again distinguishes younger from older adults given that the proportion of temporary retirement is much smaller in older age groups (Laaksonen & Gould 2014b; Månsson et al. 1994). Temporary retirement incorporates vocational retraining and rehabilitation (Järvisalo et al. 2005; Laaksonen & Gould 2014b), which are widely used among younger recipients to facilitate their return to work in another, more suitable occupation or job (Social Insurance Institution of Finland 2014). Returning to work after temporary disability retirement is also clearly more common among younger than older adults in Finland, regardless of the medical reasons for the retirement (Laaksonen & Gould 2014b). Overall, in Western countries, permanent disability retirement is rarer among younger adults than older ones (Laaksonen & Gould 2014b; Månsson et al. 1994).

### ***Gender differences in work disability***

Several studies report a female excess in sickness absence of any length (Allebeck & Mastekaasa 2004; Casini et al. 2013; Laaksonen et al. 2010; Lund et al. 2007), and in disability retirement (Albertsen et al. 2007; Claussen & Dalgard 2009; Gjesdal et al. 2004; Karlsson et al. 2006; Krokstad, Johnsen & Westin 2002; Valset et al. 2007). However, most previous study populations represent broad age ranges, and research focusing on young employees is

limited. It appears from previous findings that work-related factors such as the psychosocial work environment (Casini et al. 2013; Labriola et al. 2011), physical work demands (Laaksonen et al. 2008) and occupational class (Casini et al. 2013; Feeney et al. 1998), as well as the work-family interface (Donders et al. 2012), could explain some of the female excess in sickness absence among working-aged people. Moreover, women might have a higher tendency to take sickness absence in order to prevent the worsening of complaints (Bekker, Rutte & van Rijswijk 2009).

Public-sector employment explains about 30 per cent of the gender difference in disability retirement among working-aged adults. The majority of public-sector employees in the Nordic countries are women. Many of the working environments are emotionally and physically demanding, such as in the fields of healthcare and childcare, and the jobs may also lack social support and pay low wages (Albertsen et al. 2007). The uneven income distribution between women and men may be a significant confounding factor (Claussen & Dalgard 2009; Gjesdal et al. 2004).

Young women in particular are at a higher risk of sickness absence than older women and men (Donders et al. 2012; Pedersen et al. 2012): they are at a fertile age, and pregnant women have more sickness absence than their non-pregnant counterparts (Ariansen 2014; Sydsjo, Sydsjo & Alexanderson 2001). A Norwegian study reports that sickness absence during pregnancy has increased considerably over the last two decades (Ariansen & Mykletun 2014), although according to another Norwegian study there may not be clear medical reasons for an increase in pregnancy-related sickness absence (Rieck & Telle 2013). The explanation may lie more in changes in attitudes towards work during pregnancy. Broader sickness absence criteria, including common complaints associated with pregnancy that are not normally considered an illness, may also explain some of the increase. It is further suggested that younger pregnant women may be more willing to be absent from work because they are worried or feel it is good for the baby (Rieck & Telle 2013).

Mental disorders also cause a lot of sickness absence among young employees, especially females (Bijl et al. 2002; Kessler et al. 2005). According to a US study, for example, depression has a lifetime prevalence of about 25 per cent among 18-29-year-olds (Kessler et al. 2003), and a relatively high recurrence rate (Hardeveld et al. 2010). Some studies report that repeated sickness absence because of mental disorders is more common among younger persons (Sado et al. 2014), and women in particular (Koopmans et

al. 2010). However, it has also been found that women are at a higher risk of disability retirement due to musculoskeletal diseases (Gjesdal, Bratberg & Maeland 2011), whereas men might face a higher risk of retirement due to mental disorders (Bratberg, Gjesdal & Maeland 2009; Wedegaertner et al. 2013). It is notable that these studies represent older participants, and that knowledge about gender differences in disability retirement among young employees is lacking.

### 2.3 Socioeconomic position and work disability

Socioeconomic position is a widely used concept in health-related research, and refers to material and non-material resources and the social and economic factors that influence the positions a person or a group holds in a hierarchical societal structure (Galobardes et al. 2006; Lahelma & Rahkonen 2011). It is consistently related to people's health (Huijts, Eikemo & Skalicka 2010), and a low socioeconomic position is generally associated with a higher frequency of a wide range of health problems and disability (Lorant et al. 2003; Mackenbach 1992).

Socioeconomic position in adulthood is often measured in terms of education, occupational class and income. These factors have a temporal order and are interrelated, but each has its own effects as well (Laaksonen et al. 2005; Lahelma et al. 2004). The effect of education on work disability is partly mediated through the succeeding occupational class, and further through income (Figure 1); the effect of occupational class is partly explained by preceding education or mediated through income; and the effect of income is partly explained by education and occupational class (Dahl 1994; Lahelma et al. 2004; Lynch & Kaplan 2000).

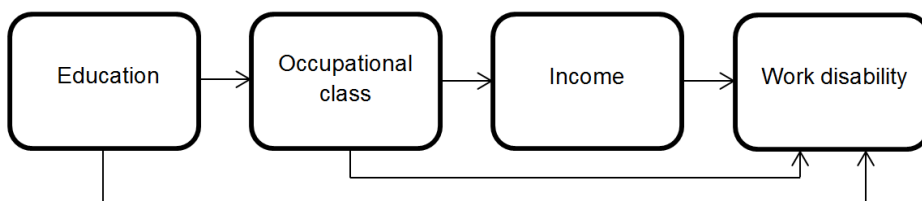


Figure 1. Interrelationships between the socioeconomic determinants of work disability (adapted from Lahelma et al. 2004).

Educational level is a hierarchical measure of socioeconomic position, and is usually determined in early adulthood. It relates more directly to knowledge and skills than other socioeconomic indicators and is therefore in a key role in health-related behaviours (Conti & Heckman 2010; Kestilä et al. 2009; Laaksonen et al. 2005). Highly educated employees are more knowledgeable about health-related issues and are better equipped to make healthier lifestyle choices (Galobardes et al. 2006). Education also provides the skills and qualifications required for succeeding in the labour market, reaching a high occupational class and attaining a high income (Galobardes et al. 2006).

Occupational class reflects the physical and psychosocial working environment, which affects health in many ways (Christensen et al. 2008; Vahtera et al. 1999b). Manual workers tend to have more physically demanding jobs, which may affect their ability to work when disability occurs. Occupations in which employees face high strain but have little control over environmental factors are known to increase the risk of work disability (Lund et al. 2005; Lund et al. 2006). There is also an association with heavy manual work, awkward postures and monotonous movements (Alavinia et al. 2009; Elders, Heinrich & Burdorf 2003; Holtermann et al. 2010; Lund et al. 2006) and shift work (Niedhammer et al. 2013), which are more typical of lower occupational positions. Those in higher occupational classes tend to have more flexibility in their work-related tasks, and therefore better opportunities to match their work with worsening health (Borg et al. 2004; G. Johansson & Lundberg 2009). However, such employees may also have more complex and mentally demanding jobs, and little social support from peers (Skakon et al. 2011).

Employment generates income, which reflects people's access to material resources (Laaksonen et al. 2005). Income provides the resources to buy healthier food, and allows access to services and health-related leisure activities (Galobardes et al. 2006). However, it is also the socioeconomic position indicator that can change most rapidly, whereas educational level remains once having been achieved, and occupational class is relatively stable if the employment continues (Galobardes et al. 2006).

Socioeconomic position differs to some extent among young adults and older people. It is not necessarily crystallised yet among the young, and may change with age: usually it is stable among middle-aged persons with a stabilised working career. The level of education determines the age at which completing one's educational career is possible, for example: basic education is normally finished as a teenager, lower-secondary education before the age

of 20, and upper-secondary and higher education in the mid-20s. Most over 25s have finished their educational career, and once established the level is not subject to major change (Krokstad, Kunst & Westin 2002). One's level of education also determines one's occupational class. Reaching a higher occupational class tends to require higher-level education, and therefore the youngest employees are rarely represented. This also affects income, which is usually higher in the upper occupational classes, which in turn are dominated by older employees. However, although differences in earnings between income groups may be smaller among younger adults, socioeconomic differences in health according to income are already present in early adulthood, among men in particular. (Huijts et al. 2010.)

Causality and health-related selection may explain the existence of socioeconomic differences in health, even among young adults. Causality means that an individual's socioeconomic position may contribute directly or through different mechanisms to health. For example, a low level of parental education may cause offspring to end up on a lower educational track (Kestilä et al. 2009), which may restrict them to lower occupational classes with more work exposure and low wages (Christensen et al. 2008; Vahtera et al. 1999a). Selection means that the health contributes directly or indirectly to the socioeconomic position in which the individual ends up (Lahelma & Rahkonen 2011).

### 3 A REVIEW OF THE LITERATURE

Sickness absence and disability retirement are widely researched in several fields, including medicine, the behavioural and social sciences and economics. However, young adults have not been the focus of attention. There is an overall lack of research on age differences in work disability: the tendency is to adjust for age and to ignore it when the results are reported (Allebeck & Mastekaasa 2004; Griffiths 2000). The participants in many studies on work disability or employee health represent a broader age range, or then the focus is on middle-aged or older workers. Moreover, the youngest employees are usually excluded in studies on work disability on account of fragmented employment or unfinished education.

Sickness absence trends among young adults, and socioeconomic differences in both sickness absence and disability retirement are poorly understood and there is a major gap in the research. For example, there are no studies focusing on young employees from a wide spectrum of working environments, and thus far none have investigated changes in short sickness absence spells among the young.

The first section of this literature review, 3.1, summarises the current understanding of sickness absence trends among young adults. Chapter 3.2 describes the socioeconomic differences in sickness absence and disability retirement reported in studies involving participants in more widely ranging age groups, and in the few studies focusing on young adults. Chapter 3.3 summarises the information on diagnostic labels in disability retirement among young adults.

Table 1 describes the studies concerning young adults that are identified this literature review in more detail, summarising them and giving the key points. The information in the table covers the data and the population, the age of the participants, the design and the measures of sickness absence, disability retirement and possible socioeconomic position, the main statistical methods used and the key results.



### **3.1 Sickness absence trends among young adults**

Sickness absence among young employees has been increasing in the Nordic countries in recent decades (Ariansen & Mykletun 2014; Krane et al. 2014), which reflects the trends among employees of all ages (Järvisalo et al. 2005; Piha et al. 2007). A Norwegian study (Krane et al. 2014) reports a significant increase in sickness absence rates between 2004 and 2008 among 20-29-year-old female municipal healthcare workers from two locations in Norway and Denmark: the number of sickness absence spells increased by 50 per cent in the Norwegian sample and 20 per cent in the Danish sample. The proportion of employees with more than six spells of absence increased specifically in this age group, and not so much among older employees in both countries. In particular, the number of 20-29-year-olds who had been on sickness absence for at least half of their working year increased during the period under study. The numbers of participants in the other age groups who were on sickness absence for at least half of the working year decreased in Norway, in contrast to Denmark in which it increased, but not as much as among the youngest age group. (Table 1.)

Another Norwegian study (Ariansen & Mykletun 2014) covered 20-44-year-old full-time employed men and first-time pregnant and non-pregnant women and their sickness absence spells of longer than 14-16-days between 1993 and 2007. The results show an increase in the number of long spells during the time period, which was evident especially among young, 20-24-year-old pregnant women, who also had the largest amount of sickness absence during the entire observational period. Overall, women had more sickness absence than men, which is in line with previous evidence. The increase was not entirely linear, however, as the number of long absences started to decline around 2003, but the level of sickness absence was still higher in 2007 than in 1993 in all the groups under study. (Table 1.)

Despite the lack of further studies on sickness absence trends among young adults, national statistics offer some information. The Social Insurance Institution of Finland maintains the national sickness insurance register, for example, which includes sickness absence periods of 10 or more working days. According to the register, the number of 20-34-year-olds who received sickness absence compensation increased by 21 per cent from 2002 to 2013 among women, but remained stable among men. However, there was a 47-per-cent increase in the number of days for which young women were compensated, and a 21-per-cent increase among young men. (The Social

Insurance Institution of Finland 2014.) A major shortcoming of the register is that there is no information about the size of the population, thus it is not known how much of the increase in sickness absence among young adults is associated with cohort differences.

Denmark is other Nordic country with accessible national sickness absence statistics, which for the governmental sector are available from 2003 to 2013. The registers only cover employees, and unlike the Finnish data also include those with no sickness absence in the calculations. According to the statistics, the approximate increase in the sickness absence rate from 2003 to 2013 was four per cent among the 20-34-year-old women, but 28 per cent among the men. Similarly, the average number of absence days per full-time-employed young person increased by only two per cent among the women, and 25 per cent among the men. The number of sickness absence spells remained almost the same among the women, but increased by 22 per cent among the men. (Statistics Denmark 2015.)

### **3.2 Socioeconomic differences in work disability**

Few previous studies focus on socioeconomic differences in sickness absence or disability retirement among young employees. There is ample evidence among employees more generally that those in lower socioeconomic positions are at a higher risk of sickness absence and disability retirement (Borg et al. 2004; Laaksonen, Piha et al. 2010; Lund et al. 2007; Moncada et al. 2002; Nielsen et al. 2006; North et al. 1993; Piha et al. 2007). Such findings are consistent irrespective of the socioeconomic indicator used, but some variation by diagnosis exists, particularly in the case of mental disorders (Roelen et al. 2012; Virtanen et al. 2011). Another rather consistent finding is that socioeconomic differences in sickness absence (Christensen et al. 2008; Hansen & Ingebrigtsen 2008; Laaksonen et al. 2010; Löve et al. 2013; Piha et al. 2007) and disability retirement (Falkstedt et al. 2014; Nilsen et al. 2012) are more pronounced among men than women.

## ***Education***

According to a previous study focusing on the interrelationships between education, occupational class, income and sickness absence among City of Helsinki personnel, education is a strong, independent determinant of medically certified sickness absence among 25-59-year-old women and men (Piha et al. 2010). Nevertheless, education is usually used as a background indicator in the research on sickness absence. There is some evidence of educational differences among young adults: it was found in a Norwegian study (De Ridder et al. 2013) that those who had dropped out high school during adolescence had a higher risk of medically certified sickness absence between the ages of 24 and 29. Negative previous life experiences and a poor parental socioeconomic position were associated with school dropout, which reflects the selection and causality of the consequences.

A Finnish study (Kujala et al. 2005) on a cohort of young employees with a mean age of 31 years examined the Work Ability Index (WAI) scores for young employed women and men. The researchers classified education on five levels and found that the proportion of excellent WAI scores systematically increased as the educational level rose. A lack of occupational education was also related to low WAI scores among both women and men. (Table 1.)

According to the results of a Norwegian study (Ariansen & Mykletun 2014) on 20-44-year-old full-time employed men and first-time pregnant and non-pregnant women, the levels of long sickness absence were higher among those with a primary- or secondary-school education than among those with a higher education. The differences were evident among pregnant women in particular, and were assumed to be associated with unhealthy work exposures. Moreover, the educational gradient in long sickness absence was steeper in 2006-2007 than in 1993-1994. (Table 1.)

It was found in another Norwegian study (Bruusgaard, Smeby & Claussen 2010) on 18-66-year-olds that educational differences in disability retirement existed throughout the whole educational classification, from primary school to doctoral education. Other studies have also found a strong negative association between educational level and disability retirement, as Hagen et al. (2000), for example, report in their Norwegian research on 20-53-year-old participants, with an 11-year-follow-up. (Table 1.)

There is evidence of an association between educational level and disability retirement among young adults. Bruusgaard et al. (2010) found that 18-29-year-old women and men with a low level of education (10-11 years) had a

slightly elevated risk of disability retirement, whereas those with more education faced smaller risks. Gravseth et al. (2007) reported an elevated risk of disability retirement by the age of 24-36 among those who had not matriculated by the age of 20 than among those who had matriculated. Women had a higher risk than men. The authors had similar results when they focused only on men: not matriculating by the age of 23 was associated with disability retirement (Gravseth et al. 2008). Similarly, De Ridder et al. (2013) found that school dropout in adolescence was strongly associated with disability retirement at the age of 24-29. Another interesting finding is that the increase in educational level among young adults reflects the importance of intellectual performance (Karnehed, Rasmussen & Modig 2015), which has previously been recognised as a major factor in receiving disability retirement at a young age (Gravseth et al. 2008). (Table 1.)

### ***Occupational class***

Occupational class is the most commonly used indicator of socioeconomic position in the research on sickness absence, but studies among younger employees are still limited to pregnant women. Previous findings have shown, for example, that 25-59-year-old municipal employees in manual occupations had two-to-three times more medically certified sickness absence than managers and professionals (Piha et al. 2007; Piha et al. 2010). However, there is some evidence of inconsistency in the socioeconomic gradient in the case of short sickness absence in that the lowest occupational class may not have the highest levels of short absence spells (Kristensen et al. 2010).

A Norwegian study (Ariansen 2014) examined the effect of occupational class on the association between age and sickness absence days among pregnant women aged 20 to over 40 years. The association before controlling for occupational class was U-shaped: those in their early 20s had the highest amount of absence whereas the over-40s had somewhat less. These results show that controlling for occupational class weakens the negative association between age and sickness absence among pregnant women, especially those in their first pregnancy. The implication is that working-class women, who dominate the age group of 20-24-year-olds, are more highly prone to sickness absence, which is in line with previous results on the association between occupational class and sickness absence. (Table 1.)

Similarly, there is ample evidence based on middle-aged employees or populations of an association between occupational class and disability

retirement (Leinonen et al. 2011; Månsson et al. 1998; Polvinen, Gould et al. 2013; Samuelsson et al. 2012a). Leinonen, Martikainen & Lahelma (2012) found in their population-based Finnish study with 30-63-year-old participants that occupational class had an independent association with disability retirement following adjustment for age, education, household income, marital status, dependent children and employment status.

### ***Income***

Very few studies have examined the association between income and sickness absence. One study (Piha et al. 2007) involving 25-59-year-old employees of the City of Helsinki reported an inconsistent association between medically certified sickness absence and individual income. For example, the lowest income quartile had less sickness absence than the second lowest. However, most of this partial gradient was attributable to the fact that more employees in the lowest income quartile were temporarily employed, and thus perhaps less likely to be absent than permanent staff. Piha et al. (2010) found in a further study that education and occupational class explained the effect of income on medically certified sickness absence. Relatively narrow income differences and public-health insurance and services in Finland might explain the lack of an individual effect of income on sickness absence, at least to some extent.

In the case of disability retirement, Gjesdal et al. (2004) found that a high income was a protective factor in their sample of the working-age population. However, the association with income was not linear. The authors gave some explanations for this, such as the large proportion of part-time workers among the women, and the fact that a higher income may be a protective factor against disability retirement through the increased possibility to adapt to work demands (Karlsson et al. 2008).

### **3.3 Diagnosed causes of disability retirement among young adults**

Mental and behavioural disorders are among the main causes of disability retirement among young adults in Finland, and in many other countries such as Denmark, Sweden, Norway, Iceland, the Netherlands and the UK.

Disability retirement due to such disorders is somewhat higher among young men than young women in the above-mentioned countries. (Kaltenbrunner Bernitz et al. 2013.)

Disability retirement on the grounds of mental disorders is commonly granted at a younger age than retirement due to other illnesses and disorders (Laaksonen & Gould 2014b). However, mental disorders tend to have phases of remission and recurrence, and their development and final outcome are hard to predict (Hardeveld et al. 2010; Laaksonen & Gould 2014b). For this reason, disability retirement granted on these grounds is often temporary, and covers a longer period than temporary retirement due to other diseases (Laaksonen & Gould 2014b).

Alexanderson, Borg & Hensing (2005) focused in their Swedish study among young adults on disability retirement on the grounds of musculoskeletal disease. They had a cohort of 213 persons aged 25-34 with over 27 days of sickness absence related to diagnosed back, shoulder or neck conditions in 1985. Within this sample, 22 per cent were granted disability retirement during an 11-year period, and the authors concluded that these diagnoses represented a very high risk of permanent disability for young adults: the risk among the women was almost double that among the men. Part-time or temporary retirement was more common among women, whereas men were more likely to be granted full-time disability retirement.

### **3.4 A summary of the previous research**

According to previous studies and available national registers from Finland and Denmark, there have been increasing trends in sickness absence among young employees in the Nordic countries in recent decades. According to one Norwegian study that also had Danish participants (Krane et al. 2014), the number of sickness absence spells, as well as the proportion of people with several spells during the working year, has increased strongly among 20-29-year-old women in both countries, Norway and Denmark. The study also reported a stronger increase among younger than among older employees. However, it concentrated only on women working in the field of healthcare, and the time period was only five years (2004-2008). Another Norwegian study reported an increase (with some variation) in long sickness absence among young adults, especially pregnant women, during the time period of

1993-2007 (Ariansen & Mykletun 2014). National sickness absence registers in Finland and Denmark attest to the increase in sickness absences, but are not easily comparable given the differences in the registers. Nevertheless, there is evidence that work disability, measured in terms of sickness absence, has increased over time among young adults, but there are major gaps in the knowledge. There is thus a need for studies covering changes up to more recent years, different lengths of sickness absence spells, and both genders.

Current knowledge about socioeconomic differences in work disability mainly concerns older employees, and the findings are rather consistent: those in lower socioeconomic positions are at a higher risk of sickness absence and disability retirement. Some research also covers younger adults, and the findings mainly support those observed among the working population within a wider age range, although the evidence is very limited. For example, no studies among young adults focus on changes in socioeconomic differences or in the interrelationships between socioeconomic indicators and work disability. Most disability retirements among young adults are granted on mental grounds (Kaltenbrunner Bernitz et al. 2013). They are often temporary, as the severity of work disability on these grounds is hard to predict in the long term (Laaksonen & Gould 2014b). Existing musculoskeletal disease constitutes a high risk for disability retirement at a young age (Alexanderson et al. 2005).

Table 1. Studies on young employees' work disability, reported as relevant for the present study

First author, year, country	Data, population, n	Ages	Design	SA/DR measure	SEP measure	Main statistical method, adjustments	Main results relevant to this study
<b>Alexanderson 2005, Sweden</b>	Young persons with over 27 days SA due to diagnosed back, shoulder or neck problems in 1985, participants from one municipality (n=213)	25-34-year-olds in 1985	Register-based study, 11-year follow-up	Full-time, partial and temporary DR	-	Pearson $\chi^2$ test and Fisher's exact test	22% of the sample granted DR during the follow-up; musculoskeletal diagnoses constituted a very high risk of permanent disability for young adults. Women had almost double the risk for DR. Part-time or temporary retirement was more common among women, whereas men were more often granted full-time DR.
<b>Ariansen 2014a, Norway</b>	Norwegian population, only full-time workers. Pregnant women (n=25,214/1993 and 31,846/2007), non-pregnant women (n=262,648/320,534) and men (n=481,965/507,715)	20-44	Register-based study, data from 1993 to 2007	SA spells covered by the national insurance (longer than 14-16 days)	Education: Primary, secondary and higher education	Linear regression, different models and adj., including age, education and income	The number of long SA spells increased during 1993-2007, especially among young pregnant women: 20-24-year-old pregnant women had the highest amount of SA. Those with a primary or secondary education had more SA than the more highly educated, the gradient in the case of long SA being steeper in 2006-2007 than in 1993-1994.



First author, year, country	Data, population, n	Ages	Design	SA/DR measure	SEP measure	Main statistical method, adjustments	Main results relevant to this study
<b>Ariansen 2014b, Norway</b>	Norwegian population, all pregnant employees 2004-2008 (n=180,483)	20-54	Register-based study, 2004-2008	SA days covered by national insurance (longer than 14-16 days)	Occupational class: agricult., semi-skilled, skilled, technic., lower routine, higher routine, lower prof., higher prof.	Zero-inflated Poisson regression, different models and adj., including working h, leave, year, marital status	Pregnant women in their early 20s had the highest amount of SA and the over 40s had somewhat less. Controlling for occupational class weakened the negative association between age and SA, especially among those in their first pregnancy. Thus working-class women who dominate the 20-24-year age group are more prone to SA.
<b>Bruusgaard 2010, Norway</b>	Ethnic Norwegians from 2003 (n=2,522,430)	Age group 18-34 given, age range 18-66	Register-based cross-section	DRs according to different diagnoses	Education: unfinished, primary, low-level second., second., low-level univers., university, research	Poisson regression	18-29-year-old women and men with a low level of education (10-11 years) had a slightly elevated risk of disability retirement. Those with more education faced smaller risks.

First author, year, country	Data, population, n	Ages	Design	SA/DR measure	SEP measure	Main statistical method, adjustments	Main results relevant to this study
<b>De Ridder 2013, Norway</b>	Norwegian Young-HUNT1 Survey (n=6,612) (51%/49%)	24-29-year-olds when followed for SA and DR  (13-20-year-olds when participating in the survey)	Survey data (conducted 1995-1997) and register linkages 1998-2008	SA spells covered by national insurance (longer than 14-16 days), all forms of DR	-	Logistic regression  Adj: health, health-rel. beh., psy.soc factors, school prob., parental SEP	Drop out from secondary school in adolescence was strongly associated with medically certified SA and DR at the age of 24-29.
<b>Gravseth 2007, Norway</b>	All Norwegians born in 1967-1976 who were alive, not on DR and who had not emigrated on their 20 <sup>th</sup> birthday (n=595,393)	24-36-year-olds, followed since the age of 20.	Register-based follow-up study	DR attributable to any causes in 1988-2003	Education: Low, high.	Cox proportional hazard regression	Those who had not matriculated by the age of 20 had a strongly elevated risk of DR than those who had. Women had a higher risk than men.
<b>Gravseth 2008, Norway</b>	Norwegian men born in 1967-1976, who were alive, not on DR had and not emigrated on their 23 <sup>rd</sup> birthday (n=302,330)	24-36-year-olds, followed since the age of 23.	Register based follow-up study	DR attributable to any causes in 1991-2003	Education: Low, high.	Cox proportional hazard regression	Men who had not matriculated by the age of 23 had an elevated risk of DR compared to those who had. Intellectual performance is an important factor in being granted DR at a young age

First author, year, country	Data, population, n	Ages	Design	SA/DR measure	SEP measure	Main statistical method, adjustments	Main results relevant to this study
<b>Kaltenbrunner-Bernitz 2013, Sweden</b>	Young adults receiving disability benefits from Finland, Sweden, Denmark, Norway, Iceland, the Netherlands and the UK.	19-29-year-olds	Study based on documents, interviews and statistics (1998-2011) based study	DRs based on different diagnoses	-	Content analysis, statistical methods not described	The number of young adults on disability benefits increased. Mental and behavioural disorders were the main reasons for DR among young adults in Finland, Denmark, Sweden, Norway, Iceland, the Netherlands and the UK. DR due to mental and behavioural disorders was somewhat higher among young men than young women.
<b>Karnehed 2015, Sweden</b>	Male Swedes born in 1951-1976 who were eligible for military conscription and had IQ information (n=1,229,346)	Under-30-year-olds.	Register-based study, all participants were followed until they were 30 years old.	DR attributable to any causes	Education: low, medium, high	Cox proportional hazard regression	The proportion of men granted DR before the age of 30 increased over time. A low IQ has become less important as a risk factor for DR and increased educational level may be part of the explanation.

First author, year, country	Data, population, n	Ages	Design	SA/DR measure	SEP measure	Main statistical method, adjustments	Main results relevant to this study
<b>Krane 2014, Norway</b>	Female municipal workers from the healthcare sector in two municipalities in Norway (n=3,181) and Denmark (n=8,545)	Age group 20-29 given, age range 20-67	Register-based study, data from 2004 to 2008	SA days and number of episodes	-	Linear and logistic regression models	SA rates increased in 2004-2008 among 20-29-year-olds. SA spells among 20-29-olds increased 50% in the Norwegian and 20% in the Danish data. The proportion of employees with 6+ SA spells increased especially among 20-29-year-olds. The number of employees on SA at least 50% of the year increased among 20-29-year-olds in particular.
<b>Kujala 2005, Finland</b>	Northern Finland Birth Cohort 1966, employed women (n=1,704) and men (n=2,021).	Mean age 31 years, SD 0.5	Clinical examination, postal questionnaire, data collected in 1997-1998	-	Education: unfinished or other/unknown, no vocational, vocational course or school, polytechnic or institute, academic	Not described	The proportion of excellent WAI systematically increased as the educational level rose. The lack of occupational education was related to a low WAI among both women and men.

<b>First author, year, country</b>	<b>Data, population, n</b>	<b>Ages</b>	<b>Design</b>	<b>SA/DR measure</b>	<b>SEP measure</b>	<b>Main statistical method, adjustments</b>	<b>Main results relevant to this study</b>
<b>Laaksonen 2014. Finland</b>	Finnish population, all temporary DR cases from the earnings-related pension system (n=10,269)	Age group 18-34 given, age range 18-62	Register-based study, data from 2008, and register linkages.	All temporary DRs starting in 2008	Education: basic, lower-sec., upper-sec., tertiary. Occupation: wage earners classified as manual and non-manual workers.	Competing risks regression, different models and adj., including age, gender, education, occup., employ. sector, employment and rehabilit.	Return to work after temporary DR was more common among the younger participants, regardless of the medical reasons. DR related to mental disorders granted at a younger age than DR related to other illnesses and disorders, in the former case the DR tended to be temporary and granted for a longer period than temporary DRs related to other diseases.

## 4 THE AIMS OF THE STUDY

### 4.1 The context

This study is part of the Helsinki Health Study on health and wellbeing among employees of the City of Helsinki, Finland (Lahelma et al. 2013). It covers the time period from 2002 to 2013.

The City of Helsinki is the capital of Finland, with more than 600,000 inhabitants (City of Helsinki Urban Facts 2014). The municipality is the largest employer in the country and its main areas of operation include healthcare, education, social services, public transport, culture, construction and technical services. The number of employees remained relatively stable during the study period, being 40,074 in 2002, 38,915 in 2008 and 40,139 in 2013 (City of Helsinki 2003; City of Helsinki 2009; City of Helsinki 2014). The employees have approximately 2,000 different occupations. The proportion of women during the study period was around 75 per cent (City of Helsinki 2008; City of Helsinki 2014), which is typical of municipalities in Finland.

All employees of the City of Helsinki are covered by the same personnel administration, registration systems and policies, which did not change very much during the study period (Lahelma et al. 2013). All employees working for the municipality have access to occupational healthcare services. The Occupational Health Centre of the City of Helsinki has been responsible for these services since 1964, and works in cooperation with management and work communities. Preventive healthcare services are provided as well as medical care focusing on illnesses and conditions that may weaken work ability. (Occupational Health Centre 2013.) Occupational health services started to focus on working communities rather than individuals in 2007, supporting the communities and providing comprehensive occupational-health services for superiors to improve their work ability and potential to support their subordinates. An 'early support' model, which requires superiors to discuss sickness absence with their subordinates, was also introduced. (City of Helsinki 2008.) Alongside with occupational health care, specialized medical care, as well as private doctors and general primary care can authorize sickness absence.

Finland went into an economic downturn in 2008, at the midpoint of the study period. This led to increased perceived job insecurity (Statistics Finland 2008). Studies have shown that downsizing reduces non-health-related absences, but increases ill health and long sickness absences (Blekesaune 2012). However, jobs are quite secure in the municipalities, given that the main operations must be carried out and that employees have strong protection against dismissal. The number of permanent staff of the City of Helsinki has increased during the economic downturn, and the number of fixed-term employees has remained quite stable. Moreover, the percentage of permanent employees resigning from their jobs has remained stable since the economic downturn started in 2008. (City of Helsinki 2014.)

## **4.2 The specific aims of the study**

The general aim of this study was to examine changes over time in sickness absence, and socioeconomic differences in sickness absence and disability retirement among young, female and male employees in the municipal sector from 2002 to 2013.

The specific aims were:

1. To examine 12-year trends in self-certified (1-3 days) and medically certified (4-14 and 15+ days) sickness absence spells among young, 18-24, 25-29 and 30-34-year-old female and male employees (Sub-study I).
2. To assess the interrelationships between education, occupational class and individual income as determinants of sickness absence among 25-34-year old female and male employees in 2002-2007 and 2008-2013 (Sub-study II).
3. To examine changes in educational differences in sickness absence among 25-34-year-old female and male employees from 2002 to 2013 (Sub-study III).
4. To examine occupational class differences in short sickness absence spells among 18-34-year-old female employees from 2002 to 2013 (Sub-study IV).
5. To study the association between educational level and disability retirement attributable to any cause as well as to mental and non-mental causes among 25-to-34-year-old employees from 2002 to 2013 (Sub-study V).

## 5 DATA AND METHODS

### 5.1 Data sources

The employer's personnel and sickness absence registers were used to obtain socio-demographic characteristics and individual-level information on sickness absence. The registers cover all employees. They are used as a basis for salary calculations and are therefore considered accurate. The personnel register data included information on the basic characteristics of the employees, such as age, gender, occupation, the work contract and individual income. The sickness absence register data included information on sickness absence and other interruptions to work to an accuracy level of one day. The form of the register data remained the same throughout the study period of 2002 to 2013.

Educational level (Sub-studies II, III and V) was obtained from Statistics Finland's register of completed education and degrees, and was linked to the City of Helsinki personnel register. The register in question is an accurate national register that includes the highest degree or the most recent qualification and is updated annually. Educational institutions and government agencies provide the information on degrees and qualifications. (Statistics Finland 2013.)

Information on disability retirement (Sub-study V) was derived from the national register of the Finnish Centre for Pensions, and was linked to the City of Helsinki personnel register. The Finnish Centre for Pensions register comprises all those granted disability retirement within the earnings-related retirement system, and includes the principal diagnosis triggering the retirement event, coded according to the International Classification of Diseases (ICD-10; WHO 2010), the type of retirement (permanent, part-time or temporary), the date of granting, and the date of expiry in cases of temporary retirement.

Statistics Finland's mortality register was used for censoring purposes in the statistical analyses of Sub-study V to identify deaths during the follow-up.



## 5.2 Ethical considerations

The Helsinki Health Study protocol follows the University of Helsinki's guidelines and data legislation (Lahelma et al. 2013). The ethics committees of the Department of Public Health, the University of Helsinki and the health authorities of the City of Helsinki approved the study. The City of Helsinki and register holders have given permission for data linkage.

## 5.3 Variables

All members of staff permanently and temporarily employed by the City of Helsinki from the years 2002 to 2013 are included in the analyses. Those under the age of 35 were classified as young. Employees aged between 35 and 54 years were used as the reference group in two of the sub-studies. The under-25s were excluded in the sub-studies in which sickness absence or disability retirement was examined according to educational level due to the potential incidence of unfinished (higher) education.

The following age groups were examined in the five sub-studies:

- I. 18-24, 25-29 and 30-34-year-olds, with 35-54-year-olds as the reference group
- II. 25-34-year-olds
- III. 25-34-year-olds with 35-54-year-olds as the reference group
- IV. 18-34-year-olds
- V. 25-34-year-olds.

Part-time employees, in other words those working less than 28 hours a week, and those with no registered income due to leaves of absence or other reasons were excluded from Sub-studies I-IV. Sub-study IV included only female employees.

Those employed on the grounds of employment subsidy granted by public employment and business services were excluded from Sub-studies II, III and V given the probability of skewed educational distributions.

Sub-study V was restricted to employees who had been employed for at least the maximum probation time (4 consecutive months; n=41,225) to guarantee

that the participants had normal work ability, and that occupational healthcare personnel had assessed their suitability for their work tasks.

### ***Sickness absence***

Consecutive and overlapping spells of sickness absence were combined. All absences other than on account of the employee's own illness, such as a child's illness or work injury, were excluded from the analyses. According to the practice of the City of Helsinki, employees may be on self-certified sickness absence up to three days, with the permission of their supervisor. A qualified nurse can certify a sickness absence spell lasting up to seven days, after which a doctor's certificate is mandatory.

In Sub-study I, spells of sickness absence were categorised in three groups according to their length: self-certified short 1-3-day spells, medically certified intermediate 4-14-day spells and long spells of more than 15 days. Annual sickness absence days were used as an outcome in Sub-study II, and annual sickness absence spells as well as days in Sub-study III. The focus in Sub-study IV was on short, self-certified sickness absence spells of between one and three days.

### ***Disability retirement***

Permanent, part-time and temporary disability retirement events were included in Sub-study V. The diagnostic causes for disability retirement were classified to three groups: 1) any cause, 2) mental causes (mental and behavioural disorders; ICD-10 codes F00-F99) and 3) non-mental causes (all others). The starting and expiry dates were also used in cases of temporary disability retirement, as well as the specified diagnostic reasons in the case of retirement due to mental causes.

### ***Education***

Education was classified on four levels annually according to the highest qualification obtained from the Statistic Finland's register: higher education (a Master's or doctoral degree), upper secondary (a bachelor's degree from a university or institution of applied sciences), lower secondary (upper-

secondary school, vocational school) and basic education (comprehensive school).

### ***Occupational class***

Occupational class was assigned to one of four categories based on the job title in the employer's personnel register: managers and professionals such as teachers and physicians, semi-professionals such as nurses and foremen, routine non-manual workers such as clerical employees and child minders, and manual workers such as technical and cleaning staff (Laaksonen et al. 2005).

### ***Income***

The participants were placed annually in four groups based on income quartiles covering their own monthly salary related to their employment with the City of Helsinki. The measure covers only individual wages or salaries and does not include income from other sources such as investments, income transfers or secondary employment.

## **5.4 Statistical methods**

Women and men were analysed separately in Sub-studies I, II and III. Sub-study IV only included women, and women and men were analysed together in Sub-study V because of the small number of disability retirement events. The time in employment, in other words actual working time, was calculated in person-years, which means that all employment periods were combined and divided by the number of employees on an annual basis. The amount of sickness absence is presented per 100-person-years, each year as an annual cross-section in time.

Joinpoint regression modelling (Kim et al. 2000) was used in Sub-studies I, III and IV to identify turning points, in other words major changes in age-adjusted sickness absence trends. Age was adjusted for as follows: among the 35-54-year-olds in Sub-study I, among the 25-34 and 35-54-year-olds in sub-study III and among the 18-34-year-olds in sub-study IV, the 2008 data being used

as the standard population. In the joinpoint models, various different trend lines are connected together at the turning points. Preliminary visual examination of the sickness absence trends revealed a potential change point. The maximum number of turning points was therefore set at two, which allowed one more point than was expected based on the visual examination. The modelling starts with a linear trend line (null hypothesis), with zero turning points, and then tests whether there are statistically significant turning points that should be added. A sequence of permutation tests and the Bayesian information criterion were used in selecting the final model. Annual percentage changes and an estimated constant percentage change per year were calculated from the joinpoint models for the identified trend periods: a P-value <0.05 means that the linear slope of the identified period is significantly different from the previous or next identified period. The Joinpoint Regression Program version 4.1.1 was used for the analyses (National Cancer Institute April 2014).

The associations of education, occupational class and income with sickness absence days were analysed in Sub-study II using generalised linear mixed models via penalised quasi-likelihood Poisson regression (Breslow & Clayton 1993) to estimate relative risks (RR) and their 95-per-cent confidence intervals. Quasi-likelihood Poisson regression was preferred over ordinary Poisson regression given the over-dispersion in the data. Separate analyses were conducted among women and men, and of the 2002-2007 and 2008-2013 data. Adjustments were made for age and measurement year. Individual-specific random intercept took yearly repeated measurements into account. Employment contracts of different lengths were taken into account by using the logarithm of days employed as the offset. First, models with education, occupational class and income, which were adjusted for age and measurement year, were fitted to obtain the age- and period-adjusted effect of each socioeconomic indicator. Hereafter these are referred to as the age-adjusted associations. Then different age-adjusted models with all combinations of the socioeconomic indicators were fitted to analyse the relations of mediation or explanation between these indicators as determinants of sickness absence. The effect of each socioeconomic indicator independently of the other two was assessed from the full model, adjusted simultaneously for all education, occupational class and income. The `glmmPQL` function in the MASS package (Venables & Ripley 2002), R statistical software version 2.13.0, was used for the analyses.

The age-adjusted relative index of inequality (RII) values and their 95-per-cent confidence intervals (CI) were calculated in Sub-study III to determine the

magnitude of the relative educational differences in sickness absence spells. The RII values for days are also presented in this study. First the original values of each educational group were replaced with the midpoint of the cumulative proportion and then ranked between 0 and 1, thus hypothetically representing the best-off (0) and worst-off (1) people in the population in terms of education. Then the indicators were used as continuous variables in the negative binomial regression models. The logarithm of the number of days employed was used as the offset to take different lengths of work contracts into account. RII imposes linearity on the associations between education and sickness absence spells and days. The resulting RII value could be interpreted as the rate ratio for having sickness absence at the bottom compared to the risk at the top of the educational hierarchy. RII values above 1.0 indicate more sickness absence in the lower educational groups, and values below 1.0 indicate reverse differences. (Shaw et al. 2007.) SPSS version 22 was used for the analyses.

Cox proportional hazard models were used in Sub-study V to estimate the hazard ratios (HR) and their 95-per-cent confidence intervals (CI) for disability retirement during the study period of 2002-2013. Women and men were pooled together and gender adjustment was applied. Age was used as the time scale (Thiebaut & Benichou 2004). The follow-up started in 2002 or when the subject reached the age of 25, whichever was the later date. It continued until the end of 2013 or ended if the employee reached the age of 35, retired (n=381) or died (n=148). Education was entered as a time-dependent covariate in the models. The mean follow-up time was 5.7 years. The analyses were conducted separately for disability retirement due to any cause, and to mental and non-mental causes. The proportional hazards assumption was valid. SPSS version 22 was used for the analyses.

## 6 RESULTS

### 6.1 Descriptive statistics for the study population

Tables 2-4 and Figures 2a/b-3a/b present the descriptive statistics for the study population for the years 2002, 2006, 2010 and 2013. Those working fewer than 28 hours a week, and those with no registered income or employed on the grounds of an employment subsidy granted by public employment and business services are excluded from the tables and figures discussed in this chapter.

First, Table 2 presents the female and male employees of the City of Helsinki by age group. The females outnumber the males and the numbers of employees increase in the respective age groups, being lowest among the 18-24-year-olds. Figures 2a/b-3a/b show the distributions for education and occupational class by gender among young employees. Young employees refer to 25-34-year-olds in the case of education because those under the age of 25 may not have finished their education. In the case of occupational class, sickness absence covers the age group comprising 18-34-year-olds. These figures are not presented by income because each quartile consists of 25 per cent of the group in question. Table 3 gives the corresponding numbers for 35-54-year-olds. As Figures 2a and 3a show, the lower-secondary is the most common educational level, and routine non-manual work is the most common occupational class among young female employees, whereas among the young men, lower-secondary and manual work are the most common categories in terms of educational level and occupational class, respectively (Figures 2b and 3b).

Table 4 presents the numbers of short, intermediate and long spells of sickness absence as well as the average numbers of days and spells by gender and age group. The youngest group of 18-24-year-olds had the largest number of short sickness absence spells, and the lowest amount of long sickness absence. They also had more sickness absence spells than the older age groups. The oldest group comprising 35-54-year-old employees had the highest number of long sickness absence.

Appendices 1-3 show the average sickness absence days and spells as well as the amount of short sickness absence for the years in question by socioeconomic indicator, gender and age group. Young employees with a

basic education had approximately twice as much short sickness absence, 2-3 times more sickness absence spells and 3-4 times more sickness absence days than those with a higher education (Appendix 1). The approximate differences were a little smaller among the older employees. The differences are less consistent when occupational class (Appendix 2) and income (Appendix 3) are the variables: the second lowest groups have more sickness absence than the lowest groups in many cases. Women have more sickness absence than men in terms of short spells, spells in general and days.

Table 2. The study population by gender and age group in 2002, 2006, 2010 and 2013

	<b>2002</b>	<b>2006</b>	<b>2010</b>	<b>2013</b>
<b>Women</b>				
18–34	1859	1886	2424	2434
25–29	2978	2470	2883	3157
30–34	3059	2663	2759	2987
35–54	15,325	14,540	14,135	13,742
<b>Men</b>				
18–34	558	505	788	734
25–29	718	678	869	884
30–34	796	802	866	1028
35–54	4003	3911	4116	4326

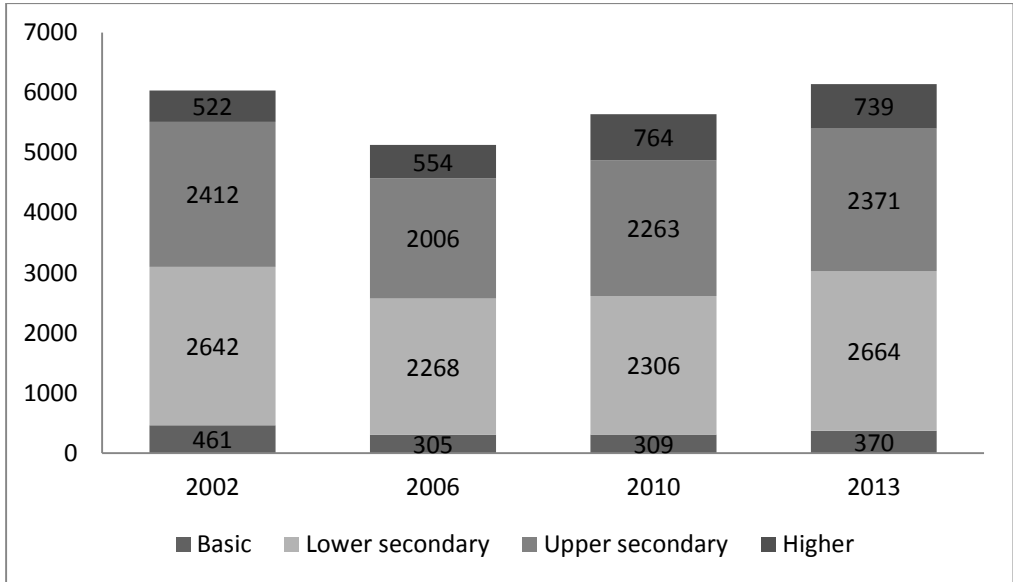


Figure 2a. 25-34-year-old female employees by educational level in 2002, 2006, 2010 and 2013

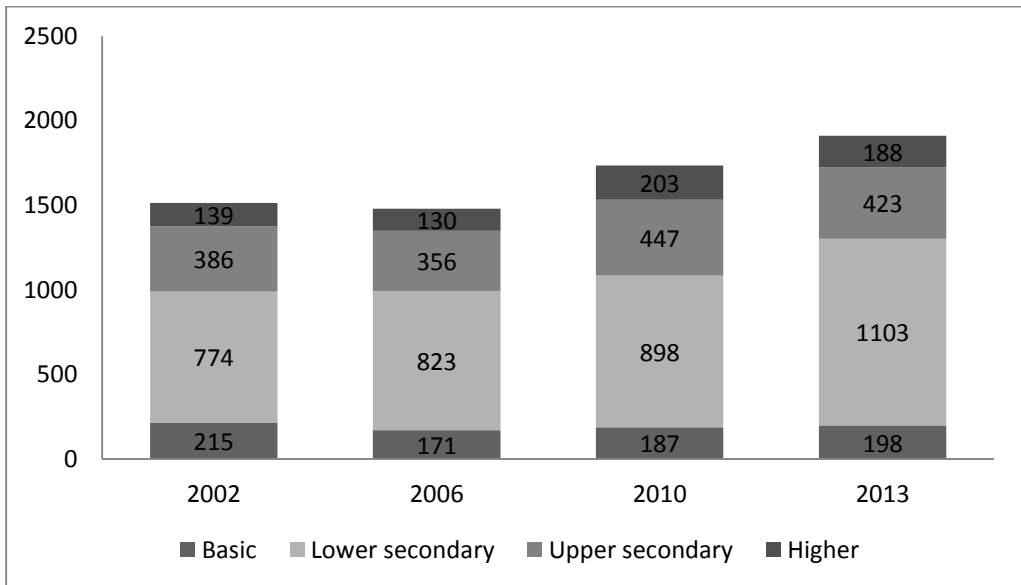


Figure 2b. 25-34-year-old male employees by educational level in 2002, 2006, 2010 and 2013



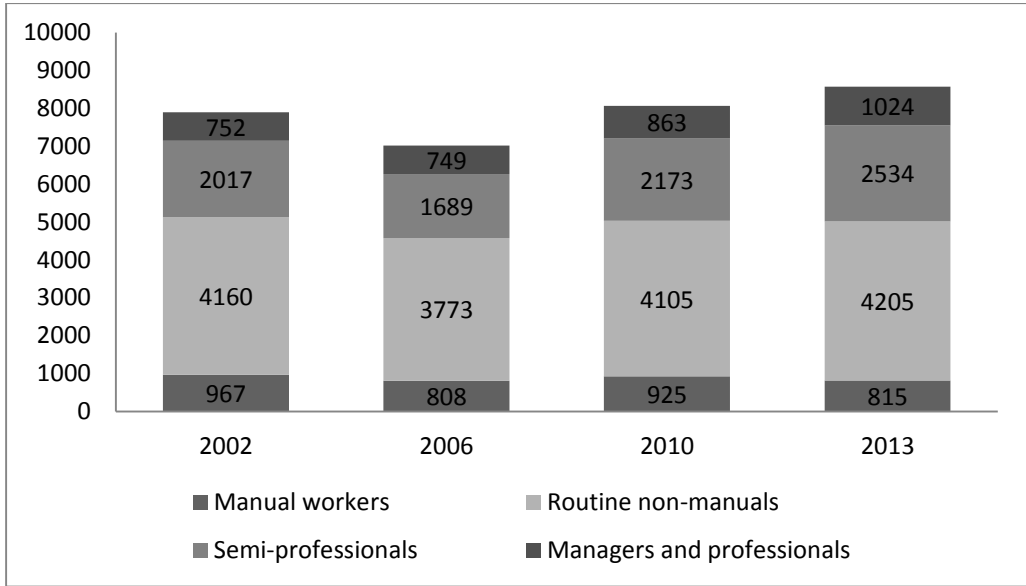


Figure 3a. 18-34-year-old female employees by occupational class in 2002, 2006, 2010 and 2013

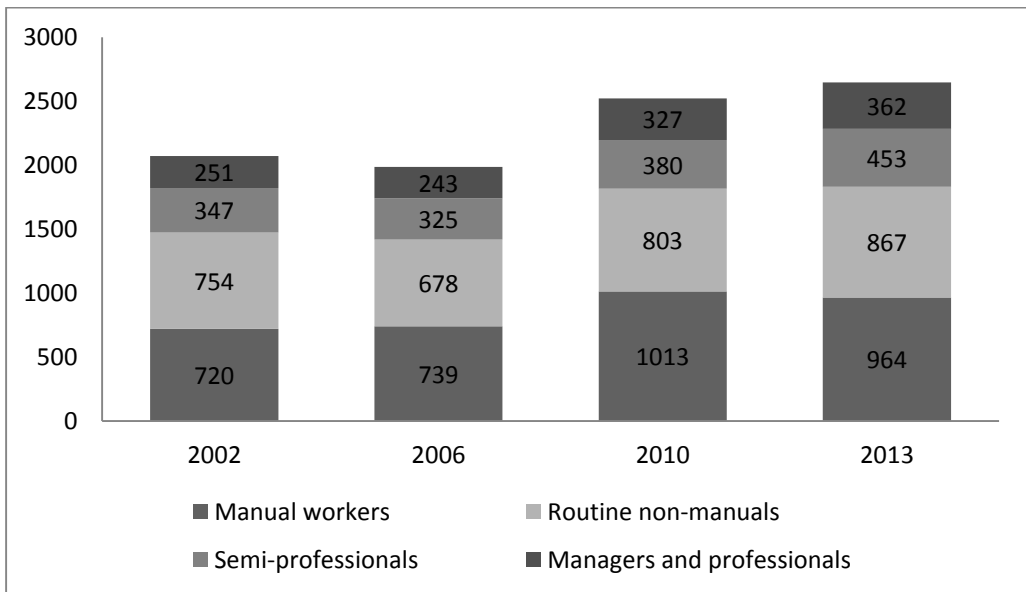


Figure 3b. 18-34-year-old male employees by occupational class in 2002, 2006, 2010 and 2013

Table 3. 35-54-year old female and male employees by education and occupational class in 2002, 2006, 2010, 2013

	<b>2002</b>	<b>2006</b>	<b>2010</b>	<b>2013</b>
<b>Women</b>				
<b>Education</b>				
Higher	1712	1806	1991	2106
Upper secondary	4901	5009	5027	4959
Lower secondary	6361	6023	5749	5472
Basic	2351	1702	1368	1205
<b>Occupational class</b>				
Managers and professionals	2442	2484	2339	2257
Semi-professionals	3705	3963	4294	4372
Routine non-manual	7156	6365	5915	5771
Manual workers	2022	1728	1587	1342
<b>Men</b>				
<b>Education</b>				
Higher	699	709	689	740
Upper secondary	1038	1062	1141	740
Lower secondary	1577	1570	1732	1887
Basic	689	570	554	527
<b>Occupational class</b>				
Managers and professionals	1149	1125	1047	1097
Semi-professionals	820	802	915	920
Routine non-manual	628	732	861	964
Manual workers	1406	1252	1293	1345

Table 4. Sickness absence (SA) spells and days by gender and age group /100-person-years in 2002, 2006, 2010 and 2013

	Women				Men			
	2002	2006	2010	2013	2002	2006	2010	2013
<b>1-3-day SA spells</b>								
18–24	353	392	361	338	255	237	221	214
25–29	254	273	284	257	188	188	203	176
30–34	212	222	234	213	162	205	187	171
35–54	183	198	223	204	120	133	154	138
<b>4-14-day SA spells</b>								
18–24	110	109	103	95	62	43	54	53
25–29	80	87	84	77	53	49	47	51
30–34	72	76	75	66	55	55	47	47
35–54	70	75	78	70	54	53	51	49
<b>Spells of 15+ days</b>								
18–24	11	17	14	15	8	8	8	9
25–29	16	20	17	15	9	11	7	9
30–34	16	20	18	17	13	11	10	8
35–54	22	23	21	20	17	17	16	14
<b>Average SA spells</b>								
18–24	475	518	478	448	325	288	283	276
25–29	349	380	385	349	250	248	257	236
30–34	300	318	327	296	230	270	245	226
35–54	274	296	322	294	192	203	220	201
<b>Average SA days</b>								
18–24	1666	1936	1739	1719	1064	1060	955	973
25–29	1512	1746	1648	1477	936	1045	982	1016
30–34	1435	1636	1663	1481	1127	1188	1192	979
35–54	1714	1894	1826	1742	1361	1424	1315	1237

## 6.2 Changes in sickness absence spells 2002-2013

Sub-study I focused on 12-year trends in short, self-certified 1-3-day spells of sickness absence, and medically certified spells of 4-14 and 15+ days among female and male employees aged 18-24, 25-29 and 30-34: 35-54-year-olds were used as the reference group.

The number of short sickness absence spells was higher among the younger than the older women. Short sickness absence first increased and then decreased among the women in all age groups during the study period. The Joinpoint regression models (Figure 4) indicate that the turning points in the trends occurred in 2007-2010, and the decline started earlier among the younger than the older women. The strongest increase at the beginning of the study period was among the 25-29-year-olds, being 3.3 per cent (95% CI 1.2, 5.5) annually. There was a decreasing trend towards the end of the period in each age group, the number of spells being higher among the 25-29 and 35-54-year-olds and on the same level among the 18-24 and 30-34-year-olds at the end than at the beginning.

Similarly, the number of short spells of sickness absence (Figure 4) was higher in the younger age groups among the men. There was also an initial increase and then a decrease, except for the youngest group. The turning points in the trends occurred between 2007 and 2009 among the younger men and in 2011 among the oldest. The 30-34-year-olds showed the highest annual increase at the beginning of the study period, at 4.7 per cent (95% CI 1.1, 8.5). The number of short sickness absence spells decreased towards the end of the study period in the three oldest age groups, ending up lower among the 25-29-year-olds, at the same level among the 30-34-year-olds and a little higher among the 35-54-year-olds than at the beginning.

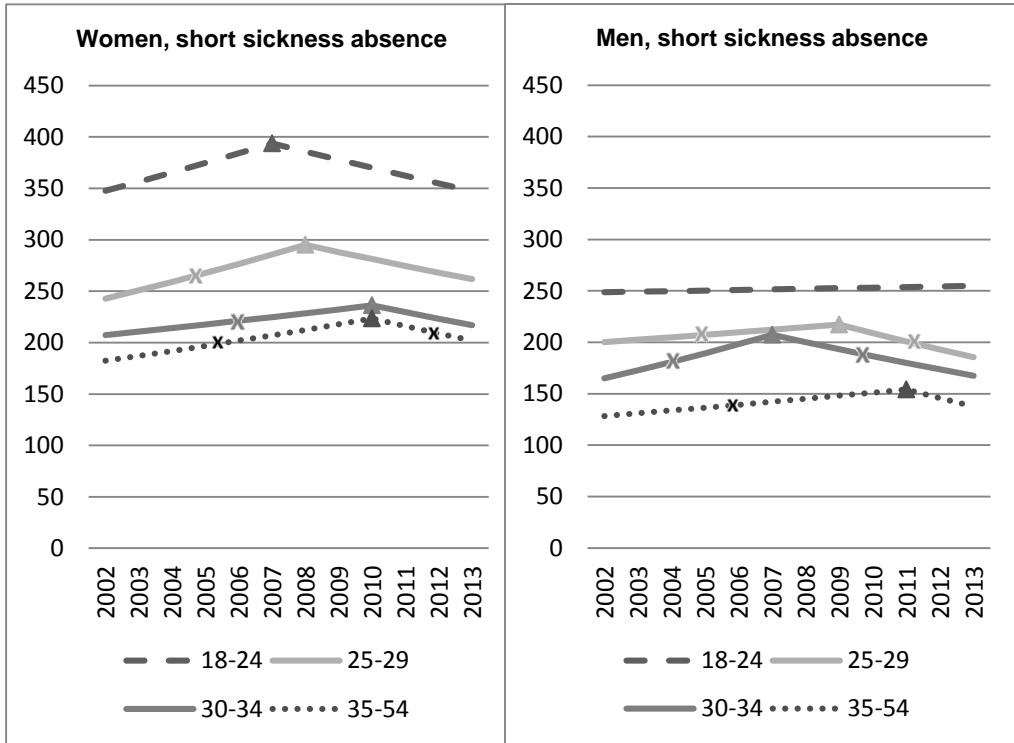


Figure 4. Joinpoint regression modelled short (1-3 days) sickness absence spells by age group /100 person-years, 2002–2013. X=p<0.05

The changes in intermediate (4-14 days) sickness absence spells (Figure 5) were very similar among the women in all age groups. The number of intermediate sickness absence was considerably higher among the youngest group of 18-24-year-olds compared to the older ones, and the trends were very similar among the 30-34 and 35-54-year-olds. After an initial increase there was a decreasing trend and the turning point occurred in 2009 in all age groups. The biggest increase between 2002 and 2009 was among the 25-29-year-olds, at 3.2 per cent (95% CI 0.6, 5.9) annually. The strongest decrease from 2009 to 2013 was among the 30-34-year-olds, at 6.3 per cent (95% CI -10.3, -2.0) annually. Women's intermediate sickness absence was a little lower among the 18-24 and 30-34-year-olds, and on the same level among the 25-29 and 35-54-year-olds at the end of the study period compared to the beginning.

Among the men the numbers of intermediate sickness absence spells were fairly even across the age groups (Figure 5). There was an increase among the 30-34-year-olds until 2008, followed by a strong annual decrease between

2008 and 2013 (-7.0%, 95% CI -10.6, -3.3). The amount of intermediate sickness absence was at a lower level in 2013 than in 2002 in all groups.

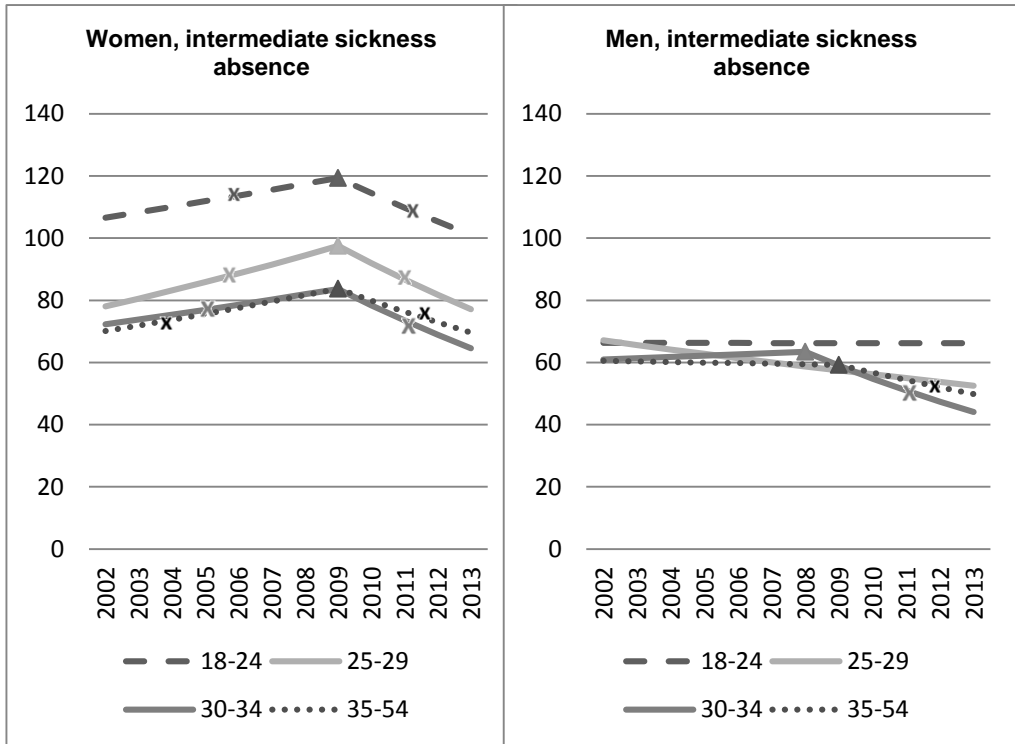


Figure 5. Joinpoint regression-modelled intermediate (4-14 days) sickness absence spells by age group /100 person-years, 2002–2013. X=p<0.05

Among the women the younger ones had fewer long (15+ days) sickness absence spells than the older ones (Figure 6). The amount of long sickness absence increased in each age group between 2002 and 2005, and decreased until 2013 except among the 25-29-year-olds. The largest increase during the period was among the 18-24-year-olds, at 15.4 per cent (95% CI 1.1, 31.8) annually. The most rapid annual decrease between 2005 and 2013 was among the 30-34 year olds, at 3.2 per cent (95% CI -4.8, -1.6). Long sickness absence in 2013 compared to 2002 was considerably higher among the 18-24-year olds, at the same level among the 30-34-year-olds and a little lower among the 25-29 and 35-54-year-olds.

Among the men the three youngest age groups differed from the oldest in terms of long sickness absence (Figure 6), which was higher among the older

ones. The amount increased in the two oldest groups between 2002 and 2005-2007, and then decreased up until 2013. The annual decrease from 2007 to 2013 was more rapid among the 30-34-year-olds, at 10.3 per cent (95% CI -15.2, -5.1). There was a further decrease of 3.4 per cent annually among the 25-29-year-olds between 2002 and 2013 (95% CI -5.9, -0.7). The amount of long sickness absence was at a considerably lower level at the end of the study period than at the beginning in the three oldest age groups.

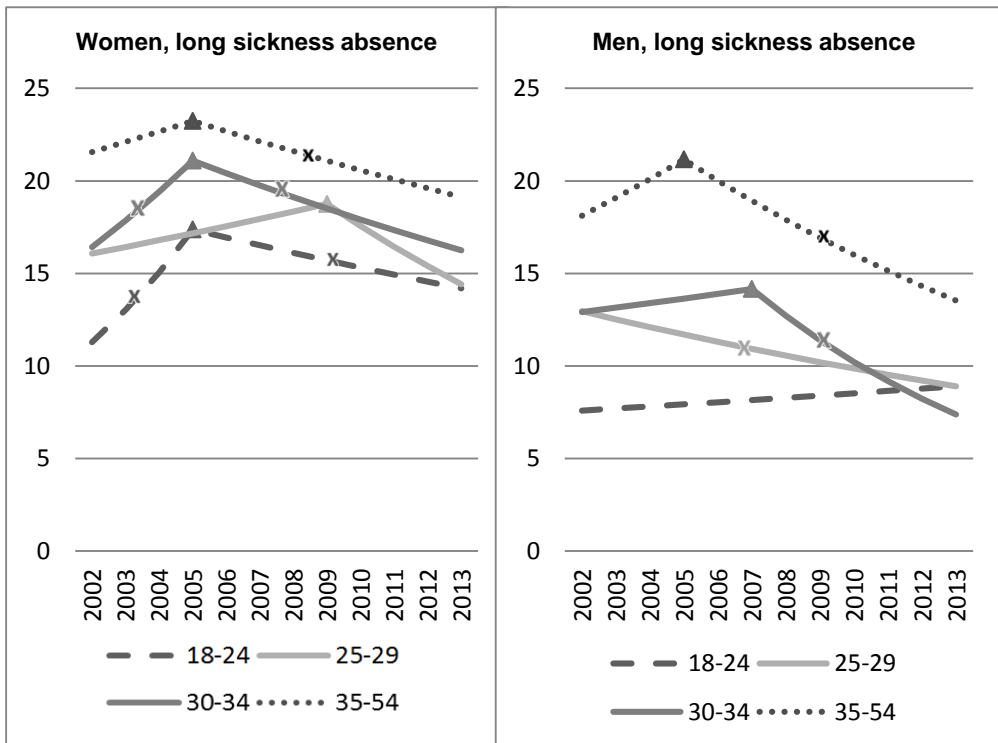


Figure 6. Joinpoint regression-modelled long (15+ days) sickness absence spells by age group /100 person-years, 2002–2013. X=p<0.05

## **6.3 Socioeconomic differences in sickness absence**

### **6.3.1 Interrelationships between education, occupational class and income as determinants of sickness absence**

Sub-study II focused on the interrelationships between education, occupational class and individual income as determinants of sickness absence. Two different periods were studied, 2002-2007 and 2008-2013, based on previous knowledge about the turning points in sickness absence trends during the study period of 2002-2013. Employees aged 25-34 were included in this study, given that the under-25s may not have finished their education.

#### ***The period 2002-2007***

In the age-adjusted models education and income showed a gradient in sickness absence among the women (Table 5). Of these, the educational gradient was stronger. Occupational class showed a partial gradient, the risk of sickness absence being the same among the routine non-manual workers (RR 2.13, 95% CI 1.98, 2.29) and the manual workers (RR 2.11, 95% CI 1.93, 2.31).

Adjusting for education in particular attenuated the association between income and sickness absence, and adding occupational class to the full model did not attenuate the association any further.

Education maintained its strong gradient in sickness absence among the women in the full models (RR 2.48, 95% CI 2.18, 2.82 for basic, RR 1.70, 95% CI 1.53, 1.90 for lower-secondary and RR 1.33, 95% CI 1.20, 1.48 for upper-secondary education). Occupational class showed a partial gradient, and weaker independent associations with sickness absence, than education. Income also had a weaker independent association, but it did follow a gradient.

The age-adjusted association between education and sickness absence was strong among the men, and followed a gradient (Table 5). Unlike among the women, occupational class showed a strong gradient in the age-adjusted



model. The age-adjusted association between income and sickness absence also followed a gradient.

Occupational class considerably attenuated the association between education and sickness absence, and adding income to the full model attenuated it only a little further. Education and income similarly attenuated the association between occupational class and sickness absence, but adding them together to the full model attenuated it even more.

In the full models, education had a strong independent association with sickness absence among the men, as it did among the women. There were only partial gradients in the independent associations between occupational class and sickness absence, and income and sickness absence. The independent associations were also weaker than the association between education and sickness absence, again as among the women.

Table 5. The rate ratio of sickness absence days per 100 person years by socioeconomic indicator from different regression models, 2002-2007 (adjusted for age and measurement year)

		Gross effect	Occupation + education	Occupation + income	Education + income	Occupation + Education + Income
<b>Women</b>						
Education	Higher	1	1		1	1
	Upper secondary	1.80 (1.66, 1.96)	1.35 (1.22, 1.50)		1.66 (1.52, 1.81)	1.33 (1.20, 1.48)
	Lower secondary	2.36 (2.17, 2.56)	1.82 (1.64, 2.03)		1.96 (1.79, 2.16)	1.70 (1.53, 1.90)
	Basic	3.46 (3.12, 3.84)	2.71 (2.39, 3.08)		2.81 (2.50, 3.15)	2.48 (2.18, 2.82)
Occupational class	Managers and prof.	1	1	1		1
	Semi-professionals	1.82 (1.68, 1.96)	1.54 (1.40, 1.68)	1.66 (1.53, 1.79)		1.45 (1.32, 1.59)
	Routine non-manuals	2.13 (1.98, 2.29)	1.45 (1.32, 1.59)	1.63 (1.49, 1.78)		1.25 (1.13, 1.38)
	Manual workers	2.11 (1.93, 2.31)	1.30 (1.17, 1.46)	1.51 (1.36, 1.68)		1.08 (0.96, 1.22)
Individual income	Highest	1		1	1	1
	Second quartile	1.35 (1.28, 1.42)		1.19 (1.12, 1.25)	1.16 (1.10, 1.22)	1.14 (1.08, 1.20)
	Third quartile	1.59 (1.51, 1.67)		1.38 (1.29, 1.47)	1.26 (1.18, 1.34)	1.26 (1.18, 1.35)
	Lowest	1.74 (1.65, 1.84)		1.52 (1.42, 1.63)	1.31 (1.23, 1.40)	1.35 (1.25, 1.45)
<b>Men</b>						
Education	Higher	1	1		1	1
	Upper secondary	1.76 (1.46, 2.12)	1.34 (1.08, 1.66)		1.46 (1.21, 1.77)	1.31 (1.06, 1.62)
	Lower secondary	2.50 (2.10, 2.98)	1.68 (1.36, 2.07)		1.81 (1.49, 2.19)	1.57 (1.27, 1.94)
	Basic	3.70 (3.05, 4.48)	2.41 (1.92, 3.03)		2.56 (2.08, 3.16)	2.23 (1.77, 2.81)
Occupational class	Managers and prof.	1	1	1		1
	Semi-professionals	1.54 (1.32, 1.79)	1.29 (1.09, 1.53)	1.35 (1.15, 1.58)		1.18 (0.99, 1.40)
	Routine non-manuals	2.27 (1.97, 2.61)	1.73 (1.47, 2.04)	1.70 (1.43, 2.02)		1.42 (1.18, 1.71)
	Manual workers	2.44 (2.13, 2.81)	1.72 (1.45, 2.03)	1.70 (1.43, 2.03)		1.35 (1.11, 1.63)
Individual income	Highest	1		1	1	1
	Second quartile	1.74 (1.57, 1.92)		1.39 (1.23, 1.57)	1.49 (1.34, 1.66)	1.33 (1.17, 1.50)
	Third quartile	1.88 (1.68, 2.09)		1.42 (1.24, 1.63)	1.49 (1.32, 1.69)	1.30 (1.13, 1.49)
	Lowest	2.25 (2.01, 2.52)		1.67 (1.43, 1.94)	1.70 (1.50, 1.94)	1.49 (1.28, 1.74)

### ***The period 2008-2013***

The age-adjusted association between education and sickness absence was strong among the women, and broadly similar to that in the previous period: only those with a basic education showed a weaker association (RR 2.82, 95% CI 2.56, 3.10: Table 6). The age-adjusted association between income and sickness absence also followed a gradient. Occupational class showed only a partial gradient, as in the previous period.

The attenuating effects of the covariates were similar to those in the previous period among the women: education had strong independent association with sickness absence in the full models. The associations were broadly similar to those in the first period, although weaker among those with a basic education (RR 2.07, 95% CI 1.85, 2.32). Occupational class had a weak independent association with sickness absence and followed a partial gradient (RR 1.32, 95% CI 1.21, 1.44 for semi-professionals, RR 1.28, 95% CI 1.16, 1.41 for routine non-manual workers and RR 1.04, 95% CI 0.92, 1.17 for manual workers). Income had an independent association with sickness absence in the full model, as in the previous period.

The age-adjusted association between education and sickness absence was slightly weaker among the men than in the previous period (Table 6), whereas occupational class showed a partial gradient in the age-adjusted model, unlike in the previous period. The age-adjusted association between income and sickness absence followed a partial gradient and was strong in the third (RR 2.61, 95% CI 2.36, 2.89) and fourth (RR 2.43, 95% CI 2.19, 2.70) quartiles in particular.

The attenuations among the men were quite similar to those in the previous period, although adding education to the age-adjusted model attenuated the association between occupational class and sickness absence somewhat less.

The association between education and sickness absence in the full model was considerably weaker than in the previous period among the men (RR 1.76, 95% CI 1.45, 2.13 for basic and RR 1.25, 95% CI 1.06, 1.48 for lower-secondary education), and disappeared among those with an upper-secondary education. The association between occupational class and sickness absence in the full model was stronger than in the first period, and followed a partial gradient. Income had stronger independent association with sickness absence in the full model than in the previous period.

Table 6. The rate ratio of sickness absence days per 100 person years by socioeconomic indicator from different regression models, 2008-2013 (adjusted for age and measurement year)

		Gross effect	Occupation + education	Occupation + income	Education + income	Occupation + Education + Income
<b>Women</b>						
Education	Higher	1	1		1	1
	Upper secondary	1.58 (1.47, 1.69)	1.27 (1.17, 1.38)		1.44 (1.34, 1.55)	1.25 (1.15, 1.36)
	Lower secondary	2.27 (2.13, 2.43)	1.76 (1.61, 1.93)		1.86 (1.72, 2.01)	1.66 (1.52, 1.82)
	Basic	2.82 (2.56, 3.10)	2.24 (2.00, 2.51)		2.25 (2.03, 2.50)	2.07 (1.85, 2.32)
Occupational class	Managers and prof.	1	1	1		1
	Semi-professionals	1.66 (1.55, 1.77)	1.41 (1.30, 1.53)	1.50 (1.39, 1.61)		1.32 (1.21, 1.44)
	Routine non-manuals	2.21 (2.07, 2.36)	1.49 (1.37, 1.63)	1.67 (1.53, 1.81)		1.28 (1.16, 1.41)
	Manual workers	1.98 (1.81, 2.16)	1.26 (1.13, 1.40)	1.40 (1.26, 1.56)		1.04 (0.92, 1.17)
Individual income	Highest	1		1	1	1
	Second quartile	1.37 (1.30, 1.44)		1.16 (1.10, 1.23)	1.18 (1.12, 1.25)	1.12 (1.06, 1.19)
	Third quartile	1.70 (1.62, 1.79)		1.36 (1.27, 1.45)	1.29 (1.22, 1.37)	1.23 (1.15, 1.32)
	Lowest	1.85 (1.76, 1.95)		1.50 (1.40, 1.61)	1.36 (1.28, 1.45)	1.33 (1.24, 1.43)
<b>Men</b>						
Education	Higher	1	1		1	1
	Upper secondary	1.58 (1.36, 1.84)	1.12 (0.95, 1.32)		1.25 (1.07, 1.46)	1.08 (0.91, 1.27)
	Lower secondary	2.29 (1.99, 2.64)	1.42 (1.20, 1.68)		1.45 (1.24, 1.69)	1.25 (1.06, 1.48)
	Basic	3.36 (2.84, 3.96)	2.05 (1.69, 2.48)		2.02 (1.69, 2.42)	1.76 (1.45, 2.13)
Occupational class	Managers and prof.	1	1	1		1
	Semi-professionals	1.88 (1.65, 2.15)	1.70 (1.47, 1.96)	1.48 (1.29, 1.70)		1.41 (1.22, 1.63)
	Routine non-manuals	2.83 (2.50, 3.21)	2.30 (1.99, 2.66)	1.75 (1.50, 2.03)		1.58 (1.34, 1.85)
	Manual workers	2.52 (2.22, 2.84)	1.93 (1.66, 2.23)	1.42 (1.22, 1.66)		1.25 (1.06, 1.48)
Individual income	Highest	1		1	1	1
	Second quartile	1.94 (1.76, 2.14)		1.59 (1.42, 1.78)	1.73 (1.56, 1.92)	1.54 (1.38, 1.73)
	Third quartile	2.61 (2.36, 2.89)		2.10 (1.85, 2.38)	2.21 (1.97, 2.47)	1.97 (1.73, 2.24)
	Lowest	2.43 (2.19, 2.70)		2.07 (1.81, 2.37)	1.98 (1.76, 2.23)	1.89 (1.65, 2.17)

### **6.3.2 Educational differences in sickness absence**

Sub-study III examined trends in educational differences in sickness absence among 25-34-year-old female and male employees from 2002 to 2013. The magnitude of the relative educational differences in 2002, 2008 and 2013 were also examined in this age group. The under-25-year-olds were excluded from the analyses on the grounds of possible unfinished education. Older, 35-54-year-old employees were used as the reference group in this sub-study.

#### ***Women***

Age-adjusted sickness absence spells and days followed a gradient during the study period of 2002-2013: those with a higher education had fewer spells and days than those with a lower education (Figures 7-10). Among the younger, 25-34-year-old women the amount of sickness absence increased in each educational group at the beginning of the study period, but decreased towards the end. Joinpoint regression models (Figures 7 & 9) confirmed that the location of the turning points in the sickness absence trends in 2007-2010 in each educational group. The finding was similar among the older women in the case of sickness absence spells (Figure 8). Overall, the trends in sickness absence spells and days were broadly similar among the younger women.

Among the younger women, the number of sickness absence spells increased the most (4.1% annually, 95% CI 2.2, 5.9) between 2002 and 2010 among the more highly educated, as did the number of sickness-absence days, at 6.1 per cent annually (95% CI 2.9, 9.4).

The numbers of sickness absence spells and days decreased towards the end of the study period among the younger women in each educational group. The strongest decrease in spells (-5.1% annually, 95% CI -9.1, -0.8) and days (-6.2% annually, 95% CI -10.7, -1.6) was between 2010 and 2013 among those with an upper-secondary education.

#### ***Men***

There was also an educational gradient in age-adjusted sickness absence spells and days among the younger men (Figures 7 & 9). The number of spells increased until 2007-2008 and then decreased towards the end of the study

period in all educational groups except younger men with a basic education (Figure 7). In the case of sickness absence days, joinpoints to decrease were located between 2008-2009, although the highly educated showed a slightly downward trend during the whole period under study (Figure 9). The trends among the younger men differed from those among the older (Figure 10).

Overall, the most pronounced changes in sickness absence spells and days were among younger men with an upper-secondary education. There was a rapid increase in spells of absence (7.7% annually, 95% CI 2.6, 13.0) between 2002 and 2007, followed by a strong decrease (-4.3% annually, 95% CI -7.5, -0.9: Figure 7), and an annual increase in days of 6.2 per cent between 2002 and 2009 (95% CI 2.0, 10.5), followed by a rapid annual decrease of -11.6 per cent between 2009 and 2013 (95% CI -18.8, -3.9: Figure 9).

### ***Relative educational differences***

The magnitude of the relative educational differences in sickness absence was stronger in the case of days than of spells. Overall, the inequalities were large in the former. The magnitude of the inequalities was steeper among the men than among the women (Table 7).

Overall, during the whole study period from 2002 to 2013 the magnitude of relative educational differences in sickness absence spells and days increased among the younger women and decreased among the younger men. There was also a decreasing trend in educational inequalities among the older women and men.

Table 7. The relative index of inequality (RII) for sickness absence spells and days according to education

	2002		2008		2013	
	RII	95% CI	RII	95% CI	RII	95% CI
<b>Younger women</b>						
SA spells	2.20	1.96, 2.47	2.44	2.16, 2.76	2.31	2.06, 2.60
SA days	2.80	2.53, 3.11	3.62	3.26, 4.03	3.87	3.49, 4.28
<b>Younger men</b>						
SA spells	2.76	2.18, 3.49	2.12	1.68, 2.69	2.26	1.79, 2.84
SA days	4.27	3.50, 5.22	3.74	3.07, 4.57	4.10	3.38, 4.99
<b>Older women</b>						
SA spells	2.29	2.13, 2.46	2.23	2.08, 2.40	2.08	1.93, 2.25
SA days	3.17	2.98, 3.37	3.22	3.02, 3.43	2.94	2.75, 3.14
<b>Older men</b>						
SA spells	2.93	2.55, 3.37	2.53	2.20, 2.90	2.11	1.85, 2.42
SA days	4.95	4.41, 5.56	4.20	3.74, 4.71	3.42	3.04, 3.84

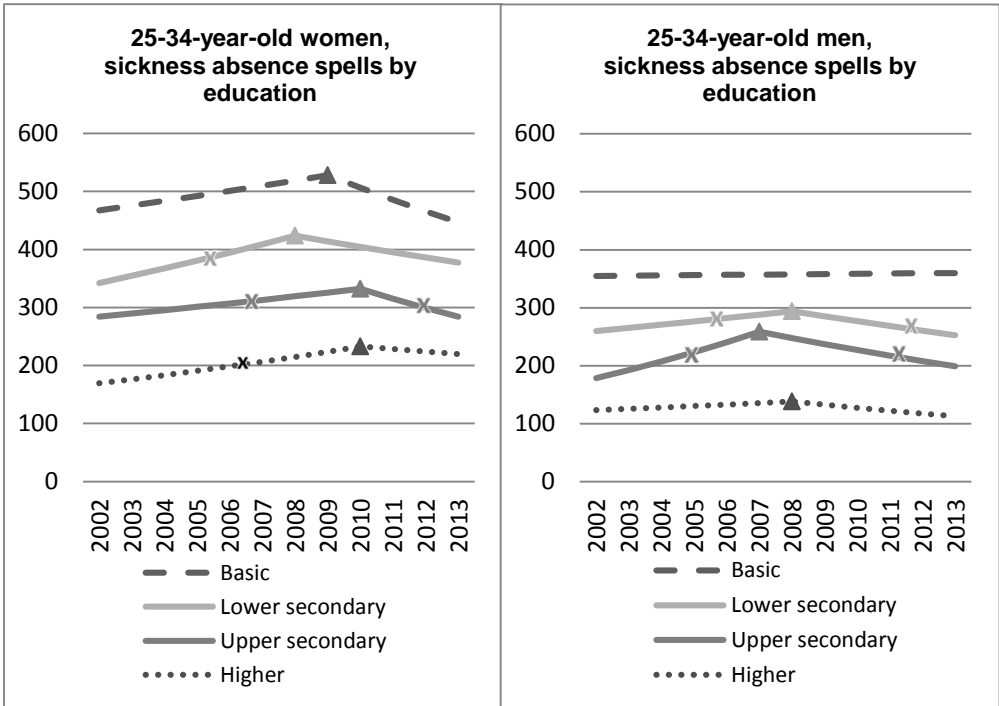


Figure 7. Joinpoint regression modelled sickness absence spells by education /100 person-years, 25-34-year-olds, 2002-2013. X=p<0.05.

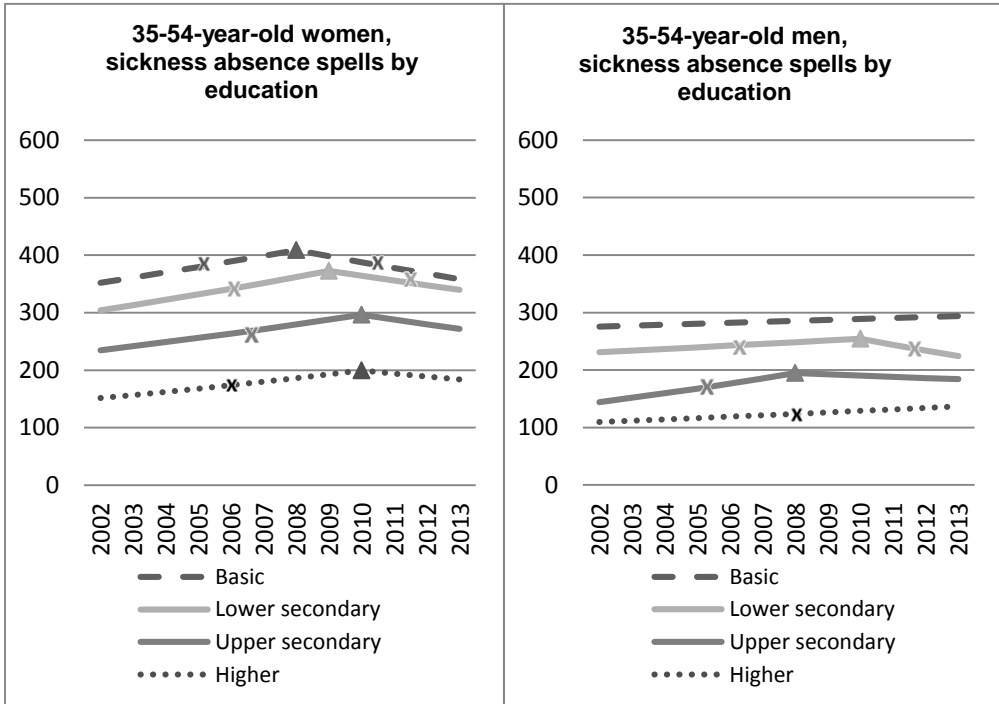


Figure 8. Joinpoint regression modelled sickness absence spells by education /100 person-years, 35-54-year-olds, 2002-2013. X=p<0.05.



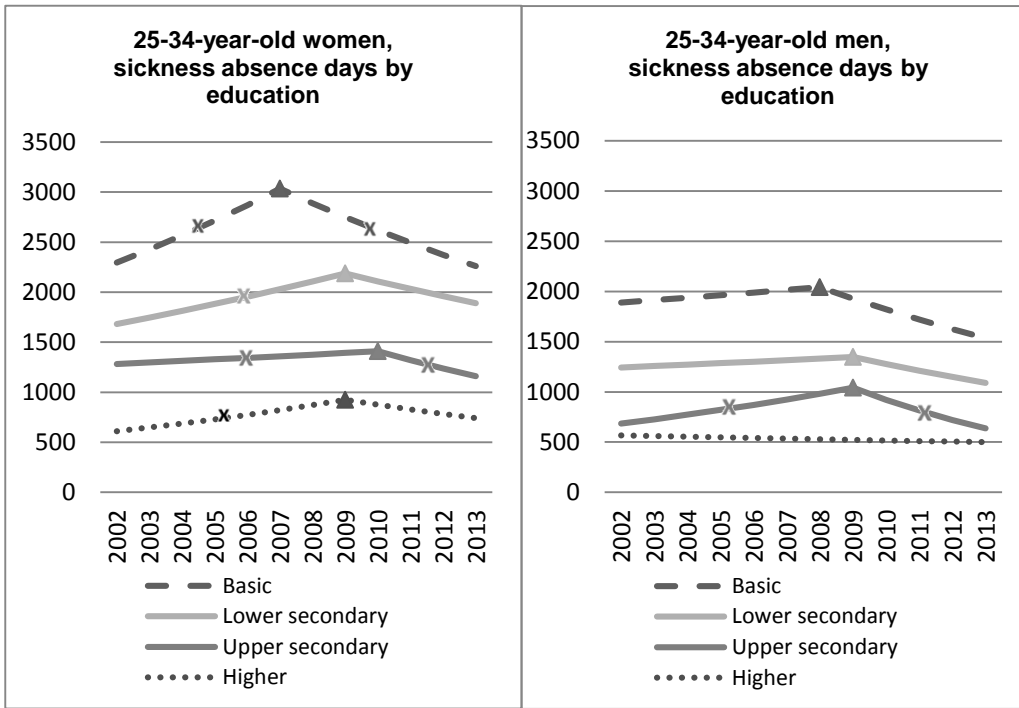


Figure 9. Joinpoint regression modelled sickness absence days by education /100 person-years, 25-34-year-olds, 2002-2013.  $X=p<0.05$ .

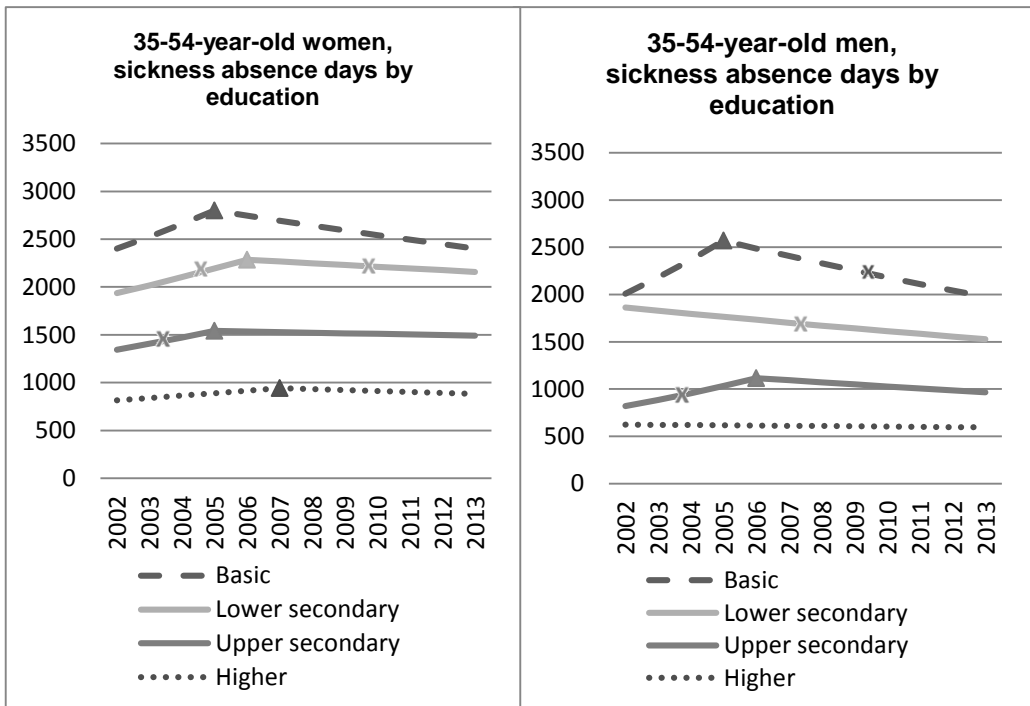


Figure 10. Joinpoint regression modelled sickness absence days by education /100 person-years, 35-54-year-olds, 2002-2013.  $X=p<0.05$ .

### 6.3.3 Trends in occupational class differences in short sickness absence spells

Because the number of short absences turned out to be high among 18-34-year-old women, Sub-study IV focused on occupational class differences in short sickness absence in this group.

Managers and professionals had the lowest amount of short sickness absence during the study period of 2002-2013, whereas routine non-manual workers had the highest amount (Figure 11). Semi-professionals also had slightly more absences than manual workers.

There was an increasing trend in short sickness absence during the study period followed by a decrease, and the main turning point was in 2008 (Figure 11). The biggest annual increase was among managers and professionals between 2002 and 2008, at 6.9 per cent (CI 1.0, 13.1), and the biggest annual decrease was in the same group, at 6.9 per cent (CI -12.6, -0.8) between 2009 and 2013. The bigger change among managers and professionals than in the other occupational classes led to a narrowing of class differences before and a widening after 2008. Overall, the class differences remained broadly stable during the study period of 2002-2013. However, short sickness absence was relatively stable among manual workers in 2002-2008 but declined in 2009-2013.

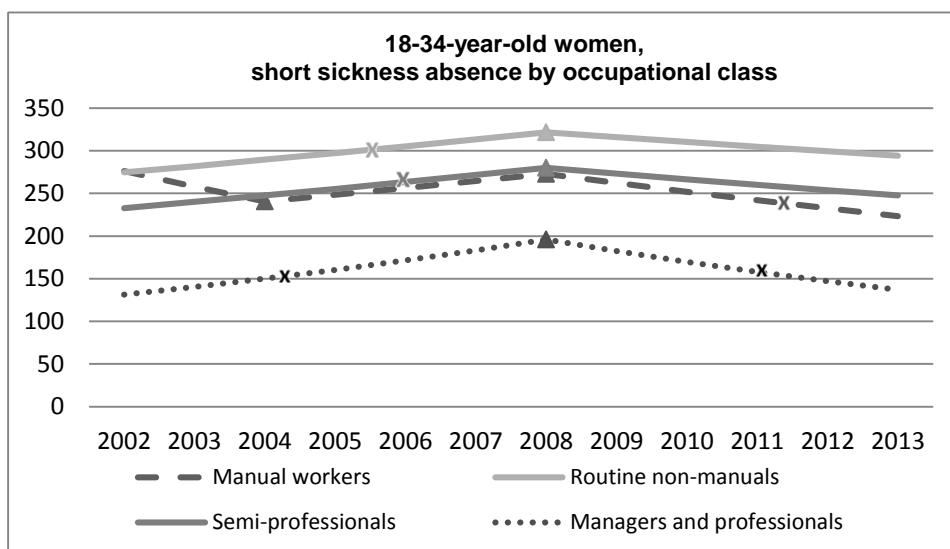


Figure 11. Joinpoint regression modelled short sickness absence spells by occupational class /100 person-years, 18-34-year-old women, 2002-2013. X=p<0.05

## 6.4 Educational level and disability retirement among young employees

Sub-study V focused on the association between educational level and disability retirement due to any cause, mental and non-mental causes. These associations were studied among 25-34-year-old employees between 2002 and 2013.

Among these 25-34-year-olds, 381 people (0.7%) retired during the study period because of disability (Table 8). Over 70 per cent of these retirement events were due to mental disorders (n=276). Temporary disability retirement was the most common type, especially in the case of mental disorders (Table 9). Part-time disability retirement on these grounds was rare. Longer-term temporary disability retirement was granted on the grounds of a mental disorder than on other grounds in all educational groups.

The risk of any-cause disability retirement followed a strong educational gradient, and was highest among those with a basic or lower-secondary education (Figure 12). A similar risk was found for retirement due to mental causes, which also followed a strong educational gradient and was the highest among those with a basic or a lower-secondary education. The same pattern emerged in the case of retirement on the grounds of non-mental disorders: there was a strong educational gradient, those with a basic education facing the highest risk, followed by those educated to the lower-secondary level.

Table 8. Causes of disability retirement by education among 25-34-year-old employees (n=41,225)

	Causes of disability retirement					
	Any cause		Mental		Non-mental	
<b>Education</b>	N	%	N	%	N	%
Higher	33	0.3	22	0.2	11	0.1
Upper secondary	74	0.5	58	0.4	16	0.1
Lower secondary	199	0.9	142	0.7	57	0.3
Basic	75	1.2	51	0.8	24	0.4
<b>All</b>	381	0.7	273	0.5	108	0.2
<b>Women</b>	284	0.7	213	0.6	71	0.2
<b>Men</b>	97	0.7	60	0.4	37	0.3

Table 9. Type of disability retirement and the duration of temporary retirement among 25-34-year-old employees by cause

	<b>Any cause</b>	<b>Mental</b>	<b>Non-mental</b>
<b>All</b>	n=381	n=273	n=108
Permanent retirement	20%	19%	21%
Temporary retirement	72%	74%	66%
Part-time retirement	8%	7%	13%

**Duration of temporary DR\***

Any cause	895 (29-4443)	1020 (29-4443)	561 (29-2799)
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\* In days, mean, minimum and maximum presented

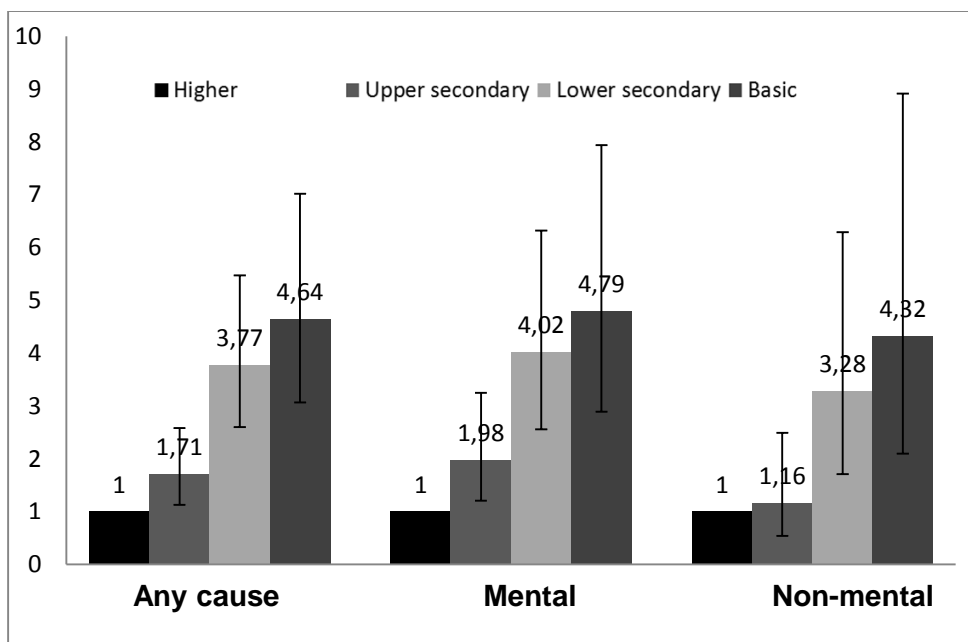


Figure 12. Hazard ratios and their 95% confidence intervals for disability retirement by cause according to education among 25-34-year-old employees during 2002-2013, adjusted for gender

## 7 DISCUSSION

The general aims of this study were to examine changes in sickness absence, and socioeconomic differences in sickness absence and disability retirement among young, 18-34-year-old female and male employees of the City of Helsinki between 2002 and 2013.

### 7.1 Main results

The main results of the study were as follows. 1) Sickness absence trends first increased and then decreased during the study period from 2002 to 2013. The turning points were mostly between 2007 and 2010, depending on the groups under investigation and the length of the sickness absence. 2) The younger employees had more short and intermediate sickness absence, but fewer long spells of absence than the older ones. 3) Of the measures of socioeconomic position, education was the strongest determinant of sickness absence among young employees, and followed a clear gradient. 4) Educational differences in sickness absence were substantial among both women and men. Among the young women the magnitude of the differences in sickness absence spells remained broadly stable, but increased in terms of sickness absence days. The magnitude of the differences in sickness absence as a whole decreased slightly among the young men. 5) The findings on differences in occupational class with regard to short sickness absence were not fully consistent in that it was more prevalent among routine non-manual workers than among the lowest occupational class, in other words manual workers. 6) Disability retirement due to any cause, and to mental and non-mental causes, followed a strong educational gradient, and mental disorders in particular constituted the grounds for retirement in the study population.

## **7.2 Interpretation of the results**

### **7.2.1 Sickness absence trends among young employees**

#### ***Changes in the trends***

The main finding of this study was that there were changes in sickness absence trends during the study period of 2002 to 2013. Almost regardless of the length of absence, there was an increasing trend until 2007-2010, and then a decreasing trend up to the end of the period among the young employees under investigation. However, the turning points were earlier in the case of long sickness absence. The increase at the beginning of the study period is in line with findings reported in studies conducted outside Finland (Ariansen & Mykletun 2014; Krane et al. 2014), but the rest of the period is not covered in previous studies.

The amount of short sickness absence was higher or at the same level in 2013, compared to 2002, and this varied by age group among both women and men, whereas in the case of intermediate sickness absence the incidence was lower or on the same level in 2013. However, there was less longer-term sickness absence in 2013 than in 2002, which is a positive sign given the trends during the whole period under study.

Among the women, the annual percentage changes were weaker in short than in intermediate sickness absence. There were also major percentage changes in long sickness absence among both young women and men, which highlights the change that has occurred.

The turning points in the change in sickness absence trends by socioeconomic group were located between 2007 and 2010. This was evident in the numbers of absence spells and days according to educational level (Sub-study III). Notably, the turning point in the case of short sickness absence among the women was in 2008 in every occupational group (Sub-study IV). The trends in absence spells according to education were increasing or on the same level at the end of the study period compared with the beginning, which is in accordance with the increasing number of short spells of absence. The educational trends in sickness absence days were broadly on same level in 2013 and 2002, which reflects the increasing numbers of short absences and the decreasing amount of longer absence during this period.

There may be several underlying reasons behind the sickness absence trends found in this study. First of all, most joinpoints were somewhere near 2008, the year when Finland went into an economic downturn that, as revealed in a national survey resulted in a rapid increase in perceived job insecurity (Statistics Finland 2008). Job insecurity may reduce non-health-related absence, but lead to poorer health and longer sickness absence (Vahtera, Kivimäki & Pentti 1997), and also to increasing sickness presenteeism (Heponiemi et al. 2010). It is possible that the economic situation is related to the development of sickness absence trends identified in this study. It is notable that many young employees have fixed-term contracts (Sub-study I), and the sickness absence level of employees with non-permanent jobs might be more sensitive to cyclical fluctuations (Virtanen et al. 2004). The turning points for long sickness absence occurred earlier. However, in absolute trends long sickness absence increased between 2010 and 2013 among the youngest women and men, and also among 25-29-year-old men. Many employees in these groups might face insecurity whether their employment continues after a fixed-term contract, and that might lead to an increase in sickness absence attributable to the stressor effect (Blekesaune 2012, Seitsamo et al. 2008).

Second, the measures introduced by the City of Helsinki occupational healthcare services in 2007, focusing on working communities rather than individuals, may have influenced the development of sickness absence levels (City of Helsinki 2008). The main aim is early prevention, and the new policy includes support for working communities and comprehensive occupational-health services for superiors wishing to develop their skills and potential to support their subordinates. It has been found that a good relationship between superiors and subordinates helps to reduce the amount of sickness absence (Stoetzer et al. 2014). The City of Helsinki also introduced a model requiring superiors to discuss with their subordinates when their days or spells of sickness absence reached a certain level (City of Helsinki 2008).

### ***Age and sickness absence trends***

The results of this study indicate that young employees have more short sickness absence than their older counterparts, and this also applies to intermediate levels of absence among younger females. As reported in Sub-study I, the number of short spells of absence was strongly related to age, the youngest having the most and the incidence decreasing with increasing age.

The same trend was apparent among the women in the case of intermediate spells of absence. However, the trend among the 30-34-year-olds was very similar to that in the reference group, in other words 35-54-year-olds. The findings among the men were broadly similar. A reverse structure was apparent in the case of long sickness absence: the youngest had the lowest number of long spells of absence, and the reference group had the highest number. As in previous findings, women had more sickness absence of any length than men during the whole period under study (Allebeck & Mastekaasa 2004; Casini et al. 2013; Laaksonen et al. 2010; Lund et al. 2007).

The findings on the structure of the short- and long-term sickness absence trends among younger and older employees are in line with those reported in previous studies (Barham & Leonard 2002; Hultin, Lindholm & Moller 2012; Lund et al. 2007; Moncada et al. 2002; Rhodes 1983). However, this study revealed a consistent age-dependent dimension: in other words the youngest group had the highest number of short and the lowest number of long spells of absence. Several factors may have contributed to this phenomenon, although the explanations need further, more detailed study.

Ill health increases with age (Donders et al. 2012; Griffiths 2000; Taimela et al. 2007), and could be connected to the sickness absence structure among employees of different ages. Short spells are self-certified and are not necessarily related to illness (Marmot et al. 1995; Moncada et al. 2002; Stapelfeldt et al. 2013; Vahtera et al. 1999a): other possible reasons include a poor fit between the job and the employee, poor coping behaviour, motivational factors and leisure activities (Janssen et al. 2003; Schou et al. 2014; Schneider 1983; Verhaeghe et al. 2003), and this type of behaviour has been connected mainly to younger employees (Rhodes 1983; Schneider 1983). Although these short spells of absence may not reflect work disability among young employees, if they occur frequently it could become more problematic with increasing age (Borg et al. 2004; Roelen et al. 2011). Longer absences may occur alongside avoidable absences if the behaviour persists.

Intermediate sickness absence requires medical certification and therefore there has to be genuine illness. The youngest women in the sample had the highest number of intermediate spells of absence, and the lowest number of longer spells. This type of structure may be associated with the tendency among younger people to recover more rapidly (Tenhiälä et al. 2013), and to the presence of more serious and chronic diseases among the older (Taimela et al. 2007).



The differences among the age groups in short sickness absence, and in intermediate absence among the women, remained relatively similar during the study period. There was an increase among the men in the case of intermediate absence, but the trends lack statistical significance. In the case of long sickness absence the age-group differences decreased in both genders, mainly because the younger age groups came closer together. However, in terms of the total number of absence days the youngest group in particular, and the reference group among the women, had similar amounts during the whole study period. This could be a matter for concern given the implication that the burden of sickness absence is equal in these groups, and only the length of the spells differs.

## **7.2.2 Socioeconomic differences in work disability among young employees**

### **Sickness absence**

The finding in Sub-study II that educational level is the strongest and most consistent determinant of sickness absence among young employees was strengthened in Sub-study III: there was a clear educational gradient among both female and male employees aged 25-34. Those with a basic education had the most sickness absence and the highly educated had the least. This finding is in line with the results of previous studies covering broader age ranges and older adults (Beemsterboer et al. 2009; Henderson et al. 2012; Lund et al. 2007; Piha et al. 2007).

Education is a key dimension of socioeconomic position, and is clearly hierarchical (Lahelma & Rahkonen 2011). In itself it has an effect on ill health and sickness absence that is partly mediated through occupational class and income, as revealed in Sub-study II and in previous studies focusing on broader age ranges and older adults (Lahelma et al. 2004; Piha et al. 2010). The educational gradient has been attributed to the fact that a higher level of education gives access to knowledge, skills, values and attitudes that are likely to support healthier choices (Galobardes et al. 2006), and also to higher occupational classes with better working conditions and higher incomes (Lahelma et al. 2004; Piha et al. 2010).

Sub-study III revealed similar magnitudes of educational differences in sickness absence spells at the end of the period in all of the groups. It is also notable that the differences were steeper with regard to the number of days compared to spells among younger women and men, as well as among older employees. This is also evident in the average numbers of absence days, which were three-to-four-times higher among those with a basic education.

Previous studies representing adults in a broader age range report steeper socioeconomic differences in sickness absence among men (Hansen & Ingebrigtsen 2008; 2010; Löve et al. 2013; Piha et al. 2010), which was evident at the beginning of this study period but not so much at the end. The participants were covered by common sickness absence policies that did not change drastically during the study period. Towards the end the numbers of people with a basic education declined among women and men in both age groups, meaning that the educational level rose among younger employees in particular. It is therefore possible that there was some form of educational selection during the economic downturn (Helgesson et al. 2013), which might have influenced the magnitude of educational differences in sickness absence.

Sub-study II also revealed an independent association between occupational class and sickness absence, although it followed only a partial gradient. Sub-study IV focused more strongly on occupational-class differences, with short sickness absence as an outcome. The findings reflect those reported in Sub-study II in that routine non-manual workers had the highest amount of short sickness absence, in other words more than manual workers, who represent the lowest occupational class. Managers and professionals had the least amount of short sickness absence. Visually, the magnitude of these differences remained broadly stable over the study period, with some widening towards the end.

It is accepted that there are differences in sickness absence between occupational classes: it is more prevalent among the lower than among higher-level classes (Borg et al. 2004; Laaksonen et al. 2010; Lund et al. 2007; Moncada et al. 2002; North et al. 1993). According to an earlier Danish study, the gradient in short sickness absence according to occupational class may only be partial: this finding was attributed to the increasing proportion of longer sickness absence spells among those with the lowest socioeconomic position, meaning that the diseases responsible for the absence are more severe in the lowest class. The results of this present study differ in that young routine non-manual workers turned out to have more sickness absence days annually than

manual workers. Previous studies covering broader age ranges have shown that physical working conditions in particular explain differences in sickness absence between occupational classes (Christensen et al. 2008; Laaksonen et al. 2010; Löve et al. 2013). Occupations in which employees are under a lot of strain but have little control over their jobs also carry a higher risk of sickness absence (Lund et al. 2005; Lund et al. 2006).

The gradient in the age-adjusted association between occupational class and sickness absence was more visible in Sub-study II, and changed in the full models. Education partly explained the association, especially with regard to routine non-manual and manual workers. These occupational classes require similar levels of education (lower secondary), although some manual jobs may not require any qualifications. The jobs in these classes are physically more demanding, which may affect work ability and contribute to disability. Most jobs among the women in the routine non-manual class were in the field of healthcare and social services. Further sensitivity analyses conducted for Sub-study IV showed much higher levels of short sickness absence among child minders, practical nurses and healthcare assistants in particular than among clerical employees, for example, who also belong to the routine non-manual class (Appendix 4a-c). Many jobs in this field are both mentally and physically demanding, and cause stresses and strains that may contribute to short sickness absence. Another contributory factor may be the nature of the job: when it is necessary to avoid infecting others employees may stay at home with minor infections and thereby increase the levels of short sickness absence.

Income was the third measure of socioeconomic position used in this study, and a low income was associated with high levels of sickness absence (Kivimäki et al. 1997; Löve et al. 2012; Piha et al. 2007). In a previous study involving 25-59-year-old City of Helsinki employees the identified income differences in medically certified sickness absence were attributed to education and occupational class (Piha et al. 2010). However, a strong independent association between income and sickness absence was identified in Sub-study II, which was evident particularly among men in the second period under study. In this the present results differ from those reported in previous research. However, income may not be the most reliable indicator of socioeconomic position among young adults in that it typically follows a curvilinear trajectory with age and can change rapidly (Galobardes et al. 2006). It was therefore decided not to study its associations with sickness absence among young employees in more detail in this study.

Health-related selection needs to be mentioned in the context of health-related socioeconomic differences among young adults. Health problems during childhood and youth and a low parental socioeconomic position may create health differences that are still visible in early adulthood, for example. An individual's health status may affect his or her ability to advance to higher education, and low parental education may predict a lower educational track among offspring (Kestilä et al. 2009). Additionally, low-level education may lead to a lower occupational position with more physical and psychosocial work exposure (Christensen et al. 2008; Vahtera et al. 1999a), leading later to adverse health behaviours and poor material and non-material resources (Conti & Heckman 2010; Kestilä et al. 2009). This type of pathway may expose young adults to work disability.

It is also notable that young employees have been exposed to working conditions for a relatively short time, thus the work may have only limited effects on socioeconomic differences in work disability (Johansson et al. 2012). It is likely that many factors contribute to the health of young adults, both past and present. Many of them nowadays are employed on fixed-term contracts and may have to change jobs and their work environment frequently. There may thus be no health check-ups, supervisory support or follow-up on work ability among the young. Problems may develop without anyone noticing and treatment may start when there has already been major deterioration in work ability - which preventive measures in the early stages might have prevented.

### **Educational differences in disability retirement**

Whereas Sub-studies I-IV concentrated on socioeconomic differences in sickness absence among young employees, the focus in Sub-study V was on educational differences in disability retirement. Retirement on the grounds of disability is a drastic outcome and is highly problematic among the young, who could have several decades of employment ahead of them. Despite the seriousness however, there is a lack of research on socioeconomic differences in disability retirement among young adults.

Previous studies focusing on older participants or broader age ranges have reported similar (Bruusgaard et al. 2010; Krokstad & Westin 2004; Nilsen et al. 2012), and even larger (Falkstedt et al. 2014; Johansson et al. 2012) differences between educational groups in the risk of disability retirement due to any diagnosed cause than those found in the present study. Four

educational groups were used in the present study. However, Bruusgaard et al. (2010) found in their Norwegian study among working-aged participants that educational differences in disability retirement existed throughout a more detailed classification.

Significant educational differences in disability retirement on mental grounds were identified in the present study, but previous findings on educational and other socioeconomic differences are inconsistent. Some former studies report a steep gradient (Bruusgaard et al. 2010), and others only small or non-existent socioeconomic differences (Falkstedt et al. 2014; Leinonen et al. 2011; Samuelsson et al. 2012b).

The present study also identified significant educational differences in disability retirement on other than mental grounds. This reflects the findings in previous studies among older participants, which have reported large educational differences particularly in retirement due to musculoskeletal diseases (Bruusgaard et al. 2010; Falkstedt et al. 2014), as well as to other than musculoskeletal or mental causes (Bruusgaard et al. 2010; Falkstedt et al. 2014).

Evaluation of the need for disability retirement incorporates assessment of the individual's occupation, work experience, age and other social circumstances (Laaksonen & Gould 2014b). This is necessary because many factors apart from the specific illness contribute to the ability to continue working or to the rehabilitation need (Ilmarinen et al. 2008). For example, people with similar health problems might not have the same opportunities to allow for their ill health in their work, depending on the task requirements and their working conditions (Bruusgaard et al. 2010; Nilsen et al. 2012). This may be one reason why the risk of disability retirement is higher among those in lower as opposed to higher socioeconomic positions (Krokstad & Westin 2004).

Educational differences appear to be steeper among younger than among older adults (Krokstad et al. 2002; Nilsen et al. 2012), although the risk of disability retirement increases with age (Bruusgaard et al. 2010; Holma et al. 2012). Those in lower socioeconomic positions retire on the grounds of disability at a younger age (Polvinen et al. 2013), which was even evident in the present study among 25-34-year-old employees. Inherent in a higher socioeconomic position may be some sort of flexibility that allows people to continue working despite deteriorating health, and thus to postpone disability retirement (Bruusgaard et al. 2010; Karlsson et al. 2008). This may lead to situations in which the more highly educated who apply for disability retirement

have more serious conditions than their less highly educated counterparts (Stover et al. 2013). However, those with a higher education may also be better placed to find a new job with manageable requirements (Stover et al. 2013).

Mental disorders, and depression in particular, constituted the main diagnostic cause of disability retirement among the young employees in all educational groups in the present study, which is in accordance with previous findings (Kaltenbrunner Bernitz et al. 2013; Laaksonen & Gould 2014b). It is notable that disability retirement on mental grounds is more common among the young, whereas musculoskeletal causes are more common among older employees (Knudsen et al. 2012; Månsson et al. 1994; Polvinen et al. 2013). Mental disorders tend to appear at a relatively young age (Kessler et al. 2003), and entail disabilities that may make coping with work tasks difficult (Knudsen et al. 2012; WHO), and participating in working life too hard. Employers' perceptions of and attitudes towards mental disorders (Glozier 1998), the benefits of vocational rehabilitation and retraining (Järvisalo et al. 2005) and possible comorbidity (Moussavi et al. 2007) may also contribute to the incidence of disability retirement on mental grounds at a young age: the lower incidence among older employees could reflect the fact that those with mental disorders may have been granted retirement at a younger age. The low level of disability retirement due to musculoskeletal diseases among the young may reflect the relatively short time of exposure to adverse physical working conditions. However, an existing musculoskeletal disease constitutes a major retirement risk, even at a young age (Alexanderson et al. 2005).

The educational differences in disability retirement on mental grounds were large among the young employees, and those with a lower level of education were at the highest risk. It is possible that the problems started early among these individuals, and affected their ability to reach the higher educational levels. Mental demands and work complexity may also contribute to mental disorders and lead to disability retirement in higher occupational positions, although this usually applies to older adults after years of demanding work (Nieuwenhuijsen et al. 2006; Polvinen et al. 2013). Correspondingly, musculoskeletal diseases are a common cause of disability retirement among older employees, especially those in manual jobs with years of exposure to physically strenuous working conditions (Polvinen et al. 2013).

As found in previous studies, most disability retirement on mental grounds among young employees was temporary but extended (Laaksonen & Gould 2014b). Mental disorders often have phases of remission and recurrence and

the development and final outcome are hard to predict, thus permanent disability retirement might be too severe (Hardeveld et al. 2010; Laaksonen & Gould 2014b). Temporary retirement incorporates vocational retraining and rehabilitation (Järvisalo et al. 2005; Laaksonen & Gould 2014b), which are widely used among younger people to facilitate a return to work (Social Insurance Institution of Finland 2014). Investing in rehabilitation tends to be profitable in that a return to work after temporary retirement is more common among the under-35s than in older age groups (Laaksonen & Gould 2014b). In sum, disability retirement at a young age is disadvantageous and costly for the individual, the employer and society.

### **7.3 An overall view of work disability among young employees**

According to the results of this study, work disability is present even among young employees who should be in the best of health given their age. The study period covered 12 years, from 2002 to 2013, during which time there were changes in sickness absence trends; first there was an increase and then a decrease. These changes could reflect the changes in the economic situation in Finland or internal actions on the part of the employer, or they may be related to other issues. A deeper understanding of the factors that influence changes in sickness absence could be of major importance to those responsible for designing measures to prevent work disability in the future. Thus, more research is needed in this field.

Despite the changes in sickness absence over time, age-related differences have been broadly similar. There were structural differences between the younger and older employees, but the burden of absence remained stable, particularly among the women. Previous studies have reported similar age differences as found in this study, in other words more short spells of absence among the younger participants and more long spells among the older ones (Arola et al. 2003; Barham & Leonard 2002; Hultin et al. 2012; Laaksonen et al. 2010; Moncada et al. 2002; Nielsen et al. 2006; Thomson et al. 2000; Thorsen et al. 2015; Vahtera et al. 2004), but the reasons behind this phenomenon are still largely unknown. The shorter spells are sometimes considered avoidable absences (Schneider 1983), in that the reason may be other than health-related (Janssen et al. 2003; Marmot et al. 1995; Moncada et al. 2002; Stapelfeldt et al. 2013; Vahtera et al. 1999a; Verhaeghe et al.

2003). However, the burden for the employer is still the same, regardless of the reason.

The high number of short spells of sickness absence among the younger employees raises many questions and confirms the need for action on several fronts. Supervisory support and an understanding of the situation in which young employees find themselves could prevent some of these absences: they may need more guidance in carrying out their work tasks, for example. The guidelines for early support, meaning the discussion with superiors and related action before, during or after the absence, could be tailored differently for younger and older employees, given the differences in trends among these groups. Support could be offered to younger employees, and actions implemented after a few short, self-certified absences, for example. Those in need of support might also benefit from health check-ups as part of the occupational healthcare service, in that the early prevention of potential illness and timely support in coping with the mental and physical demands of the job could have positive outcomes with regard to work ability at a later age.

It appears from the results of this study that those with a low level of education and a low occupational class in particular are at risk of both sickness absence and disability retirement. This knowledge, combined with the finding that young women have more sickness absence than young men, could help in identifying the groups on which preventive measures could be focused, alongside individual needs.

Educational level showed the most consistent gradient with sickness absence in this study. It is not appropriate or even possible to educate everyone to a higher level. However, in the field of public health there may be room for development in the overall knowledge of health-related issues, perhaps mainly on the comprehensive-school level, which covers everyone in Finland. The participants of this study were young, yet socioeconomic differences were still evident among them. Differences in health between educational groups are associated, in part, with knowledge of health-related issues (Galobardes et al. 2006), as well as with the benefits that higher education offers, leading to a higher-level occupational position and a higher income. Giving everyone the same tools for enhancing understanding of health-related issues and making healthier choices at a young age and beyond might prevent the emergence of some of the differences between socioeconomic groups. Policies that promote healthier choices in daily food intake at the expense of over-processed products could guide people in following a healthier life style regardless of the level of knowledge of these issues.



Another area for development would be to improve the fit between employee health and work tasks. Both sickness absence and disability retirement are most prevalent among the lower occupational classes, to which those with a low level of education usually belong. The work environment and the tasks tend to be the most adverse in manual occupations, including those in the field of healthcare and childcare in which many of the young female participants of this study were employed. If the work tasks could be adapted to take disabilities into account it may reduce the need to stay away from work and prevent, or at least postpone disability retirement. The possible benefits of job rotation based on work ability should also be investigated, especially among large employers.

The introduction of the Swedish model according to which employees receive no pay for the first day of sickness absence could affect the rates of absence among young employees, who are more likely to have short spells of absence. However, an external solution to this problem may not be feasible in the long term because some of the problems young employees have that cause their absenteeism may accumulate over time and cause more severe problems, possibly leading to disability retirement. Moreover, given that sickness presenteeism constitutes a risk for later sickness absence (Bergstrom et al. 2009), actions that focus on internal needs for being absent may be the ones to improve in the first place.

## **7.4 Methodological considerations**

This study was based on a large sample of young employees of the City of Helsinki during 2002-2013. The sickness absence registers are held by the employer, and constitute a reliable and comprehensive data source in that salary payments are also based on them. However, the registers lack further information on the participants, their health-related background, work environment and work history outside of the City of Helsinki. The data does not include lifestyle factors or health behaviour, which would have been useful background information in terms of understanding the patterns of work disability that emerged. A further limitation, especially in the case of the women, is the lack of diagnostic information. Younger women have been shown to have more pregnancy-related sickness absence than other women (Ariansen & Mykletun 2014), and this may contribute to the amount of sickness absence among the women in this study, although no information on

pregnancy was available. In fact, pregnancy-related absences tend to be longer (Ariansen & Mykletun 2014), and therefore their impact on short absences, which turned out to be high among young women, is questionable.

The employer's registers were linked to Statistics Finland's register of completed education and degrees, and to the Finnish Centre for Pensions national register data, both of which are complete and accurate national registers. Statistics Finland's register includes the highest degree or the most recent qualification and is updated annually. The information on education and qualifications comes straight from the educational institutions and government agencies. Education was used as a measure of socioeconomic position in Sub-studies III and V. This has many advantages when the employees under study are young: it is hierarchical and determined in early adulthood, most over 25-year-olds have finished their educational career and once established, the level of education does not change much and only rises (Krokstad, Kunst et al. 2002). The weakness was that the number of young employees in the higher educational groups was relatively small.

The data, which covered the years 2002-2013, and joinpoint modelling facilitated the identification of changes in recent sickness absence trends. As is typical of the municipal sector (Laaksonen et al. 2008), the study population included more women than men. The small number of younger men would have affected the statistical power in the analysis of the turning points, however, and therefore Sub-study IV focused only on women.

The relatively long time period was also exploited in Sub-study II, in which the focus was on the interrelationships among education, occupational class and income as determinants of sickness absence in two different time periods. The recurrence of the associations in both periods strengthens the results. The Relative Index of Inequality (RII), which was used to examine the relative educational differences, is recommended when making comparisons over time. Its advantage is that it accounts for the different amounts of sickness absence in all the groups, and also the relative size and position of each one (Shaw et al. 2007).

Sub-study V focused on those who had been employed for at least the maximum probation time. This limit ensured that the participants were healthy enough to work during their recorded pathway. The age group of 25-to-34-year-olds was chosen to represent young employees because disability retirement events among the young are extremely rare. However, it was not possible to conduct detailed diagnosis-specific analyses given the relatively

small number of disability retirement events. Although the association between education and disability retirement was similar among the women and men in the study, more retirement events would have allowed detailed examination of possible gender differences. The number of events limited the analyses especially among the more highly educated groups.

The participants in this study were municipal employees of a single employer. This limits the generalizability of the findings, even though the City of Helsinki is the largest municipal employer in Finland. The results could be generalised with caution to the Finnish public sector, but not to the Finnish labour force in general. Differences in for example education and healthcare structure, municipality sizes, cultures and sickness absence policies makes comparisons and generalizability to other countries challenging, thus further research is warranted.

## 8 CONCLUSIONS

Sickness absence trends among young employees changed during the study period of 2002-2013. There was an increase in the early 2000s, and the turning points to decline occurred in the economic downturn, between 2007 and 2010. The trend was downwards at the end of the study period, which is a positive direction and sign. However, further measures are needed to prevent possible increases in sickness absence in the future. There was a considerable amount of absence among these young employees throughout the study period, particularly in short spells, even though they should be healthy given their age. This type of sickness absence behaviour may remain or change when younger employees get older. If it remained it would increase the burden of sickness absence for employees and employers, given that health and functioning deteriorate with age.

There were clear socioeconomic differences in work disability even among these young employees. Educational level was the most consistent determinant of sickness absence, and strong gradients were found. Occupational class also turned out to determine the level of absence, but less consistently. Those with a low level of education and a lower occupational position are more vulnerable to work disability.

The magnitudes of the educational differences in sickness absence spells were larger among the men than the women at first, but similar at the end. The higher educational level among the young may have contributed to this, thus educational attainment should be further promoted. The findings were similar in terms of disability retirement: educational gradients were evident. Mental disorders in particular constituted a threat to work ability among the participants. Efforts are being and should be made to facilitate a return to work among young disability retirees. It should be possible, for example, to achieve a better match between both workplace and job demands, and employees' skills and ability to cope across a range of occupations with their respective educational needs.

Attention should be given to the health and lifestyles of young employees in order to prevent work disability and to extend work careers. Planned and systematic health check-ups should also cover the young, not just employees who are aging or already have disabilities. Those in lower socioeconomic positions in particular would benefit from preventive measures. The targeting of prevention at an early stage would make it more successful in terms of

maintaining work ability. The health of those who leave their employment or change jobs should also be monitored. New technology allows resource-friendly ways of monitoring work ability among employees of all ages, and it should be used to advantage. Changes and socioeconomic differences in work disability among young employees should be studied and monitored more closely. The resulting information would facilitate the evaluation of earlier preventive measures and the development of further measures aimed at reducing work disability and extending working careers.

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## **APPENDICES**

Appendix 1. The amount of short sickness absence (SA) in spells and days by gender, age group and education /100 person-years in 2002, 2006, 2010 and 2013

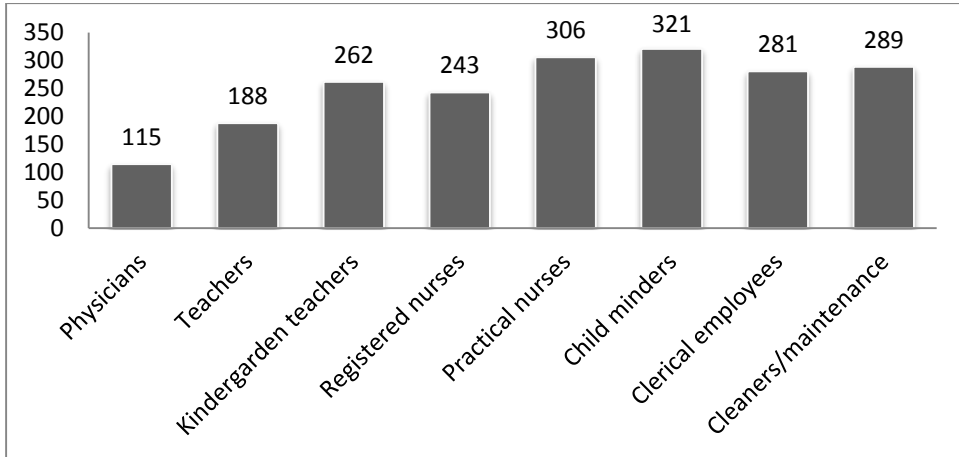
	<b>Women</b>				<b>Men</b>			
	2002	2006	2010	2013	2002	2006	2010	2013
<b>1-3 day SA spells</b>								
<i>Age 25–34</i>								
Higher	131	157	179	161	100	90	101	100
Upper secondary	215	226	247	211	140	190	182	152
Lower secondary	247	271	284	267	184	209	206	187
Basic	325	331	322	321	236	247	261	207
<i>Age 35–54</i>								
Higher	115	122	155	141	86	82	102	108
Upper secondary	169	186	215	199	97	123	142	131
Lower secondary	202	219	247	226	144	149	173	147
Basic	208	238	252	233	134	168	178	164
<b>Average SA spells</b>								
<i>Age 25–34</i>								
Higher	168	204	226	208	130	116	125	122
Upper secondary	289	304	327	276	178	236	223	193
Lower secondary	355	396	406	380	254	280	270	251
Basic	475	506	484	454	360	346	344	299
<i>Age 35–54</i>								
Higher	156	163	200	186	113	112	132	138
Upper secondary	237	265	294	274	142	174	191	179
Lower secondary	309	337	370	338	232	235	254	219
Basic	343	381	395	361	253	280	280	271
<b>Average SA days</b>								
<i>Age 25–34</i>								
Higher	579	812	837	770	587	504	506	446
Upper secondary	1265	1386	1371	1103	623	923	1020	655
Lower secondary	1671	2023	2081	1948	1053	1211	1164	1111
Basic	2351	2871	2620	2246	2045	1717	1539	1671
<i>Age 35–54</i>								
Higher	836	880	877	892	647	576	605	646
Upper secondary	1338	1559	1504	1528	833	1077	1016	966
Lower secondary	1936	2268	2219	2136	1669	1727	1552	1506
Basic	2534	2626	2747	2307	2163	2293	2061	1710

Appendix 2. The amount of short sickness absence (SA) in spells and days by gender, age group and occupational class /100 person-years in 2002, 2006, 2010 and 2013

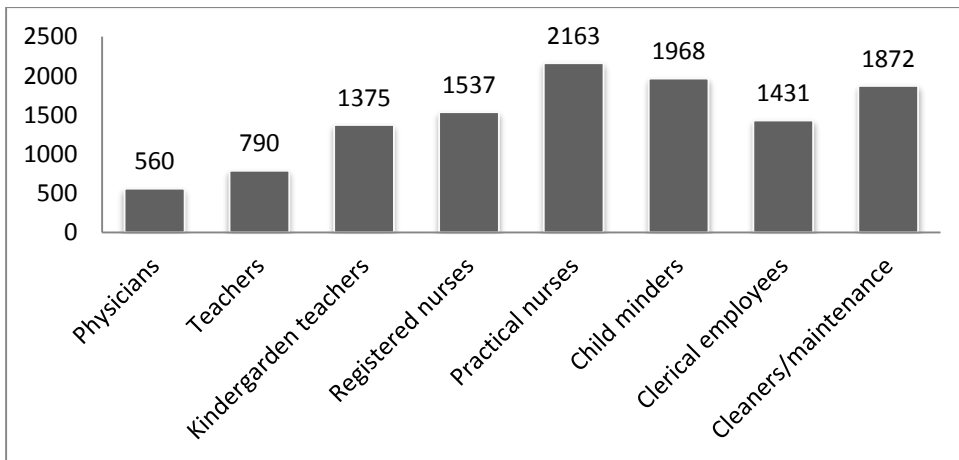
	<b>Women</b>				<b>Men</b>			
	2002	2006	2010	2013	2002	2006	2010	2013
<b>1-3 day SA spells</b>								
<i>Age 18–34</i>								
Managers and prof.	154	172	175	149	102	108	115	108
Semi-professionals	228	240	262	231	176	214	187	175
Routine non-manuals	276	305	314	301	230	256	260	251
Manual workers	266	262	251	220	183	191	191	152
<i>Age 35–54</i>								
Managers and prof.	124	128	154	139	78	86	104	104
Semi-professionals	178	194	222	207	105	141	155	139
Routine non-manuals	208	231	262	236	201	204	224	187
Manual workers	174	187	187	172	130	128	148	131
<b>Average SA spells</b>								
<i>Age 18–34</i>								
Managers and prof.	202	223	224	191	132	134	140	131
Semi-professionals	306	324	346	302	227	266	235	221
Routine non-manuals	386	430	435	416	305	327	335	329
Manual workers	383	380	363	324	264	262	251	214
<i>Age 35–54</i>								
Managers and prof.	169	175	200	180	107	119	134	135
Semi-professionals	247	277	303	284	164	201	211	193
Routine non-manuals	317	350	385	348	285	289	307	262
Manual workers	304	319	320	292	238	232	242	217
<b>Average SA days</b>								
<i>Age 18–34</i>								
Managers and prof.	797	822	874	661	556	711	551	436
Semi-professionals	1309	1504	1479	1184	846	889	981	768
Routine non-manuals	1675	2012	1962	1962	1272	1309	1350	1271
Manual workers	1763	1845	1689	1555	1148	1233	1097	1089
<i>Age 35–54</i>								
Managers and prof.	894	941	951	865	635	637	557	694
Semi-professionals	1351	1669	1486	1535	1054	1184	1111	997
Routine non-manuals	1997	2266	2274	2168	1629	1681	1725	1620
Manual workers	2401	2452	2414	2109	2020	2145	1818	1581

Appendix 3. The amount of short sickness absence (SA) in spells and days by gender, age group and income quartile /100 person-years in 2002, 2006, 2010 and 2013

	Women				Men			
	2002	2006	2010	2013	2002	2006	2010	2013
<b>1-3 day SA spells</b>								
<i>Age 18–34</i>								
Highest	180	200	210	185	130	161	145	118
Second quartile	234	239	265	244	177	205	232	223
Third quartile	297	354	341	310	232	239	217	192
Lowest	323	328	328	303	251	238	219	200
<i>Age 35–54</i>								
Highest	135	134	160	144	62	71	85	90
Second quartile	188	205	233	216	113	134	158	129
Third quartile	202	221	259	233	150	161	202	169
Lowest	210	235	243	226	159	168	171	167
<b>Average SA spells</b>								
<i>Age 18–34</i>								
Highest	244	271	278	237	175	197	180	151
Second quartile	319	338	359	331	249	275	299	294
Third quartile	421	500	477	430	315	323	283	258
Lowest	447	451	450	422	327	298	286	273
<i>Age 35–54</i>								
Highest	184	185	210	190	88	101	113	118
Second quartile	270	295	321	297	173	192	212	178
Third quartile	310	341	386	346	250	251	293	253
Lowest	341	370	377	349	262	275	269	258
<b>Average SA days</b>								
<i>Age 18–34</i>								
Highest	1065	1224	1201	923	721	770	791	519
Second quartile	1423	1626	1631	1447	1104	1221	1313	1293
Third quartile	1866	2291	2078	2058	1405	1488	1197	1183
Lowest	1813	2041	1996	1861	1057	1062	916	1047
<i>Age 35–54</i>								
Highest	994	1087	980	941	587	563	551	600
Second quartile	1581	1692	1602	1603	1084	1162	1140	1067
Third quartile	1997	2333	2355	2227	1901	1873	1782	1640
Lowest	2367	2531	2436	2251	1913	2177	1847	1678



Appendix 4a. Average numbers of short sickness absence spells in 2002–2013 by occupation, 18–34-year-old women /100 person-years



Appendix 4b. Average numbers of sickness absence days in 2002–2013 by occupation, 18–34-year-old women /100 person-years

Appendix 4c. Average numbers of 18–34-year-old female employees by occupation in 2002–2013

	<b>n</b>
Physicians	162
Teachers	276
Kindergarten teachers	477
Registered nurses	624
Practical nurses	1682
Child minders	906
Clerical employees	75
Cleaners/maintenance	258