

Socio-economic determinants of sickness absence

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ACADEMIC DISSERTATION

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CONTENTS

LIST OF ORIGINAL PUBLICATIONS	4
ABBREVIATIONS	5
ABSTRACT	6
TIIVISTELMÄ	8
1 INTRODUCTION.....	10
1.1 Research traditions on socio-economic inequalities in health.....	11
1.2 Research traditions on sickness absence	12
1.3 Relevance of previous traditions	13
2 REVIEW OF THE LITERATURE.....	15
2.1 Sickness absence as a health indicator	15
2.2 Age and gender differences	16
2.3 Length of sickness absence periods	17
2.4 Work injury absences.....	18
2.5 Socio-economic inequalities in sickness absence.....	19
2.6 Trends in socio-economic inequalities in sickness absence	20
2.7 Multiple socio-economic position measures as determinants of sickness absence.....	21
2.8 Socio-economic inequalities in work injuries	22
2.9 Explanatory factors for socio-economic inequalities in sickness absence	23
2.10 Theoretical framework of sickness absence	26
2.11 Summary of previous research and conceptual model of determinants of sickness absence	28
3 AIMS OF THE STUDY	32
3.1 Context of the study	32
3.2 Specific aims of the study.....	32
4 DATA AND METHODS	34
4.1 Background	34
4.2 Register data	34
4.3 Survey data and linkages	35
4.4 Measurements.....	36
4.5 Statistical methods	39
4.6 Ethical issues	40
5 RESULTS.....	41
5.1 Trends in socio-economic differences in sickness absence.....	41
5.2 Interrelationships between socio-economic determinants of sickness absence.....	44
5.3 Work injury absence as determinant of socio-economic inequalities in sickness absence.....	46
5.4 Explanations of occupational class differences in sickness absence.....	48
6 DISCUSSION	51
6.1 Main findings	51
6.2 Trends in socio-economic differences in sickness absence.....	52
6.3 Interrelationships in socio-economic determinants of sickness absence and work injury absence.....	54
6.4 Explanations of occupational class differences in sickness absence.....	56
6.5 Methodological issues.....	57
6.6 Overview of socio-economic determinants of sickness absence	58
7 CONCLUSIONS	61
ACKNOWLEDGEMENTS	63
REFERENCES.....	64

LIST OF ORIGINAL PUBLICATIONS

- I Piha K, Martikainen P, Rahkonen O, Roos E, Lahelma E. Trends in socio-economic differences in sickness absence among Finnish municipal employees 1990-99. *Scandinavian Journal of Public Health* 2007; 35(4): 348-55.
- II Piha K, Laaksonen M, Martikainen P, Rahkonen O, Lahelma E. Interrelationships between education, occupational class, income and sickness absence. *European Journal of Public Health* 2010 Jun; 20(3): 276-80. Epub 2009 Oct 20.
- III Piha K, Laaksonen M, Martikainen P, Rahkonen O, Lahelma E. Socio-economic and occupational determinants of work injury absences. *European Journal of Public Health* 2013 Aug; 23(4): 693-8. Epub 2012 Dec 3.
- IV Laaksonen M, Piha K, Rahkonen O, Martikainen P, Lahelma E. Explaining occupational class differences in sickness absence: results from middle-aged municipal employees. *Journal of Epidemiology and Community Health* 2010 Sep; 64(9): 802-7. Epub 2009 Sep 23.

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ABBREVIATIONS

BMI	Body Mass Index
CI	Confidence Interval
MET	Metabolic Equivalent
RR	Relative Risk
SA	Sickness Absence
WHO	World Health Organization

ABSTRACT

Socio-economic inequalities in health are a remarkable public health issue. There is abundant evidence showing that low socio-economic position is associated with poor health. Sickness absence is a well-established health-related measure, which causes substantial direct and indirect costs. Sickness absence is associated with other health indicators, such as self-rated health, disability pension, and mortality. Low socio-economic position, as measured by education, occupational class, and income, is associated with higher sickness absence rates. Although socio-economic inequalities in other domains in health have increased for decades, there is a lack of studies on changes over time of socio-economic inequalities in sickness absence. Different socio-economic position measures form a pathway that produces ill health, but no studies have so far analysed these pathways in sickness absence. Also, occupational class differences in work injuries are large, but socio-economic inequalities in work injuries and related absence by other socio-economic position measures are unknown. Explanatory factors, such as family-related factors, physical working conditions, psychosocial working conditions, and health-related behaviours contribute to sickness absence and other health outcomes, but the results vary between studies. In addition, their effects on occupational class inequalities in sickness absence are less examined. Previous sickness absence research provides no established theoretical framework for the study of socio-economic determinants of sickness absence. Based on previous research, a conceptual model of the determinants of sickness absence is developed. The conceptual model is considered from structural, causal, and intervention perspectives.

The aim of this study was to examine the socio-economic determinants of medically certified sickness absence. Specific aims were to analyse (1) time trends, (2) interrelationships between key socio-economic position determinants, (3) work injury absence as a contributor to socio-economic inequalities in sickness absence, and (4) explanatory factors of occupational class inequalities in sickness absence.

The study is part of the Helsinki Health Study, a prospective cohort study. The data for this study include register data for 25-59-year-old employees of the City of Helsinki for years 1990-1999, 2001, 2003-2007, and 2011 for time series- and register-based analyses. The number of employees annually was 16.000 to 28.000 women and 5.000 to 7.000 men, depending on the analyses. Survey data from 2000 to 2002 from those employees who reached the age of 40, 45, 50, 55 or 60 each year were linked to register data and were used in analysing explanatory factors. These data included 5.470 women and 1.464 men. Four days or longer medically certified sickness absence was used as an outcome variable. Key socio-economic determinants, namely education, occupational class, and individual income, were used. Explanatory factors included work arrangements, physical working conditions, psychosocial working conditions, health-related behaviours, and family-related factors. Statistical analyses included Poisson regression.

Large and consistent socio-economic gradients in sickness absence were found by all socio-economic position measures, showing that low education,

occupational class, and individual income were all associated with higher sickness absence rates. Age-adjusted sickness absence rates increased from 1990 to 1999, and absolute socio-economic inequalities widened. Changes from 2001 to 2011 indicated that educational and occupational inequalities in sickness absence decreased. In both genders, education and occupational class practically explained the effect of income. Clear pathways through socio-economic position measures were found, indicating that socio-economic position develops during a longer time period throughout the life course and affects sickness absence. Socio-economic inequalities in work injury absence were equally consistent and larger than sickness absence owed to other causes. Work injury absence, however, accounted for only a minor part of the overall socio-economic inequalities in sickness absence. Physical working conditions and health-related behaviours were the strongest explanatory factors for the occupational class inequalities in sickness absence. The effects of work arrangements, psychosocial working conditions, and family-related factors were negligible.

This study provided new and important evidence on the pathway of the effects of sickness absence through education, occupational class, and individual income. The results for socio-economic inequalities in sickness absence supported previous research. In all, the explanatory factors accounted for 40 to 60% of the occupational class differences in sickness absence. The results from this study empirically supported the developed conceptual model of the determinants of sickness absence. Further research could focus on earlier socio-economic determinants and pathways to sickness absence. The results indicated that work injuries remain a minor but avoidable source of socio-economic inequalities in sickness absence. Possible targets in sickness absence prevention include improving physical working conditions and health promotion designed to enhance health-related behaviours.

TIIVISTELMÄ

Sosioekonomiset terveyserot ovat merkittävä kansanterveysongelma. On laajalti osoitettu, että matala sosioekonominen asema on yhteydessä huonoon terveyteen. Sairauspoissaolot on vakiintunut terveydentilan mittari. Sairauspoissaolot aiheuttavat merkittäviä suoria ja epäsuoria kustannuksia. Sairauspoissaolot ovat yhteydessä muihin terveydentilan mittareihin, kuten koettuun terveyteen, työkyvyttömyyseläkkeelle jäämiseen ja kuolleisuuteen. Koulutuksella, ammattiasemalla ja tuloilla mitattu matala sosioekonominen asema on yhteydessä korkeampiin sairauspoissaolotasoihin. Vaikka sosioekonomiset terveyserot muilla terveydentilan mittareilla arvioituna ovat kasvaneet usean vuosikymmenen ajan, tutkimusta sairauspoissaolojen sosioekonomisten erojen kehityksestä on vain vähän. Sosioekonomisen aseman eri tekijät muodostavat polun, joka johtaa kohti huonoa terveydentilaa, mutta tutkimusta siitä, miten nämä polut johtavat sairauspoissaoloihin ei ole. Työtapaturmista aiheutuneiden poissaolojen ammattiaseman mukaiset erot ovat suuria, mutta muiden sosioekonomisen aseman mittarien yhteyttä työtapaturmista aiheutuneisiin poissaoloihin ja eriarvoisuuteen niissä ei tunneta. Selittävät tekijät, kuten perhetilanne, fyysiset työolot, psykososiaaliset työolot ja terveystyötyminen ovat yhteydessä sairauspoissaoloihin ja terveydentilan muihin osa-alueisiin, mutta tulokset vaihtelevat tutkimuksesta toiseen. Lisäksi näiden tekijöiden yhteyksiä sairauspoissaolojen ammattiaseman mukaiseen eriarvoisuuteen on tutkittu vain vähän. Aiempi sairauspoissaoloja koskeva tutkimus ei ole tuottanut sairauspoissaolojen sosioekonomisiin syytekijöihin soveltuvaa teoreettista viitekehystä. Tutkimuksessa kehitetään aiempaan tutkimukseen pohjautuva malli sairauspoissaolojen syytekijöistä. Mallia arvioidaan rakenteellisesta sekä syy-yhteyksien ja vaikutusmahdollisuuksien näkökulmista.

Tutkimuksen tarkoituksena oli selvittää lääkärintodistusta vaativien sairauspoissaolojen sosioekonomisia syytekijöitä. Tarkoituksena oli erityisesti tutkia (1) muutoksia ajassa, (2) sosioekonomisten tekijöiden keskinäisiä yhteyksiä, (3) työtapaturmista aiheutuneiden poissaolojen vaikutuksia sairauspoissaolojen sosioekonomisten erojen kokonaisuuteen ja (4) sairauspoissaolojen ammattiaseman mukaisia eroja selittäviä tekijöitä.

Tutkimus on osa Helsinki Health Studya, joka on työssä olevia koskeva etenevä kohorttitutkimus. Tutkimuksen rekisteriaineisto kattaa 25-59 vuotiaat Helsingin kaupungin työntekijät vuosilta 1990-1999, 2001, 2003-2007 ja 2011. Aineistoa käytettiin aikasarjoissa ja rekisteripohjaisissa analyyseissa. Analyysistä riippuen aineistossa oli vuosittain 16.000-28.000 naista ja 5.000-7.000 miestä. Selittäviä tekijöitä koskevissa analyyseissa käytettiin vuosina 2000-2002 kerättyä kyselyaineistoa, joka kattoi työntekijät, jotka kunakin vuonna täyttivät 40, 45, 50, 55 tai 60 vuotta. Kyselyaineisto yhdistettiin rekisteriaineistoon luvan antaneiden osalta, joita oli 5.470 naista ja 1.464 miestä. Vastemuuttujana käytettiin neljä päivää tai pidempään kestäneitä sairauspoissaoloja, joita varten tarvittiin lääkärintodistus. Tutkimuksessa hyödynnettiin tärkeimpiä sosioekonomisen aseman mittareita, jotka ovat koulutus, ammattiasema ja henkilökohtaiset tulot. Selittäviä tekijöitä olivat työaika ja työsuhte, fyysiset työolot, psykososiaaliset

työolot, terveystyytyminen ja perhetilanne. Tilastollisena menetelmänä käytettiin Poissonin regressiota.

Sosioekonomiset erot olivat suuria ja johdonmukaisia kaikkien tutkittujen sosioekonomisen aseman mittarien mukaan. Matala koulutus, ammattiasema ja henkilökohtaiset tulot olivat yhteydessä korkeisiin sairauspoissaolotasoihin. Ikävakioidut sairauspoissaolot lisääntyivät ja sosioekonomiset erot sairauspoissaoloissa kasvoivat vuosien 1990 ja 1999 välillä. Vuosien 2001 ja 2011 välillä koulutuksen ja ammattiaseman mukaiset erot sairauspoissaoloissa vähenivät. Sekä miehillä että naisilla koulutus ja ammattiasema käytännössä selittivät henkilökohtaisten tulojen yhteyden sairauspoissaoloihin. Tutkimuksessa löydettiin selkeitä polkuja sosioekonomisen aseman eri mittarien välillä, joka viittaa siihen, että sosioekonominen asema muotoutuu pidemmän ajan kuluessa elämänkaaren eri vaiheissa ja vaikuttaa myöhempiin sairauspoissaoloihin. Sosioekonomiset erot työtaturmista aiheutuneissa poissaoloissa olivat johdonmukaisia ja suurempia kuin muissa sairauspoissaoloissa. Työtaturmista aiheutuneiden poissaolojen merkitys sairauspoissaolojen sosioekonomisten erojen kokonaisuuteen oli kuitenkin pieni. Fyysiset työolot ja terveystyytyminen selittivät eniten ammattiaseman mukaisia eroja sairauspoissaoloissa. Työaika ja työsuhte, psykososiaaliset työolot ja perhetilanne eivät juurikaan selittäneet eroja.

Tutkimus tuotti uutta ja merkittävää tietoa koulutuksen, ammattiaseman ja henkilökohtaisten tulojen muodostamasta polusta kohti sairauspoissaoloja. Havaitut sosioekonomiset erot sairauspoissaoloissa tukivat aiempia tutkimuksia. Tutkitut tekijät selittivät kaikkiaan 40-60 % sairauspoissaolojen ammattiaseman mukaisista eroista. Tutkimuksen tulokset tukivat empiirisesti sairauspoissaolojen syytekijöistä kehitettyä mallia. Tulevien tutkimusten tulisi kiinnittää huomiota sairauspoissaolojen varhaisiin sosioekonomisiin syytekijöihin ja niiden muodostamiin polkuihin. Tutkimuksen tulokset osoittavat, että työtaturmat ovat pieni, mutta ehkäistävässä oleva sairauspoissaolojen sosioekonomisten erojen lähde. Mahdollisia kohteita sairauspoissaolojen vähentämiseksi ovat fyysisten työolojen kohentaminen sekä terveyden edistäminen terveystyytymiseen vaikuttamalla.

1 INTRODUCTION

Socio-economic inequalities in health are an extensive and remarkable public health issue and human phenomenon, and their causes are still largely unknown. There is vast evidence showing that low socio-economic position is associated with poor health, as measured by self-assessed health (Kunst et al. 2005), sickness absence (Feeney et al. 1998, Morikawa et al. 2004, Melchior et al. 2005), injuries (Laflamme, Eilert-Petersson 2001, Laflamme, Burrows & Hasselberg 2009), and mortality (Mackenbach et al. 2003, Tarkiainen et al. 2012). The finding has been demonstrated across numerous socio-economic position measures over the life course, such as childhood socio-economic position, education, occupational class, and individual and household income (Galobardes et al. 2006a, Galobardes et al. 2006b). Socio-economic inequalities in health appear to be a wide and ingrained part of modern society.

It is remarkable that socio-economic inequalities in health are not limited to certain countries, but are found in all Western societies (Mackenbach et al. 1997, Mackenbach et al. 2008). Also remarkable is that socio-economic inequalities have remained stable or increased across European countries (Mackenbach et al. 2003, Kunst et al. 2005, Mackenbach et al. 2008, Tarkiainen et al. 2012). Therefore, the importance of socio-economic inequalities in health is increasing, as potential losses in health, well-being, and economic activity are now receiving attention.

Sickness absence is a well-established health-related measure, which causes substantial direct and indirect costs in terms of lost production and economic activity. In Finland, the costs of sickness absence were estimated to be 4.6% of the gross domestic product in 1991 (Liiketaloustieteellinen tutkimuslaitos 1993). A recent report from the private sector in Finland revealed that, on average, 4.2% of working time was lost to sickness or injury (Elinkeinoelämän keskusliitto 2012). The sickness absence rates have been increasing in Finland from the beginning of the 1980s (Elinkeinoelämän keskusliitto 2012). The relative importance of socio-economic inequalities in sickness absence is likely to be significant and justifies deeper examination.

The focus of this study is on socio-economic inequalities in sickness absence. Special emphasis is given to multiple socio-economic position measures as determinants of subsequent sickness absence. Explanatory factors of socio-economic inequalities in sickness absence are poorly understood. If the underlying phenomena and determinants affecting socio-economic inequalities are better known, we can find ways to affect them favourably. In addition to vulnerable and disadvantaged groups, we can try to find groups that manage well and factors that help them do so. All this information is needed for the design of effective interventions. Research traditions and previous literature on socio-economic inequalities in health and sickness absence need to be reviewed to put individual studies in a wider context.

1.1 Research traditions on socio-economic inequalities in health

The origins of the Finnish research tradition on socio-economic inequalities date back to 1749, when the authorities, then part of the Swedish government, began collecting population statistics. In the late 1800s, several academics addressed topics on socio-economic mortality and morbidity differentials (Lahelma, Karisto & Rahkonen 1996). In particular, Konrad ReijoWaara's study from 1892 of health situation in a rural medical district included analyses on socio-economic inequalities in occupational health among rural population. After certain decline in research on socio-economic inequalities in the 1920s and 1930s, modern social sciences emerged between the 1930s and 1960s in Finland which used quantitative analyses and population-based data sets (Lahelma, Karisto & Rahkonen 1996).

British research on socio-economic inequalities in health, including sickness absence, has been particularly influential. Of the research projects, the Whitehall study on British public sector employees has been important since the late 1960s. Since then, information has been gathered from numerous follow-up surveys, health examinations, and registers. Numerous studies have been made on various public health topics, but from the perspective of this study the most important are those on socio-economic inequalities in health and especially sickness absence (Marmot et al. 1978, Marmot et al. 1991, North et al. 1993, Feeney et al. 1998, Ferrie et al. 2002).

In 1980, the British Black Report pointed out the continuous magnitude and importance of socio-economic inequalities in health (Department of Health and Social Security 1980). The Black Report had a major impact on public health discussion and it set the direction for future research on socio-economic inequalities in health. Since then, a vast literature has emerged analysing the underlying mechanisms and etiological processes behind the inequalities (Macintyre 1997), but even systematic policy to reduce socio-economic inequalities in health has not been successful (Mackenbach 2011), indicating their multidimensional and deeply rooted nature. Recently, the Marmot Review has reintroduced health inequalities and actions necessary for their reduction to wider public discussion (The Marmot Review 2010).

Socio-economic position and its various dimensions and indicators have been thoroughly examined by Galobardes and colleagues (Galobardes et al. 2006a, Galobardes et al. 2006b). They define 'socio-economic position' in terms of the different social and economic factors that affect individuals' or groups' position in the structure of a society. Numerous socio-economic position indicators exist and are used in different settings and for different purposes. Evidently, there is no single indicator of socio-economic position, which could be regarded as the best or suggested for application in all contexts. Galobardes and colleagues categorise socio-economic position indicators throughout the lifecycle, beginning from childhood, when indicators such as parents' education are used, to young adulthood and active working life, and finally to retirement age (Galobardes et al. 2006a, Galobardes et al. 2006b). Increasing focus has been devoted to understanding the determinants of socio-economic inequalities in health over the life-course of an individual (Blane 1999). This thesis takes the

general development towards a more longitudinal approach into account and uses several socio-economic position measures simultaneously.

From the 1990s onwards, socio-economic inequalities in health have been increasingly in the focus of research in medical sociology and public health. In addition, findings in research have migrated towards the political agenda. Recent Finnish public health programmes, such as the “National action plan to reduce socio-economic inequalities in health 2008-2011” and “Health 2015”, aim to reduce socio-economic inequalities in mortality by 20% by the year 2015 (Sosiaali- ja terveystieteiden ministeriö 2001, Ministry of Social Affairs and Health 2008). Besides socio-economic inequalities in health, sickness absence has appeared on the agenda of public health. Although the problem has been identified, few concrete measures have been implemented. This thesis, like public health research in general, can help to develop ways to contribute to public health targets. Public health research, however, cannot affect the will to plan and execute necessary actions to reduce socio-economic inequalities other than indirectly.

1.2 Research traditions on sickness absence

Sickness absence has been studied from the perspective of several disciplines, such as public health, medical sociology, and economics, which is needed to gain a deeper understanding of sickness absence. Public health research on sickness absence has been increasing in both number and depth since the end of the 1990s. Pioneering work on socio-economic position and sickness absence from the earlier era include, for example, Söderfelt and colleagues' study on various social class measures and sickness absence (Söderfelt, Danermark & Larsson 1987). Also an early and remarkable is Tage Kristensen's study from 1991 on work strain and sickness absence among slaughterhouse workers in Denmark. The study was an ambitious attempt to address theoretical considerations on how sickness absence should be seen as an individual phenomenon, which was also a result of the environment. In addition, the study had an empirical part on the effects of physical and mental work strain on sickness absence. Its greatest significance was that it was one of the first to address sickness absence and its determinants in a comprehensive and multidimensional way. Further sickness absence research has largely been conducted along the lines of the Whitehall study as well as the Swedish and Finnish research traditions.

The Whitehall study has been influential in analysing socio-economic position measures and sickness absence. An important reason for this is that the study combined survey data with health examination and register data and therefore new research questions could be addressed. In the 1990s, numerous studies analysed e.g. the association of health behaviours and sickness absence (Marmot et al. 1993), occupational class and short and long sickness absence from different perspectives (North et al. 1993, Stansfeld et al. 1995, Hemingway et al. 1997, Feeney et al. 1998), and gender differences in sickness absence (Feeney et al. 1998). Whitehall studies were also important in establishing

sickness absence as an acknowledged measure of ill-health (Marmot et al. 1995, Kivimäki et al. 2003b).

The Swedish tradition on sickness absence and its association with social class originates from the 1980s (Söderfelt, Danermark & Larsson 1987), but most of the research has appeared from the late 1990s and early 2000s. Regarding sickness absence as a research topic itself, Swedish research is abundant, including epidemiology of sickness absence (Alexanderson et al. 1994, Elfstrand, Alexanderson 2001), gender differences in sickness absence (Alexanderson et al. 1995, Åkerlind et al. 1996), and sickness absence as a predictor of disability pension (Borg, Hensing & Alexanderson 2001, Kivimäki et al. 2007). In addition, Swedish researchers have contributed to general sickness absence research in developing methodology (Hensing et al. 1998, Wikman, Marklund & Alexanderson 2005, Soderberg, Alexanderson 2005) and in publishing systematic reviews on sickness absence and factors related to it (Alexanderson 1998, Alexanderson, Norlund 2004, Allebeck, Mastekaasa 2004a, Hensing 2004, Allebeck, Mastekaasa 2004b). Public debate on sickness absence, to which research has contributed, has also been extensive in Sweden.

In Finland, the Finnish Public Sector Study, led by Vahtera and Kivimäki, has studied sickness absence in detail. Beginning in the late 1990s, employees of a few municipalities in South-West Finland were analysed and clear gradients in sickness absence by employment grade were found (Vahtera et al. 1999). In other studies, for example, effects of psychosocial working conditions (Kivimäki, Elovainio & Vahtera 2000, Kivimäki et al. 2001a, Elovainio, Kivimäki & Vahtera 2002), organisational downsizing and job insecurity on sickness absence (Kivimäki et al. 2001b, Virtanen et al. 2002, Kivimäki et al. 2003a, Vahtera et al. 2004) have been analysed. Collaboration between Finnish, British and Swedish researchers has been extensive and allowed exchange of ideas and international comparisons.

Currently, more research topics are using sickness absence as a generic health indicator (Marmot et al. 1995, Kivimäki et al. 2003b, Kivimäki et al. 2004). The benefits are evident, as sickness absence records have been more openly available as electronic medical records and human resource management systems have become more common. In addition, especially long and medically certified sickness absence has been considered as a reliable and comprehensive health indicator. The sickness absence research has developed from a detached area of research to more generic public health research (Laaksonen, Piha & Sarlio-Lahteenkorva 2007, Salonsalmi et al. 2009, Laaksonen et al. 2010). The impact of sickness absence is also easier to communicate to different stakeholders in terms of health or economic consequences.

1.3 Relevance of previous traditions

This thesis is in many respects based on the previous research traditions on both socio-economic inequalities in health and sickness absence.

In terms of the main focus, this thesis relates to a longer tradition of research on socio-economic inequalities in health, studied in Finland, Britain, the Netherlands and Sweden. In this thesis, the term 'socio-economic inequalities in sickness absence' is used to refer to the underlying inequalities in health, in accordance with the tradition from the Black Report (Department of Health and Social Security 1980) to the Marmot Review (The Marmot Review 2010) and conventions of the leading European researchers in inequalities in health (Kunst et al. 2005, Mackenbach et al. 2008). Terms such as 'socio-economic differences' and 'socio-economic gradients' are more often applied to empirical results, as is often the case in previous studies. As multiple socio-economic measures are taken into consideration together, the study takes into account the most recent developments in research on socio-economic inequalities in health.

The Helsinki Health Study, of which this study is a part, follows the Whitehall tradition in terms of wide and comprehensive data sets and special interest in socio-economic inequalities in health (Lahelma et al. 2004, Lahelma et al. 2005, Lahelma et al. 2012). Employers' register data on sickness absence are available in the Helsinki Health Study and studies utilising several follow-up surveys and longitudinal register data have been produced.

As a sickness absence study, this study leans on both the Whitehall study and Swedish tradition. Sickness absence is also seen as a more generic measure of health, as in recent sickness absence research.

2 REVIEW OF THE LITERATURE

In this chapter, previous research on sickness absence is reviewed first to explain what sickness absence actually is and how it relates to common background characteristics typically found in different populations. Next, literature is reviewed on socio-economic determinants of sickness absence to summarise present knowledge on the subject. Finally, previous conceptual and theoretical considerations on socio-economic determinants of sickness absence are reviewed and a conceptual framework for this study is presented.

2.1 *Sickness absence as a health indicator*

Sickness absence relates to concepts of disease and illness (Taylor 1979). Disease refers to specific medical conditions, usually diagnosed by a doctor. Illness, however, commonly refers to the subjective symptoms experienced by an individual. Sickness can be seen as a role an individual takes, when experiencing a disease or an illness and related limitations in functioning. Sickness absence in itself relates to the concepts of illness, disease and sickness (Alexanderson, Norlund 2004). A person can be on sick leave for three reasons: (1) disease diagnosed by a doctor, even if the person feels otherwise healthy or is seen as such by the environment, (2) feeling ill and being on sick leave without a medical condition and a specific diagnosis, and (3) being on sick leave without an experience of illness or specific disease (Alexanderson, Norlund 2004, Wikman, Marklund & Alexanderson 2005).

Usually, sickness absence is the product of a medically diagnosed disease, causing loss of functional and working ability. Medically certified sickness absence especially is based on a disease diagnosed by a doctor. The diagnosis of the disease is usually based on the entirety of symptoms, findings from the medical examination, and often laboratory or imaging examinations as well. It must however be noted that not all diseases lead to illness or loss of working ability. For example, stable and controlled hypertension or type 2 diabetes may not cause any symptoms in an early phase. The act of seeking medical advice or sickness absence certification is based on a person's subjective expression of an illness. Therefore, illness precedes medical certification and the disease behind that. Also, empirical evidence suggests that a person's own expression of illness plays a key role in sickness absence (Wikman, Marklund & Alexanderson 2005). When the loss of working ability conflicts with work demands, sick leave is taken or granted by a doctor (Alexanderson, Norlund 2004).

Before research on sickness absence was as extensive as it is today, criticism was expressed of the reliability of sickness absence as a health indicator. Sickness absence was seen as vague and non-specific. For example, an employee's subjective considerations on one's own health were thought to meet with unspecific factors, such as conflicts in the workplace. Recent evidence has shown, however, that sickness absence is an independent indicator of health and well-being among employees (Laaksonen et al. 2011).

Sickness absence is associated with other health indicators, such as functioning and self-rated health (Marmot et al. 1995, Blank, Diderichsen 1995). Sickness absence has also been found to predict subsequent disability pension in Swedish and British data sets (Borg, Hensing & Alexanderson 2001, Kivimaki et al. 2004, Kivimaki et al. 2007). This is important, as an employee needs to have a specifically diagnosed and long-lasting disease to be granted a disability pension. In addition, longer sickness absence spells have been found to predict mortality in British, Finnish, Danish and French settings (Kivimäki et al. 2003b, Vahtera, Pentti & Kivimäki 2004, Gjesdal et al. 2008, Ferrie et al. 2009). The association can be regarded as reliable, as it has been found to be clear and consistent in several countries with different social security systems. One Swedish study revealed that a surprisingly large proportion of people on long-term sick leave reported in a questionnaire that they had no limiting long-standing illness and that their self-rated health was good (Sundquist et al. 2007). In the same study, however, sickness absence correlated well with limiting long-standing illness, self-rated health, and various other health outcomes. Although sickness absence is strongly related to other health indicators, we have to bear in mind that an individual's subjective experience of their own health and well-being is an important dimension in sickness absence behaviour (Wikman, Marklund & Alexanderson 2005).

Sickness absence as a health indicator also has other significant strengths, such as reliability, accuracy, and good coverage. Typically, information on sickness absence is gathered from personnel registers, which can be seen as a more reliable source of information than, for example, self-reported data (Burdorf, Post & Bruggeling 1996, Svedberg et al. 2010). As the benefits of using sickness absence as a health indicator are notable, it has been used increasingly in the fields of public health research, occupational health research, and medical research. Information on sickness absence is available only for the working population, however, which limits the feasibility of sickness absence as a health indicator in larger populations.

2.2 Age and gender differences

Longer sickness absences are more common in older age groups, in parallel with numerous other health indicators (Chevalier et al. 1987, Sandanger et al. 2000, Allebeck, Mastekaasa 2004b). One significant difference is found in employees over 60 years old, who are typically less absent from work than 50-60-year-olds. This can be seen as a variant of a healthy worker effect, indicating that their less healthy counterparts retire earlier and only the healthiest and fittest continue in modern working life. The age slope in long sickness absence spells tends to be steeper among men than among women (Moncada et al. 2002). Age differences in sickness absence reflect the decreasing work ability and increasing burden of disease in older ages.

There is a vast amount of research showing that women have more sickness absence than men (Chevalier et al. 1987, Feeney et al. 1998, Gjesdal, Bratberg 2002, Moncada et al. 2002, Allebeck, Mastekaasa 2004b). Explanations have

been rare. Some studies indicate that women have more sickness absence because of urogenital disease and mental illness (Chevalier et al. 1987, Hensing et al. 2000). Explanatory factors have been sought in psychosocial working conditions and family-related burdens in a Danish study (Labriola et al. 2011), but in a Finnish study, these did not explain gender differences (Laaksonen et al. 2008b). Some evidence exists that different occupational distributions between genders explain part of gender differences (Mastekaasa 2005, Laaksonen et al. 2010, Sorlin, Ohman & Lindholm 2011). Overall, the research on gender differences in sickness absence has been limited and lacks a comprehensive approach. The unexplained gender differences suggest that women and men should be taken into consideration separately in sickness absence research, as in this thesis.

2.3 Length of sickness absence periods

Sickness absence periods vary in length but no commonly used categorisation exists and different lengths are used in different studies (Hensing et al. 1998). Usually, short and long spells have been divided, but the cut-off point between these varies from three to 14 days. Very often, no medical certification is needed for short sickness absence, but this depends on employer, insurance policies, social security rules, and legislation.

Short sickness absence has been shown to be owed more often to minor and common illnesses, such as respiratory infections, gastrointestinal infections, headache or other well-defined reasons (Feeney et al. 1998). A small number of employees accounts for long and repetitive sickness absence (Chevalier et al. 1987).

In sickness absence research in general, short sickness absence spells are typically not used as an outcome or are used in comparison with longer spells. In many workplaces, however, occupational health care has adopted a more comprehensive approach towards sickness absence and more attention has been paid to repetitive short sickness absence spells. It has been seen as an indicator of poor job satisfaction and a sign of emerging mental or physical health concerns on an individual level, but the evidence varies (Notenbomer, Roelen & Groothoff 2006, Roelen et al. 2008). Traditionally, more attention has been paid to long and medically certified sickness absence spells.

It has been found that very long sickness absences reflect more serious and medically defined health problems. Mental and musculoskeletal diagnoses in particular cause most of the very long sickness absence periods (Feeney et al. 1998). A Swedish study, with data only on 93 employees absent from work because of musculoskeletal problems, analysed background factors for more than 100 days long sickness absence. Although the study group was small and selected, some valid findings emerged. Employees with more than 100 days long sickness absence more often had monotonous and repetitive work and limitations in several areas of life, such as getting along at home or lack of recreation (Ekberg, Wildhagen 1996). A Norwegian study analysed over 14 days long sickness absence owed to psychiatric illnesses (Hensing et al. 2000). The

study group included more than two million Norwegians and therefore can be considered as comprehensive and reliable. Women had almost double the rate of sickness absence of men but men had more frequent long sickness absence periods than women for diagnoses of psychoses and addictions. Depression was the reason for more than 60% of cases for both women and men.

In this thesis, long sickness absence means more than three days' absence, as medical certification has been considered to be a critical dividing factor. The problem with studying only very long sickness absences is that they account for only part of the sickness absence burden. A study group using only employees with very long sickness absence could also be selected and would limit generalisability of the results.

2.4 Work injury absences

In Western societies, particular attention has been paid to work injuries. For example, in Finland, legislation and regulation on work safety is advanced and extends to practically all areas of work life. Work injuries are also heavily sanctioned and supervisors and managers are held personally responsible if work injuries occur and shortcomings are identified in further investigations. In addition, employers have financial incentives to reduce work injuries in terms of lower insurance payments. Safer work practices are taught in vocational education and continuously in workplaces. Personal protection measures are adopted and are increasingly mandatory. In many workplaces, special attention has been paid to preventing work injuries, by for example "zero accident" programmes. Also, the structure of the economy has changed, and more employers are to be found in service sectors and fewer in agriculture and industry, where the risk of work injuries is higher (Statistics Finland 2011). As a result, work injuries in general and especially fatal work injuries have decreased considerably from 1990 onwards in Finland (Statistics Finland 2011) and the European Union area (Eurostat 2010). Despite this favourable development, work injuries still remain a potentially avoidable source of ill-health and absence from work.

Work injury absences are distributed in parallel to other sickness absences. Men, younger employees, and those in lower occupational classes are at higher risk of work injuries (Melamed et al. 1999, Niedhammer et al. 2008, Laflamme, Burrows & Hasselberg 2009, Eurostat 2010). Also, low education has been found to be associated with higher rates of work injuries (Oh, Shin 2003). Construction, food processing, agriculture and livestock work are most risk prone industries in Finland (Statistics Finland 2011). Niedhammer and colleagues (2008) found in French data that occupational inequalities exist in long sickness absence and work injuries. They found that lower occupational classes have poorer self-rated health, more long sickness absence and more work injuries. Many explanatory work-related factors were found, such as possibility to decide on own work, ergonomics, and physical and chemical exposures. The authors also suggest that focusing on these work-related factors could be a way to reduce socio-economic inequalities in health. They did not,

however, study work injury absences directly. There is a clear lack of research on socio-economic inequalities in work injury absence.

2.5 Socio-economic inequalities in sickness absence

Numerous socio-economic position indicators have been used in public health research, but the most common are education, occupational class, and income. The socio-economic position measures follow a temporal order and are interrelated as follows. (1) Education is usually completed in early adulthood and is also a prerequisite for certain jobs. In addition, education provides people with certain general knowledge and makes it easier for them to learn about health-affecting factors and adopt healthier behaviours in their everyday life. (2) Occupation largely determines working conditions. Certain occupations have more unfavourable physical, mental, and social working conditions and are more dangerous with regard to work injuries and work-related deaths than others. Usually, wage from occupation forms a major part of an individual's income. (3) Income in itself reflects material resources and determines the possibility to consume, for example, healthier food or private health services, acquire proper housing, and perform physical exercise of different types. Income usually changes over time, in contrast to other indicators of socio-economic position. It is thus clear that no single socio-economic position measure fits all situations or research questions (Galobardes et al. 2006a, Galobardes et al. 2006b.)

Socio-economic inequalities in sickness absence are similar in direction and strength as in other health indicators. Low socio-economic position is related to higher rates of sickness absence, as concluded in a comprehensive systematic review of the literature carried out by the Swedish Council on Technology Assessment in Health Care (Allebeck, Mastekaasa 2004b), but studies focusing on this issue have been limited.

Education is determined in early adulthood but is a prerequisite for many occupations in later life. Several studies with other main research questions have employed education as a background indicator for sickness absence. These studies show that low education predicts future sickness absence in various countries and study groups including Sweden (Floderus et al. 2012, Mittendorfer-Rutz et al. 2013), Greek study on a limited and selected population of shipyard workers (Alexopoulos et al. 2008), and concerning psychiatric sickness absence in Norwegian men in a study with large population data (Kristensen, Gravseth & Bjerkedal 2010). In a Swedish study, education was found to predict future disability pensions also if previous sickness absence was adjusted for (Wallman et al. 2009). Practically no studies have focused directly on educational differences in sickness absence or tried to find explanatory factors or subsequent phases in the lifecourse.

Occupational differences in sickness absence have been reported in the basic statistical reports often published by statistical authorities. More detailed analysis from the Whitehall study has revealed that low occupational class is associated with higher short and long sickness absence (Feeney et al. 1998). The findings are supported by evidence from Finland (Vahtera et al. 1999) and

France (Melchior et al. 2005) with large and representative cohorts. Occupational differences have also been found in a Spanish study showing that manual workers have more long sickness absence spells than white-collar workers (Moncada et al. 2002). In Spain, the occupational class inequalities tend to be steeper among men than among women and the findings were evident in all working-age groups. Occupational differences were smaller or no differences were found in very short absences (Vahtera et al. 1999). In addition, specific findings have been reported in studies with smaller and less representative study groups and narrower research questions. For example, welders and metal workers have been reported to have more respiratory sickness absence than, for example, office workers (Alexopoulos, Burdorf 2001). Findings from studies on limited or selected populations can be regarded as complementary only.

One comparative study exists which analysed occupational class differences in a French GAZEL cohort and a British Whitehall II study cohort (Fuhrer et al. 2002). The outcome was more than eight days long sickness absence. The results were similar indicating that occupational class was an independent determinant of sickness absence in both cohorts and that known risk factors did not explain the association. Although the occupational inequalities were greater in the British cohort, the study indicated that occupational inequalities in sickness absence share a common element that applies to different workplaces and social security environments.

Surprisingly few studies have analysed income as a determinant of sickness absence, as the association of low income and other health indicators, such as self-rated health and mortality, has been studied and found in several countries (Rahkonen et al. 2002, Mackenbach et al. 2005, Mackenbach et al. 2008, Tarkiainen et al. 2012). A Swedish study from the early 1990s analysed the association of income and sickness absence in Malmö region (Isacsson et al. 1992). All inhabitants of suitable age who were entitled to sickness benefits were included in the study. No sub-classification regarding unemployment, part-time employment, and full-time employment was made, however, and this must be regarded as a weakness. The findings showed that the absence rates were smallest in the lowest income group and the highest income groups. The results were interpreted by the fact that part-time employees, students, and employees with temporary employment, were overrepresented in the lowest income groups. These groups might be more prone than others to be sick at their own expense. In another Swedish study, high-income groups were less likely to be on the sick list than those in the control population (Love et al. 2012).

2.6 Trends in socio-economic inequalities in sickness absence

In Western European countries the public health authorities often follow up and report trends in socio-economic inequalities in health. The follow-up is important for spotting desirable or non-desirable developments. In addition, it offers opportunities to examine the effectiveness of different policies designed to improve overall health or to reduce socio-economic inequalities in health.

Generally, mortality and morbidity have decreased in Western societies but socio-economic inequalities in health have increased, mostly because the development has been more favourable in high socio-economic groups (Marang-van de Mheen et al. 1998, Mackenbach et al. 2003, Tarkiainen et al. 2012). National registers regularly report trends in sickness absence in various countries. In Finland, Statistics Finland (Statistics Finland 2013) and employers' associations, for example, report such figures (Elinkeinoelämän keskusliitto 2012). They indicate that the overall rates of sickness absence have remained relatively stable from the late 1980s, but a slight decrease in sickness absence occurred in the mid-1990s, after which they increased again. More explanatory approaches have been rare.

An Irish study on construction industry employees examined more than three days long sickness absence in the 1980s and 1990s. Sickness absence decreased from 1981 to 1988. The study indicated that economic depression in the construction industry might explain the reduction (Brenner, Ahern 2000). Bergendorff examined sickness absence among 20-64-year-old employees in various European countries between 1983 and 2001, based on surveys carried out in all the studied countries (2003). In Finland, the overall sickness absence levels were in the mid-range, in comparison with other countries, and remained relatively stable. The Netherlands, Norway and Sweden had more sickness absence than other countries and the rates somewhat increased. Denmark and former West Germany were identified as countries with low sickness absence rates. The weakness of this study was that the sickness absence was self-reported and not gathered from registers. In addition, no deeper explanations were pursued. Self-rated sickness absence has been shown to be more unreliable than register data (Burdorf, Post & Bruggeling 1996, Svedberg et al. 2010).

There is a lack of studies on socio-economic inequalities in sickness absence, which aim to analyse changes over time. As there are changes in both socio-economic inequalities in other health indicators and sickness absence rates in general, changes in socio-economic inequalities in sickness absence might also have occurred.

2.7 Multiple socio-economic position measures as determinants of sickness absence

Variable socio-economic indicators have been used in research on socio-economic inequalities in health. Less attention has been paid to the specific features of certain socio-economic indicators, as practical issues such as data and variable availability have limited the choice. Increasing evidence exists that socio-economic indicators do not reflect the same features of an individual, are differently associated with health outcomes and thus are not interchangeable without care (Geyer, Peter 2000, Lahelma et al. 2004, Geyer et al. 2006, Galobardes et al. 2006a, Galobardes et al. 2006b). An increasing number of studies, however, have now included more than one socio-economic position indicator at the same time in order to reveal the differences and interrelationships between them.

In sickness absence research, several studies have revealed that occupational class appears to be an important factor, but its relation to the other socio-economic determinants has remained largely unknown (North et al. 1993, Melchior et al. 2005, Christensen et al. 2008). Previous studies on other health outcomes, such as psychosocial health and self-rated health suggest that the effects of the socio-economic position measures might be mediated or explained by each other (Singh-Manoux, Clarke & Marmot 2002, Laaksonen et al. 2005).

Lahelma and colleagues (2004) analysed three different socio-economic position indicators, namely education, occupational class, and income, as determinants of limiting long-standing illness and self-rated health. The data they used were the Helsinki Health Study survey, which is also used in this thesis. When all three socio-economic position indicators were taken into account simultaneously, household income was individually associated with limiting long-standing illness among women and occupational class among men. When self-rated health was analysed as a health outcome, household income was associated most strongly among women and education among men (Lahelma et al. 2004). The results are remarkable in showing that different socio-economic position indicators are all involved in a certain pathway that produces ill-health. It is, however, difficult to interpret the results and further studies on other health outcomes and explanatory factors are needed.

When evidence from multiple analysis and research on several socio-economic position measures are put together, it is evident that different socio-economic position measures should be regarded as complementary indicators, each of which partly reflects different aspects of socio-economic position dimensions. This is also true of sickness absence research. Knowing more of the pathways on the production of sickness absence, we could direct preventative measures at the earlier and probably the more effective phases of the development of socio-economic inequalities in health.

2.8 Socio-economic inequalities in work injuries

Laflamme and colleagues wrote a report for WHO (2009), in which socio-economic inequalities in all kinds of injuries were reviewed as comprehensively and systematically as within reason possible, considering that the subject is quite narrow. Studies focusing on socio-economic inequalities of injuries are scarce. The authors identified and evaluated a vast number of studies on injuries, which usually included some of the socio-economic position measures as a background factor. The factors included, for example, education, occupational class, income, and several other measures. Also, different injury types were analysed; the majority of studies included self-caused injury and suicide, traffic accidents, and domestic violence. The authors concluded that low socio-economic position is largely associated with higher risk of injuries (Laflamme, Burrows & Hasselberg 2009.)

There are very few studies on the socio-economic determinants of work injuries. One Swedish study with a county-based population found that manual workers

had more injuries than salaried employees, even after various work related factors were taken into consideration (Laflamme, Eilert-Petersson 2001). A study with a nationally representative population from the United States revealed that education was an individual risk factor for non-fatal work injuries, after occupational factors were adjusted for (Oh, Shin 2003).

There is a clear lack of research on socio-economic inequalities in work injuries. Also, the overall contribution of work injuries to socio-economic inequalities in health has not been analysed. As the development of work injuries in recent decades suggests, work injuries remain a potentially avoidable source of socio-economic inequalities in health, and further research is needed.

No studies have examined several socio-economic position measures together to analyse in greater depth the socio-economic pathways to work injuries. In addition, only few studies have analysed socio-economic differences in work injury absence and more detailed analyses are lacking. These issues are relevant as previous studies suggest that differences exist and information on their grades would help the analysis of their relative significance and reveal possible targets for interventions.

2.9 Explanatory factors for socio-economic inequalities in sickness absence

As previous studies have shown, the socio-economic inequalities in sickness absence are steep and consistent. Therefore, it is a logical step to look at potential explanatory factors for the differences found. As sickness absence as a phenomenon is limited to the working population, suitable domains to explore are family-related factors, physical working conditions, psychosocial working conditions, and health behaviours. These domains are shown to be associated with other health outcomes. The factors also help in identifying potential targets for interventions or protective measures.

In family-related factors, much has been discussed about the double burden, especially among women. Double burden means that a person has a high workload in terms of both paid and domestic work. Research evidence on family burden and sickness absence has been scarce and incoherent, however. In a Swedish study, responsibility for small children increased sickness absence among women but not among men (Blank, Diderichsen 1995).

Physical working conditions include traditional risk factors such as lifting heavy loads, physically strenuous work, repetitive movements, and being exposed to such agents as dust, dirt, heat, and damp. This area is usually well covered in traditional occupational healthcare practices, protective regulation and legislation. Also, working life has changed from manufacturing towards services during decades, and physical working conditions have improved inside workplaces.

Evidence on the association of physical working conditions and sickness absence varies. A Swedish review analysed a large number of studies and concluded that only physically stressful work was somewhat related to sickness

absence (Allebeck, Mastekaasa 2004b). A Danish study found that in general terms physical working conditions were associated with sickness absence (Christensen et al. 2008). A Dutch prospective study analysed both psychosocial and physical working conditions as determinants of subsequent sickness absence because of low back pain. The follow-up time was on average more than three years. In terms of physical working conditions, bending of the body, rotation and lifts were associated with higher risk of sickness absence (Hoogendoorn et al. 2002). Unfortunately as regards to the subject of this study, no socio-economic position was included in the analyses as the researchers thought it would overexplain the findings. A French cohort study found that adverse physical working conditions, as measured by postural constraints, occupational hazards, night work, and outdoor work activities, were strongly related to musculoskeletal sickness absence (Melchior et al. 2005). Another French study from a national survey on working population revealed that physical work exposure, such as ergonomic factors, and physical and chemical exposures were associated with occupational class differences in long sickness absence (Niedhammer et al. 2008). Overall, the evidence on the association of physical working conditions and sickness absence seems reliable, but is divided to small parts.

Psychosocial working conditions are a heterogeneous group of work-related factors, which have been thought to affect health and well-being. Often, the ideas for the factors originate from fields such as psychology and social psychology and are operationalised so that information is gathered from questionnaire patterns. The most widely analysed factor is the combination of high job demands and low job control, as presented in a classical study of Swedish men (Karasek et al. 1981). Generally, the evidence is far from consistent. A Swedish systematic review concluded that for psychosocial working conditions consistent evidence was only found for low job control, which was associated with higher sickness absence (Allebeck, Mastekaasa 2004b). If studies on psychosocial working conditions and sickness absence are examined in more detail, the results vary between countries and data sets, as follows.

The British Whitehall study on civil servants found that high job demands, low job control, variety of and use of skills, low levels of job satisfaction, and support at work by peers were associated with higher sickness absence (North et al. 1993, North et al. 1996). In the same data, low job control and low work pace was associated with higher sickness absence due to back pain (Hemingway et al. 1997). From Western Europe, similar results were found in a French study, showing that low job control, high psychological demands in work, time pressures, and low social support received from peers were associated with higher future psychiatric sickness absence (Melchior et al. 2003). Further analyses of the same data set found only limited evidence that working conditions explain occupational class differences in sickness absence (Melchior et al. 2005). Another French study on national survey on working population did not find occupational differences explained by psychosocial working conditions (Niedhammer et al. 2008). In a Dutch study of psychosocial working conditions, only low job satisfaction determined future sickness absence (Hoogendoorn et al. 2002).

Results from the Nordic countries are no different from those of other countries in that the evidence varies. In Sweden, psychological demands were associated with higher sickness absence, and the association was clearer among women (Blank, Diderichsen 1995). In another Swedish study with a small data set, greater job demands and active job position were related to over 14 days long sickness absence (Krantz, Östergren 2002). A Swedish questionnaire-based cross-sectional study indicated that opportunities to adjust work tasks and other work characteristics to cope with reduced health status and stimulating work on the motivational side were associated with lower sickness absence and also explained some of the socio-economic differences in sickness absence (Johansson, Lundberg 2009). In Finnish studies, poor control over working times was associated with higher sickness absence among women (Ala-Mursula et al. 2002) and low perceived organisational justice was associated with higher sickness absence in future (Elovainio, Kivimäki & Vahtera 2002).

Previous studies on psychosocial working conditions show that they do not constitute clear and indisputable risk factors in sickness absence. The associations identified follow no clear pattern and explanatory differences between the studies are difficult to find.

Health behaviours usually mean classical behavioural risk factors for ill-health, namely increased alcohol use, smoking, poor dietary habits, overweight, and little or no exercise. Vast evidence exists showing that these factors are associated with poor health. Nevertheless, direct studies on health behaviours and sickness absence are rarer. Classically, smoking has been found to be associated with higher sickness absence. The finding has been confirmed in multiple settings and periods from Polish factory workers in the 1970s (Jedrychowski 1976) to Australia in the 1990s with nationally representative data (Bush, Wooden 1995). The Australian study showed that every additional year of smoking yielded a 1.2% rise in sickness absence. Respectively, smoking cessation reduced the risk of sickness absence. North and colleagues found that smoking and alcohol use were associated with higher sickness absence (1993). A Finnish study revealed that problem and binge drinking increased the risk of self-certified and medically certified sickness absence among women (Salonsalmi et al. 2009). In a Danish study, health behaviours accounted for 5 to 18% of sickness absence differences between occupational classes (Christensen et al. 2008). The finding from Denmark is interesting, but more evidence from studies, which take other factors into account, is needed. On the whole, health behaviours appear as a clear potential risk factor in sickness absence. They also have clear and understandable explanatory mechanisms through which they affect health status and further sickness absence.

As explanatory factors may overlap in character, it is useful to assess the combined effect of these factors on the socio-economic inequalities in sickness absence. Three more profound studies have analysed this question. First, a British study, which accounted for several psychosocial factors together, found that approximately one-third of the occupational class inequalities in sickness absence were explained by these factors (North et al. 1993). Second, a French study, which also included information on physical working conditions, concluded that psychosocial and physical work conditions explained

approximately 20% of the occupational class differences in sickness absence (Melchior et al. 2005). Third, a Danish study revealed that health behaviour, physical working conditions, and psychosocial working conditions together accounted for 41 to 59% of occupational class differences, depending on occupational class and gender (Christensen et al. 2008).

It can be concluded that single explanatory factors are seldom remarkable and the combined effect appears to be relatively strong. However, the profound determinants of occupational class inequalities in sickness absence remain unknown. Even less is known on explanatory factors for other socio-economic position measures, such as education and income.

2.10 Theoretical framework of sickness absence

Although research on sickness absence has increased, only minor attention has been paid to the construction of relevant theory. Alexanderson analysed previous research on sickness absence in 1998 from the perspective of the different explanatory models and theories included in the studies (Alexanderson 1998). According to the review, in most models, sickness absence has been categorised in dichotomies, such as avoidable-unavoidable, illegal-legal and unnecessary-necessary. Sickness absence is seen as the latter part of these dichotomies, namely as unavoidable, legal and necessary. In the models, factors associated with sickness absence have often been structurally categorised on national, workplace, and individual levels.

Another comprehensive review, carried out by the Swedish Council on Technology Assessment in Health Care, examined previous literature on sickness absence in relation to the explanatory models and theories used (Allebeck, Mastekaasa 2004a). The review indicated that studies on sickness absence very often lack a theoretical model. Explanatory mechanisms are also seldom analysed or focus on specific research questions only.

In a commentary review, Steensma (2011) concluded that different theories aiming to explain sickness absence usually fall into three categories, namely decision models, occupational stress models, and organisational models. First, decision models regard sickness absence as something that an individual person can affect within certain limits, driven by experience of the advantages and disadvantages of being absent. Second, occupational stress models emphasise especially the psychological characteristics of work and the work environment. Moreover, people are seen to have different coping abilities when faced a stressor. Generally, the higher the stressors and lower the coping abilities, the more likely sickness absence is to occur. Finally, organisational models highlight the motivational and rewarding factors that are more likely to keep people at work. Steensma also calls for integrated theories to adopt useful aspects of the several more limited theoretical approaches.

The Danish researcher Tage S. Kristensen listed five requirements for a suitable explanatory theory for sickness absence in a widely cited study (1991):

1. *A theory of sickness absence should be holistic, incorporating factors at all levels*
2. *A theory of sickness absence should consider the individual as a product of his or her environment and, at the same time, as a conscious actor who makes choices within a given social framework. Thus absence cannot be explained by using only a deterministic or a voluntaristic model.*
3. *A theory of sickness absence should not regard absence from a normative point of view, i.e. see it as something bad that must be reduced or minimized. Such a theory should rather deal with the functions absence serves for employees and attempt to uncover which type of absence is optimal seen from a health perspective.*
4. *Sickness absence is not a simple function of sickness but reflects a person's general subjective perception of his/her own health and the factors that influence it.*
5. *The greater the job demands and the fewer the coping possibilities in the work situation, the higher the sickness absence rate.”* (Kristensen 1991)

Kristensen's list of requirements is in parallel with other reviews of sickness absence research theories and explanatory models (Alexanderson 1998, Allebeck, Mastekaasa 2004a). It is, however, evident that Kristensen has more questions than answers regarding theories. Kristensen's requirements are a good starting-point, but the fifth requirement can be regarded as somewhat narrow, as the evidence on psychosocial and other explanatory factors of sickness absence is increased after 1991.

The Swedish researchers Thulesius and Grahn presented a practical theoretical approach to sickness absence and practical problems limiting return to work, which was based on qualitative interviews (2007). According to Thulesius and Grahn, return to work after sickness absence may be limited because of hurt drivers, which they define as a combination of incentives or motivating factors to work. If these drivers are hurt, for example, because of individual experience of illness or symptoms, or getting stuck in a patient role, or because the social security system creates economic disincentives to work, then return to work may be limited. Thulesius and Grahn suggest that these hurt drivers should be recognised on an individual level and should be repaired by a process known as reincentivising work, for example, by providing adequate medical therapy or creating a positive emotional atmosphere. In addition, they introduce a concept of rehumanising, which means providing an employee on sick leave with a support network offering authenticity, safety, new energy and learning (Thulesius, Grahn 2007).

The Swedish researcher Gun Johansson developed a more motivationally oriented theoretical model, called the 'model of illness flexibility', for sickness absence in her thesis (2007). According to Johansson, poor health, knowledge, and specific skills lay the foundation for the capacity to work. Adjustment latitude, by which Johansson means how freely people can affect their work tasks and workload, affects working ability. Motivational factors aiming to keep people at work include attendance requirements, such as the fact that people must catch up with the work later if they are absent, and attendance incentives, such as a positive work climate. Motivational factors encouraging absence from work include absence requirements, such as the feeling that a person is not welcome at work, and absence incentives, such as domestic workload or the need to take care of children. Johansson's model of illness flexibility can be useful for analysing psychosocial characteristics and the environment in the

workplace and at home, but is of limited use for analysing known risk factors for health, such as age, gender, and health behaviours, or exposure to traditional occupational risk factors, such as different chemicals and noise.

From the previous studies and reviews on different theoretical frameworks on sickness absence it is clear that sickness absence can be approached by different theoretical models which suit different research questions. No single model exists, however, that can comprehensively take previous and increasing evidence on sickness absence into consideration. Regarding socio-economic determinants of sickness absence, no applicable theoretical framework is readily available.

2.11 Summary of previous research and conceptual model of determinants of sickness absence

Systematic reviews from previous sickness absence research often call for comprehensive studies on determinants of sickness absence, where more background factors and causal relationships could be addressed (Alexanderson 1998, Allebeck, Mastekaasa 2004a). Previous studies have often focused on narrow or practical research questions, which often lack attachment to wider conceptual models or theoretical frameworks.

Findings from the previous research can be grouped and positioned in the following conceptual model of the determinants of sickness absence, which is also the basis for the empirical part of this thesis (Figure 1):

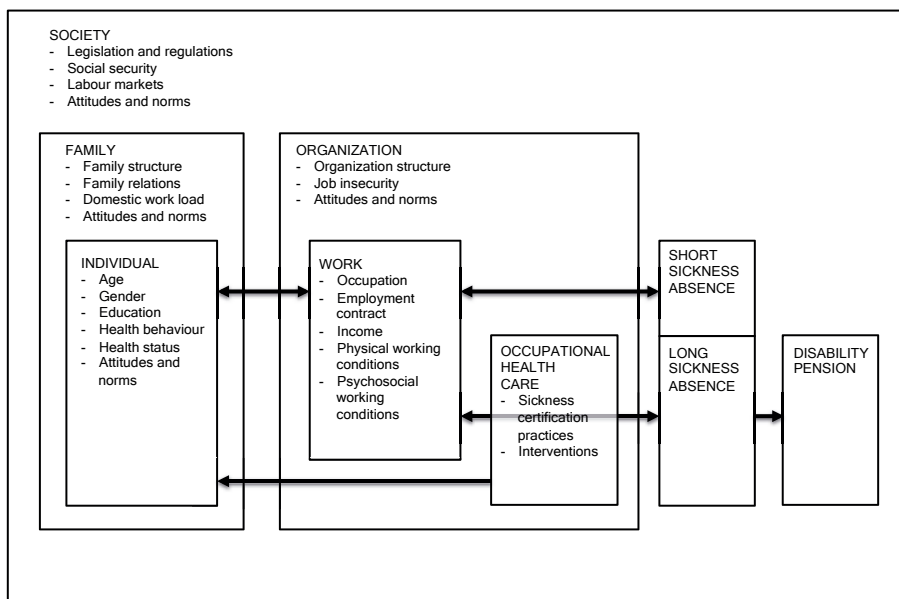


Figure 1. Conceptual model of the determinants of sickness absence.

The conceptual model can be considered from various angles, which are (1) structural, (2) causal, and (3) interventions. In addition, attitudes and norms are seldom analysed but are implicitly thought to affect the background. Principally, sickness absence is considered as a health indicator. For the most part, previous studies support the model, but gaps exist in several areas.

First, the factors, which have been found or are assumed to be involved in the development of both sickness absence and socio-economic inequalities of sickness absence, can be grouped structurally. The surrounding society creates the overall background, in which legislation and regulations, social security regulations and rules, welfare investments, and labour market trends affect sickness absence. Often, both childhood family experiences and present family situation, e.g. domestic workload and taking care of small children (Blank, Diderichsen 1995, Åkerlind et al. 1996), affect the individual. A person is characterised by common background factors, such as age (Chevalier et al. 1987, Sandanger et al. 2000, Allebeck, Mastekaasa 2004b), gender (Chevalier et al. 1987, Feeney et al. 1998, Hensing et al. 2000, Gjesdal, Bratberg 2002, Moncada et al. 2002, Allebeck, Mastekaasa 2004b) and education (Alexopoulos et al. 2008, Kristensen, Gravseth & Bjerkedal 2010, Floderus et al. 2012, Mittendorfer-Rutz et al. 2013). Health behaviours such as smoking (Jedrychowski 1976, North et al. 1993, Bush, Wooden 1995), alcohol use (North et al. 1993, Salonsalmi et al. 2009), exercise, and dietary habits affect health status and sickness absence. Health status as measured by other health indicators is a strong determinant of sickness absence on the individual level (Blank, Diderichsen 1995, Borg, Hensing & Alexanderson 2001, Kivimäki et al. 2003b, Vahtera, Pentti & Kivimäki 2004, Kivimäki et al. 2004, Kivimäki et al. 2007, Marmot et al. 2005, Gjesdal et al. 2008, Ferrie et al. 2009). Working life is structured through organisations, such as workplaces, which may vary from small single entrepreneurs to multinational companies including several smaller organisations. These can be divided into smaller suborganisations or groups. Work itself is characterised by factors such as occupation (Alexopoulos, Burdorf 2001, Moncada et al. 2002), employment contract (Virtanen et al. 2001), income (Isacsson et al. 1992, Love et al. 2012), and physical (Hoogendoorn et al. 2002, Allebeck, Mastekaasa 2004b, Melchior et al. 2005, Christensen et al. 2008, Niedhammer et al. 2008) and psychosocial working conditions (North et al. 1993, Blank, Diderichsen 1995, North et al. 1996, Hemingway et al. 1997, Ala-Mursula et al. 2002, Elovainio, Kivimäki & Vahtera 2002, Hoogendoorn et al. 2002, Melchior et al. 2003, Allebeck, Mastekaasa 2004b). The employer usually arranges occupational health care, where sickness certification practices and interventions aiming to affect working conditions are usually applied. Also, other health service providers may participate in the treatment of a sick employee and grant a sickness certificate, but they are regarded as more distant from the work and organisation and belong structurally to the society level. Sick leave may occur for various reasons, including mental and physical disease and work injuries. Sick leave means an employee is out of the workplace and relieved from work tasks and the influence of the workplace is strongly reduced in consequence.

Previous research on other health indicators suggests that socio-economic position measures constitute causal pathways to sickness absence (Lahelma et al. 2004). These pathways are not yet confirmed in sickness absence as a health indicator, however. For example, it has been shown that the socio-economic position of the childhood family affects future education and health behaviours. Education precedes future occupation and income (Galobardes et al. 2006a, Galobardes et al. 2006b). Several aspects of work predict future sickness absence. Depending on the social security rules, occupational health care acts as a gatekeeper of long sickness absence by means of sickness certification practices. In most cases, an employee must be on long sick leave before a disability pension can be granted.

Causality is not unidirectional only, however, as several intervention or feedback possibilities exist. Work-related factors such as occupation, and physical and psychosocial working conditions may modify individual health behaviours and health status. Occupational health care may apply interventions, for example, treatment of acute and chronic illnesses and rehabilitation of individual employees. Being on sick leave may affect an individual's situation in the workplace, or their income, and may initiate modifications in work tasks. Society in general may alter social security rules aimed at reducing sickness absence (Voss, Floderus & Diderichsen 2001, Arrelöv et al. 2003). Possible selective mechanisms, in which poor health leads to poorer socio-economic position, must be taken into consideration (Chandola et al. 2003).

Although very little studied, attitudes and norms involved on the level of society, family, workplace or organisation (Grinyer, Singleton 2000, Virtanen et al. 2000), and individual may affect each other and sickness absence behaviour. Attitudes and norms can be assumed to affect also the development of control mechanisms, such as legislation and social security rules, psychosocial working conditions, and sickness certification practices (Tellnes, Sandvik & Muom 1990, Arrelöv et al. 2003). Attitudes and norms may vary between societies and subgroups and may help explain differences between countries. In addition, they change over time and may help our understanding of development over time, such as the fact that the overall sickness absence levels have increased in Western societies although health status has improved and mortality declined (Rahkonen et al. 2004, Martikainen et al. 2005).

The strongest evidence exists on the association of well-established individual level risk factors for ill-health, such as age, gender, occupational class, and health behaviour. Weaker evidence exists on work and organisation level risk factors. Evidence on society-level risk factors is mainly indirect, provided by international comparisons, or gained from studies on specific and narrow research questions such as the effect of introducing a qualifying day for sickness absence benefits. The evidence does not, however, contradict the grouping of the factors structurally.

Sickness absence studies often involve a follow-up setting, as the information on sickness absence as an outcome variable is often gathered after a certain baseline. Therefore, causality can be addressed more often than in cross-sectional studies. Longer pathways involving information from several points of

time are studied seldom, however. There is also a lack of sickness absence research including settings with longer time series.

Interventions are usually studied by linking specific occupational healthcare projects and changes in subsequent sickness absence (Elders, van der Beek & Burdorf 2000, Taimela et al. 2008). Projects aiming at reducing smoking or altering health behaviour have sometimes been shown to be successful in reducing sickness absence (Bly, Jones & Richardson 1986, Jones, Bly & Richardson 1990). Effects of changes in social security regulations or economic incentives have rarely been studied scientifically, but some studies exist (Voss, Floderus & Diderichsen 2001, Arrelöv et al. 2003).

Studies on attitudes and norms regarding sickness absence and sickness absence behaviour are rare (Grinyer, Singleton 2000, Virtanen et al. 2000). Some studies have mainly focused on medical certification practices (Tellnes, Sandvik & Muom 1990, Arrelöv et al. 2003).

According to previous research, there is a need for research, which explores more deeply the several socio-economic determinants of sickness absence, and their relative importance, pathways, and explanatory factors. The conceptual model also indicates that these factors are of importance. It is also evident that not all sickness absence causes are similar. Therefore, different causes of sickness absence, including all cause and work injuries, and their socio-economic determinants need to be examined.

3 AIMS OF THE STUDY

3.1 *Context of the study*

This study was conducted on employees of the City of Helsinki, Finland, and it covers two decades from 1990 to 2011. Major changes occurred in the Finnish economy and labour market situation in the 1990s during the study period.

In the early 1990s, the Finnish economy suffered a very deep economic recession and the unemployment rate increased more than fivefold from 3% in 1990 to 17% in 1994. After 1994, the unemployment rates declined at a relatively slow rate to ca. 10% in 1999 and ca. 8% in 2005 (Statistics Finland 2013). The economic downturn also had profound impacts on public sector organisations, which were forced to reduce the number of personnel as tax incomes declined. Ways of reducing personnel varied from layoffs to moderate reductions effected by not replacing retirees and not renewing temporary employment contracts. The social security rules for sickness absence benefits tightened in 1992 and 1993 so that the benefits declined by ca. 10% (Kela 2001).

The impacts of the recession on health have been studied as well. Finnish studies by Vahtera and colleagues have shown that organisational downsizing increased the risk of medically certified sickness absence among those worst affected (Vahtera, Kivimäki & Pentti 1997, Vahtera et al. 2004). Also, organisational downsizing was shown to increase cardiovascular mortality somewhat, but the absolute number of deaths was small and the results must be interpreted as directional (Vahtera et al. 2004). At the same time, however, general health as measured by self-rated health remained stable and the overall mortality declined in Finland (Lahelma et al. 2002, Martikainen et al. 2005).

In the 2000s, the Finnish economy and labour situation were more stable, including the public sector. No major legislation or social security regulation changes took place, which affected sickness absence benefits.

3.2 *Specific aims of the study*

The general aim of the study was to examine relationships between socio-economic determinants of sickness absence and their explanatory factors. Specific attention was paid to analysing key socio-economic position measures, i.e. education, occupational class, and individual income, both separately and together, to examine independent and interdependent effects. In addition, gender differences were considered. The specific aims were to:

1. Study the associations of education, occupational class, and individual income with sickness absence, and assess the changes of the socio-economic differences from 1990 to 1999 (substudy I) and from 2001 to 2011.

2. Assess interrelationships between education, occupational class, and individual income, as determinants of sickness absence (substudy II).
3. Examine education, occupational class, and income as determinants of work injury absence and study the contribution of work injury absence to overall inequality in sickness absence by these determinants (substudy III).
4. Study working conditions, health-related behaviours, and family-related factors as potential explanatory factors for occupational class differences in sickness absence (substudy IV).

4 DATA AND METHODS

4.1 *Background*

The study is part of the Helsinki Health Study, an occupational cohort study carried out in the Hjelt Institute, Department of Public Health at the University of Helsinki, Finland. In Helsinki Health Study, health and well-being of the employees of the City of Helsinki are studied comprehensively. Information on the employees is gathered from various sources, such as register data from the City of Helsinki, baseline questionnaire data with several follow-up questionnaires, and health examination data. In addition, data linkages for third-party registers are included (Helsinki Health Study 2012, Lahelma et al. 2012).

Helsinki is the capital of Finland, and has a population of more than 600.000. The City of Helsinki serves many central welfare functions such as healthcare, social welfare services, basic and secondary education, cultural services, public transport, and technical services (Helsingin kaupunki 2001). For these functions, it employs ca. 40.000 people and is the largest employer in Finland. The number of personnel was reduced in the 1990s recession from 1991 to 1994, after which it increased again. The reductions were mostly effected by not renewing temporary employment contracts. This led to the reduction in the number of temporarily employed personnel by 43% from 1990 to 1994. At the same time, the proportion of the temporarily employed decreased from 34% to 23%. From 1994 to 1999, the number of the temporarily employed increased again and, accordingly, the proportion increased to 29%. Typically of the municipal workplace in Finland, almost 80% of the personnel were women (Helsingin kaupunki 2001).

The Helsinki City Occupational Health Centre provides the employees of the City of Helsinki with preventive occupational health services and primary healthcare level services. The personnel of the Helsinki City Occupational Health Centre consist of 140 employees and are organised through teams consisting of an occupational health nurse, an occupational health physician, a physiotherapist, and a psychologist (Helsingin kaupunki 2013). No major changes affected the service or its coverage during the study period.

The data for this study include both register data obtained from the information system of the City of Helsinki and survey data linked with the registers and collected by the Helsinki Health Study. In general, register-based studies can be regarded as more a reliable source of information on sickness absence than self-reports from questionnaires (Burdorf, Post & Bruggeling 1996, Svedberg et al. 2010).

4.2 *Register data*

The register data included information on basic characteristics of the employees, such as age, gender, education, occupation, work contract, and individual income. In addition, the data included information on sickness

absence and other interruptions to work within an accuracy of one day. The foundations and features of the register data remained the same from the beginning of the 1990s to the end of the 2000s.

The primary register data were processed for study purposes. All full-time permanently and temporarily employed staff aged 25 to 59 were included in the analyses. Only actual working time was included in the analyses and tenures shorter than one full year were taken into consideration by combining them. If an employee had more than one employment period, information on determinants of sickness absence was taken from the longest employment period.

For the first substudy, the years 1990 to 1999 were included in the analyses, except the year 1998, which was excluded because of partly missing primary data, which made it impossible to compare it with the other years. The data included an average of 25.562 women and 7.086 men annually. The time series presented in the first substudy have been extended to include the years 2001, 2006 and 2011 in the analyses and these additional analyses are presented in the Results chapter.

For the second substudy, only permanent employees aged 25 to 59 years working full-time for the City of Helsinki in 2003 were included in the analyses. Employees who were temporarily or part-time employed, or had only secondary employment in the City of Helsinki, were excluded from the analyses. In all, the data for the second substudy included 21.599 women and 5.841 men.

For the third substudy, permanent and full-time employees aged 25 to 59 who were working for the City of Helsinki at the beginning of the year 2004 were included in the study and were followed up until the end of the year 2007. In the third substudy, 16.471 women and 5.033 men were included in the data set, and the mean follow-up time was 3.0 years.

4.3 Survey data and linkages

In the fourth substudy, a survey data collected in the Helsinki Health Study was used (Lahelma et al. 2012). In 2000, 2001 and 2002, all employees in the City of Helsinki who reached the age of 40, 45, 50, 55 or 60 each year received a self-administered questionnaire by mail. In all, 13.346 employees received the questionnaire, of which 67% responded. A non-response study showed that the data collected were representative of the target population (Laaksonen et al. 2008a, Lahelma et al. 2012).

A personal identification number was used to link survey data to the registers of the City of Helsinki for the 78% of the respondents who gave their written consent to the data linkage. A non-response study revealed that those who gave consent differed only slightly from those who did not give consent in terms of background characteristics and sickness absence rates (Laaksonen et al. 2008a). Overall, the survey data can be regarded as reliable and representative.

In the fourth substudy, the survey respondents were followed up on their sickness absence records until their work contract ended or until the end of 2005. The final study population included 5.461 women and 1.463 men and the mean follow-up time was 3.9 years.

4.4 Measurements

Measures used in this study can be categorised as follows: (1) the socio-demographic background indicators age and gender, (2) sickness absence as an outcome measure, (3) the socio-economic position measures education, occupational class, and individual income, and (4) explanatory factors. All measurements are widely used in previous studies on socio-economic inequalities in either sickness absence or other health measures.

Background indicators

Information on age was derived from the personnel register of the City of Helsinki. For the study purposes, only employees within the ages of 25 to 59 were included in the register-based analyses. Age was grouped in five-year groups. In the analyses using survey data, employees were selected according to age.

Information on gender was obtained from the personnel register of the City of Helsinki.

Sickness absence

All sickness absence spells were included in the analyses and consecutive and overlapping sickness absence spells were merged. The outcome was four days or longer sickness absence periods per 100 person years. The City of Helsinki requires a medical certificate from all employees for these sickness absence periods. The sickness certification practices of the City of Helsinki have remained the same since the 1990s.

For the third substudy, sickness absence was categorised as (1) all-cause sickness absence, (2) work injury absence, and (3) other-cause sickness absence, where all-cause sickness absence included work injury absence and other-cause sickness absence. Eurostat uses work injury absences of four days or longer as an outcome measure in reports and has promoted the use of this measure (Eurostat 2010).

Register-based information on sickness absence, as used in this study, can be regarded as highly accurate and reliable. As sickness absence affects both employers' direct personnel costs and national or other health insurance expenses, accurate information on sickness absence is required and provided. A Dutch study on limited data from animal feed-mill workers indicated that self-rated sickness absence is not as reliable as register-based information and varies according to diagnoses (Burdorf, Post & Bruggeling 1996). More reliable results were obtained from a large study on Swedish twins, indicating that

register-based long sickness absence information is more accurate than self-reported sickness absence and is suggested for use in sickness absence research (Svedberg et al. 2010). The most unreliable was sickness absence owed to respiratory diseases and the most accurate was sickness absence owed to back pain. Also, international comparisons based on questionnaires show a more than fourfold difference in overall sickness absence rates, which appear very large (Gimeno et al. 2004).

Hensing and colleagues reviewed different measures in sickness absence research (1998). The authors found that the measures varied considerably, but they suggested that sickness absence incidence, namely the number of new sickness absence episodes divided by total days of population at risk, would be best. The main argument is that sickness absence incidence takes account of the population at risk and does not overestimate the importance of a few very long sickness absences. This could cause problems if the number of days were used. The sickness absence measure used in this study, the number of sickness absence days per 100 person years, is consistent with this recommendation.

Education

Information on education was obtained from the personnel register for each employee. Education was classified on three levels. First, employees with upper secondary school education were classified as having a high educational level. Second, employees with intermediate school and comprehensive school education were classified as being on the middle educational level. Third, employees with education to the mandatory level were classified as having a low educational level.

Occupational class

Information on job title was obtained directly from the personnel register of the City of Helsinki. Occupational class was classified in five categories for study purposes:

- Managers
- Professionals (e.g. doctors, teachers and engineers)
- Semi-professionals (e.g. nurses and foremen)
- Routine non-manuals (e.g. clerical employees)
- Manual workers (e.g. technical workers and janitors)

Categorisation provides consistent results, as compared with several other socio-economic position indicators (Laaksonen et al. 2005). In the fourth substudy, managers and professionals were combined and four categories were used to provide larger groups and narrower confidence intervals in statistical analyses.

Income

Information on income was derived from the personnel register. It is noteworthy that only individual income from the main job with the City of Helsinki was used.

No income from other jobs, income transfers, or capital income was included in the income measure.

For study purposes, employees were divided into income quintiles. The cut-off points for the quintiles were adjusted for the specific needs of each substudy. In the first substudy, the cut-off points were derived from the study year 1999 and were discounted for previous years by average yearly income index for the whole study population to allow comparability between years.

For the second substudy, employees were divided into individual income quartiles according to their monthly individual salary in 2003. In the third substudy, income quartiles were similarly calculated based on the information from the beginning of the year 2004.

Occupation

In the third substudy, numerical information on the occupation title was directly gathered from the personnel register. As the number of the occupational title was used, different spellings of the same occupation did not cause difficulties.

Explanatory factors

Four kinds of explanatory factors were used in the fourth substudy: work arrangements, physical working conditions, psychosocial working conditions, health-related behaviours, and family-related factors. Information on the explanatory factors was derived from the questionnaire data.

Three measures of work arrangements were used: working overtime (more than 40 hours a week), shift work (all those who did not work traditional office hours only), and dichotomy of permanent and temporary employees according to the type of work contract.

Four measures of physical working conditions were used. First, physical workload was assessed by questions on e.g. repetitive movements, lifting, and carrying. Second, exposure to various physical and chemical substances, such as dirt, dust, solvents, and wetness, were assessed. Third, sedentary and computer work were assessed. Fourth, respondents were asked to self-assess how physically strenuous their work was.

Psychosocial working conditions included six generally used measures. First, respondents were asked to assess how mentally strenuous their work was. Second and third, job control and demands were ascertained by the Framingham version of the Karasek questionnaire (Karasek et al. 1998). Fourth, social support at work was assessed by four questions from the Sarason inventory (Sarason et al. 1987). Fifth, job dissatisfaction was self-assessed and a most suitable alternative from the questionnaire was chosen. Finally, existence of bullying at the workplace was asked in the questionnaire.

Health-related behaviours included four basic measures. First, information on smoking grouped respondents in four categories ranging from heavy to never-

smokers. Second, alcohol use was divided into heavy, moderate, and non-drinking. Third, physical activity was divided into quartiles according to the MET index. Fourth, BMI was used to categorise respondents into four categories ranging from underweight to obesity.

Family-related factors included six measures. First, marital status was divided into married or cohabiting, single, and previously married categories. Second, number of underage children was categorised as 0, 1, 2 or more. Third, work-home conflict was assessed by asking how satisfied the respondent was with combining work and family life. Fourth, information on social networks was assessed by asking how often the respondent met friends or relatives. Fifth, social support was assessed by the Sarason inventory (Sarason et al. 1987). Finally, occurrence of negative life events in the family was queried and a sum index was created.

4.5 Statistical methods

Generally, men and women were analysed separately in all analyses. In addition, age was taken into consideration in all analyses.

A direct age-adjustment method was used in the first substudy, using all employees in the study group in 1995 as the standard population (Breslow, Day 1987).

In the first substudy, linear regression was used for analysing time trends for long sickness absence spells. In analysing time trends, age group and study years were included as continuous variables in linear regression models. In this way, a regression coefficient was obtained and showed the average annual change in long sickness absence spells.

In the second and third substudies, Poisson regression was used to estimate relative risks (RR) and their 95% confidence intervals for each socio-economic position group. In the fourth substudy, relative risks were first calculated for each socio-economic position group, and subsequently explanatory variables were adjusted for in the models one at a time. In the final model, all background and explanatory variables were adjusted for simultaneously.

Poisson regression is widely used in sickness absence research (Vahtera, Pentti & Kivimäki 2004, Melchior et al. 2005, Christensen et al. 2008). The main benefit is that it takes the uneven distribution of sickness absence periods, with bigger weight in smaller numbers, into greater consideration. Differences in follow-up time were taken into consideration by using a logarithm of the time as the offset.

In the second substudy, inequality indices were calculated with Poisson regression. A similar approach has been used in previous research (Martikainen, Blomgren & Valkonen 2007). In constituting inequality indices, socio-economic position measures are used as continuous variables, as they are ordinal in nature and consistent gradients by each measure are found. By

calculating inequality indices, we can obtain a single index figure for the effect of each socio-economic position measure. In subsequent analyses, percentage changes in a single index figure are easier to follow and logical interpretations are achievable.

In the third substudy, net contribution of the work injuries was analysed by calculating the reduction of the inequality indices between all-cause sickness absence and other-cause sickness absence. By this approach, the net effect of work injuries could thus be estimated.

All statistical analyses were performed with SAS statistical software versions 8 to 9.1, as the study was carried out over time (SAS Institute Inc. 2013).

4.6 Ethical issues

Ethical issues have been taken into full consideration in this thesis. The modern principles of research ethics in medical sciences were established in the Declaration of Helsinki on medical research on human subjects in 1964, with the latest update in 2008 (World Medical Association 2008). The national guidelines and legislation governing medical and public health research comply with the Declaration.

The Helsinki Health Study and this study as part of it are committed to following the ethical principles of the University of Helsinki. Also, Finnish legislation including the Personal Data Act has been fully complied with. The Department of Public Health at the University of Helsinki and the Ethical Committee of the Health Authorities of the City of Helsinki approved the Helsinki Health Study, and this study as part of it. All necessary data protection measures have been applied. The response to the survey was voluntary, and data linkages were made only for those respondents who gave written consent. The results of this thesis should benefit the study group in terms of increased knowledge of the determinants of their health.

5 RESULTS

5.1 Trends in socio-economic differences in sickness absence

An overview of associations and trends over time was needed for studying the socio-economic determinants of sickness absence. Using data from the personnel register of the City of Helsinki in from 1990 to 1999, socio-economic gradients and relative changes over time. Further analyses were derived from the years 2001, 2006 and 2011 for insight into the changes, which occurred in the 2000s.

In general, a clear and consistent socio-economic pattern across all studied socio-economic dimensions was found, showing that low education, occupational class, and individual income were all associated with higher sickness absence rates.

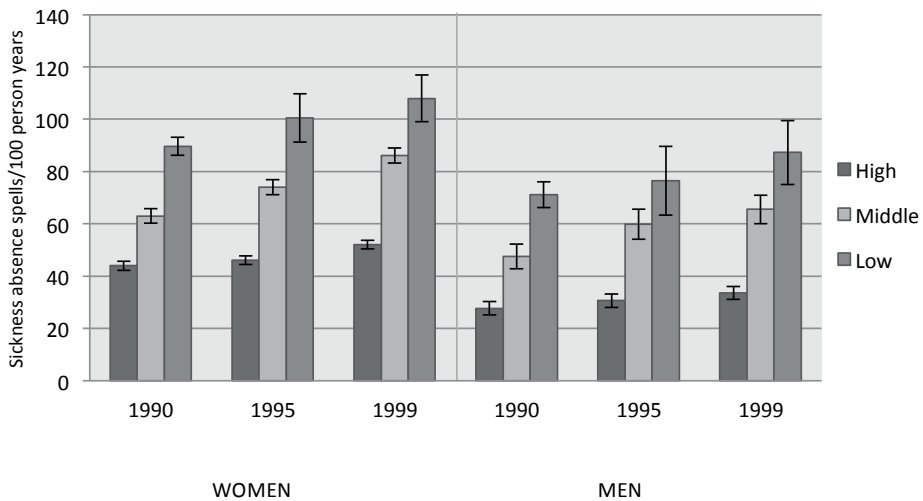


Figure 2. Number of age-adjusted medically certified sickness absence spells/100 person years by education in 1990, 1995 and 1999 (95% CI). Women and men.

For women, the low education group had on average age-adjusted sickness absence rates twice as high as those of the high education group (Figure 2). Sickness absence rates increased considerably from 1990 to 1999 in all education groups. For men, the low education group had on average sickness absence rates two and a half times higher than those of the high education group. As for women, sickness absence rates increased considerably from 1990 to 1999 in all education groups. The absolute differences between lowest and highest education groups increased by 22% among women and 24% among men from 1990 to 1999, showing increased educational inequality in sickness absence.

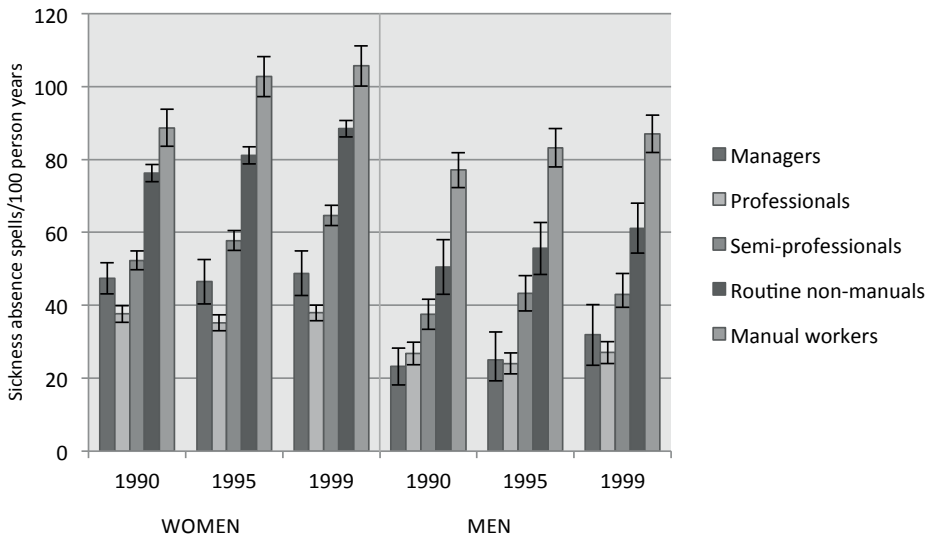


Figure 3. Number of age-adjusted medically certified sickness absence spells/100 person years by occupational class in 1990, 1995 and 1999 (95% CI). Women and men.

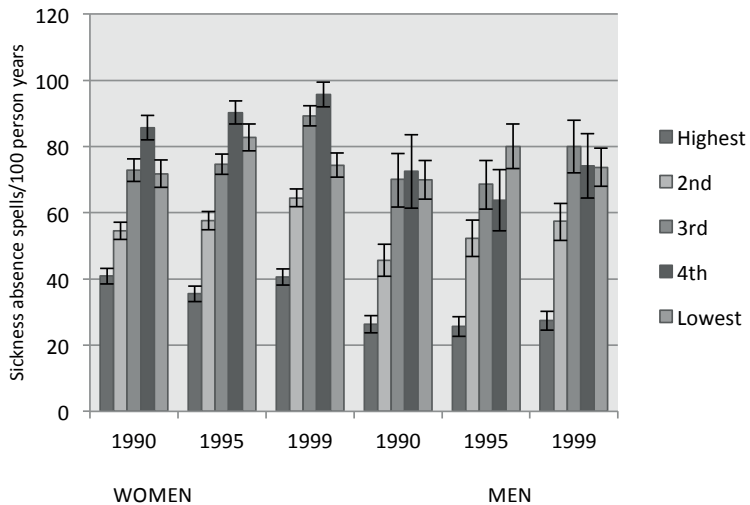


Figure 4. Number of medically certified age-adjusted sickness absence spells/100 person years by income quintiles in 1990, 1995 and 1999 (95% CI). Women and men.

Similar results were also found when differences in age-adjusted sickness absence by occupational classes were analysed (Figure 3). For women in all years and also for men in 1999 a slightly J-shaped gradient in sickness absence by occupational classes was found, showing that the professionals were the lowest sickness absence class and manual workers the highest. Sickness absence rates increased considerably in all occupational class groups from 1990 to 1999. For women, the increase of sickness absence rates among managers and professionals was almost non-existent and the increase in lower occupational classes was considerable. For men, only professionals managed well and the increase was remarkable in all other occupational classes. The absolute increase in sickness absence rates between manual workers and managers increased 38% for women but only 2% for men.

When differences in sickness absence rates by income quintiles were analysed, a clear and consistent gradient was evident, except that the lowest income group among women had somewhat less sickness absence than the second lowest group (Figure 4). When time trends by income quintiles were analysed, more stable development was found than for the other socio-economic position measures. Overall, the absolute differences increased by 9% among women and 6% among men from 1990 to 1999. The picture changes, however, when the fourth income quintile was taken into consideration for women. As it had the highest sickness absence rate among women, the absolute difference between the fourth and the highest income quintile increased by 23%.

	Women			Men		
	2001	2006	2011	2001	2006	2011
<i>Education</i>	SA			SA		
High	46.9	53.4	56.2	35	37.8	38.2
Middle	75.5	92.3	93.9	63.5	67.7	69.4
Low	113.2	117	116.4	92.8	92	82.2
<i>Occupational status</i>						
Upper white-collar	39.7	43.6	44.3	30.1	29.9	30.2
Intermediate white-collar	55.8	67.2	67.4	47.3	50.1	46.4
Lower white-collar	80.8	89.9	90.9	48	58.7	57.6
Manual worker	100.9	116.9	112.6	94.3	87.6	82.1
<i>Individual income</i>						
Highest	43.1	44.7	45.8	32.8	31.6	31.7
2nd quartile	65.8	63.2	65.2	69.9	61.2	56.3
3rd quartile	82.4	99.4	96	74.4	71	72.2
Lowest	74.8	89	89.8	70.8	80.6	70.9
All	68.4	75.8	75.4	56.7	58.1	55.1
(Number)	23952	21247	20094	6145	6258	5871

Table 1. Number of medically certified sickness absence spells/100 person years by socio-economic position in 2001, 2006 and 2011. Women and men.

Additional analyses using more recent data than the first substudy were carried out to assess the development of socio-economic differences in the 2000s. This put the results from the second third, and fourth substudies into context, as they used the data from the 2000s. The overall sickness absence rates increased among women and remained at the same absolute level among men from 2001 to 2011 (Table 1). During the 2000s, educational differences in overall rates in sickness absence tended to decrease somewhat for both women and men. Occupational class differences also tended to decrease in men but not in women. No major changes occurred in income differences in sickness absence from 2001 to 2011. Absolute and relative gender differences tended to increase. Further adjustments for socio-demographic background are needed, however, to allow comparison of years and more accurate and detailed assessment of trends.

The results from the time trends revealed that socio-economic inequalities in age-adjusted medically certified sickness absence were clear and consistent in all socio-economic position measures and at all times from 1990 to 1999. Development from 2001 to 2011 indicates that the socio-economic inequalities remained but changed in education and occupational class. In the next phase, all these socio-economic position measures were taken into consideration in more complex analyses.

5.2 Interrelationships between socio-economic determinants of sickness absence

Next, education, occupational class, and individual income as independent and interdependent determinants of sickness absence were simultaneously analysed. The general results supported findings from the time trends, showing that low education, occupational class, and individual income were associated with higher sickness absence. The gradients were steeper for men. When all socio-economic determinants were added to the model simultaneously, however, only education and occupational class remained as independent determinants of sickness absence. Practically no individual effect was left for individual income, suggesting that education and occupational class largely explain the differences by income.

Further analyses using inequality indexes were conducted to explore the interdependencies in more detail. Educational inequalities in sickness absence were clear for both women and men (Figure 5). Occupational class mediated the effect of education more than income for both women and men. However, clear independent effect of education was left in the fully adjusted model.

Occupational class inequalities in sickness absence class were steep and strong for both women and men (Figure 6). Education explained only little and income mediated practically none of the effect of occupational class. The results show that occupational class is a strong individual determinant of sickness absence. The effect was more evident for men.

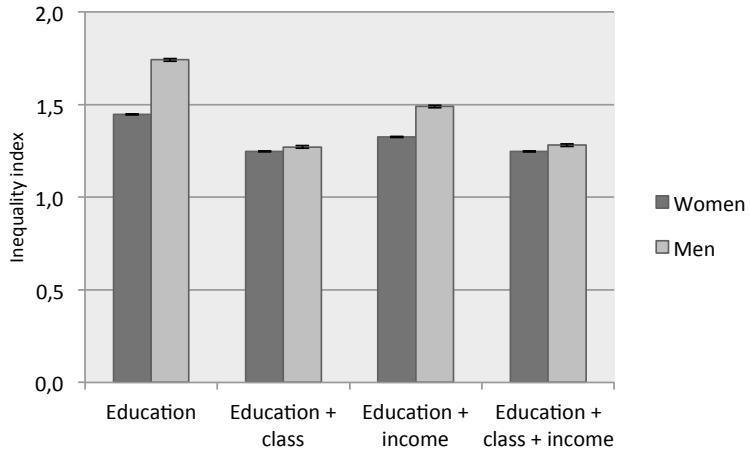


Figure 5. Inequality index for sickness absence spells/100 person years in 2003 by education (95% CI). Women and men.

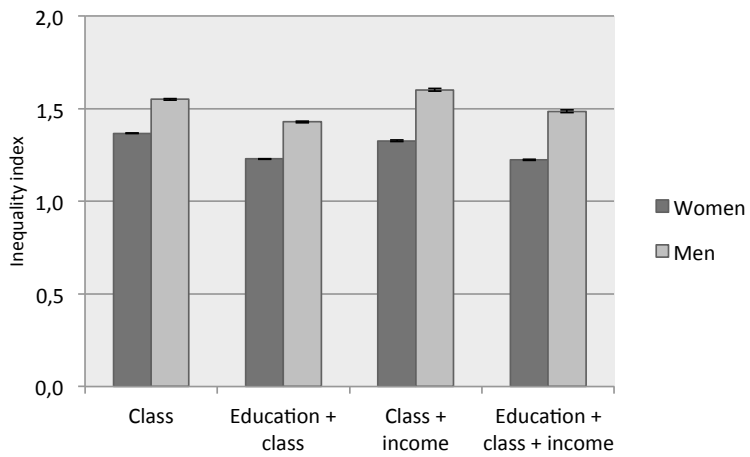


Figure 6. Inequality index for sickness absence spells/100 person years in 2003 by occupational class (95% CI). Women and men.

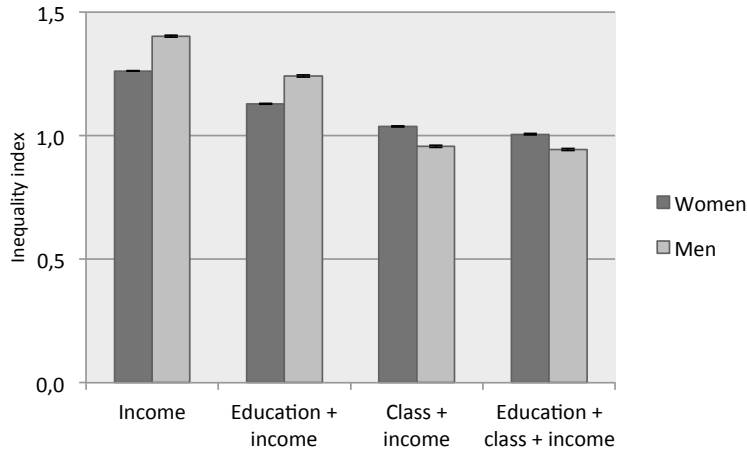


Figure 7. Inequality index for sickness absence spells/100 person years in 2003 by individual income (95% CI). Women and men.

At first, the inequality index by individual income was parallel with education and occupational class (Figure 7). Adding education to the model attenuated the effect of income clearly, and adding occupational class left practically no independent effect on income. Education and occupational class thus explained the income inequalities in sickness absence.

The results from the analyses on interrelationships showed that different socio-economic determinants must be taken into consideration together and there is a need for analyses, which explain the socio-economic inequalities and their contributors.

5.3 Work injury absence as determinant of socio-economic inequalities in sickness absence

Further analyses were performed to examine socio-economic and occupational determinants of work injuries and their contribution to overall socio-economic inequalities in sickness absence.

The results showed that education, occupational class, and individual income predicted subsequent work injury absence as well as all-cause sickness absence. Work injury absences accounted for only a minor part of the overall sickness absence. Inequality indices by different socio-economic determinants were analysed to examine the socio-economic inequalities and the contribution of work injuries in more detail.

Inequality index by education, in the fully adjusted model, showed that education was an independent determinant of both work injury and other-cause sickness absence (Figure 8). For men, the inequality by education was steeper in work injury by absence than other-cause sickness absence. The difference between all-

cause sickness absence and other-cause sickness absence was negligible, however, showing that work injury absences did not explain the overall socio-economic inequalities in sickness absence by education.

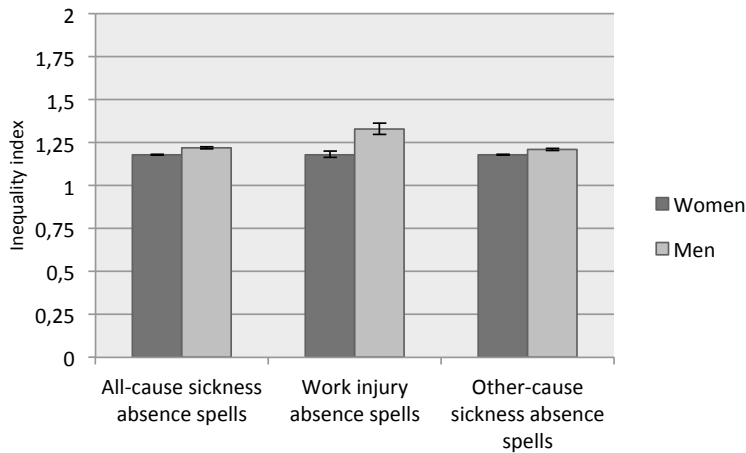


Figure 8. Inequality index for sickness absence spells/100 person years in 2003-2005 by education (95% CI). Fully adjusted model, women and men.

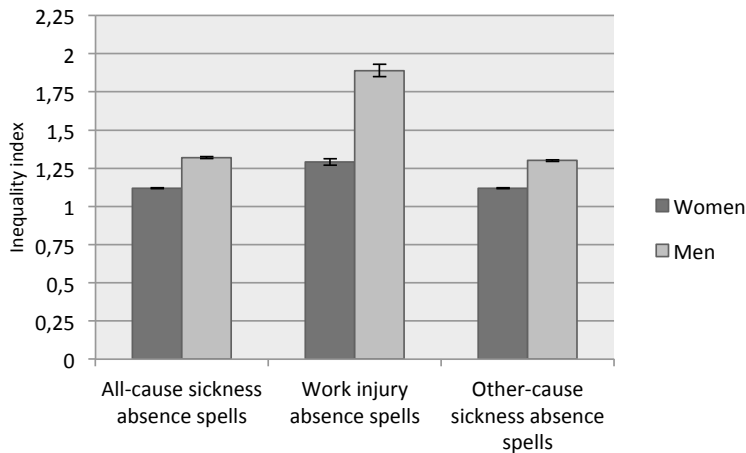


Figure 9. Inequality index for sickness absence spells/100 person years in 2003-2005 by occupational class (95% CI). Fully adjusted model, women and men.

The results from the analyses of inequality indices by occupational class showed that differences were evident in all categories of sickness absence (Figure 9). Occupational class was a strong individual determinant of work injury absence and the effect was bigger than in other-cause sickness absence.

Although the number of work injuries was relatively small, if they were eliminated totally, a reduction of 5% among women and 6% among men in occupational class inequality in sickness absence followed.

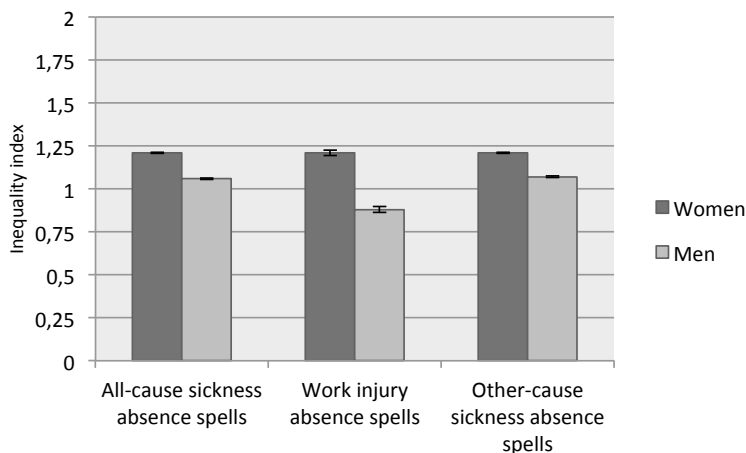


Figure 10. Inequality index for sickness absence spells/100 person years in 2003-2005 by individual income (95% CI). Fully adjusted model, women and men.

The results from inequality indices by individual income were in accordance with the previous analyses on sickness absence, showing that the effect of income was smaller than the effect of education or occupational class (Figure 10). For women, income was an independent determinant of both work injury and other-cause sickness absence. For men, there was practically no effect left for income.

The results from the previous analyses, showing that socio-economic differences in both all-cause sickness absence and work injury absence are wide and consistent, indicate that further analyses are needed to examine more profound and preceding factors. The results suggest that it is important to examine occupational class differences in more detail, as the socio-economic gradients in occupational class were steeper than in education and individual income.

5.4 Explanations of occupational class differences in sickness absence

Working conditions, health-related factors, and family-related factors are potential explanations of occupational class differences in sickness absence.

The results on the differences were in accordance with the previous analyses showing that occupational class was a strong determinant of subsequent sickness absence.

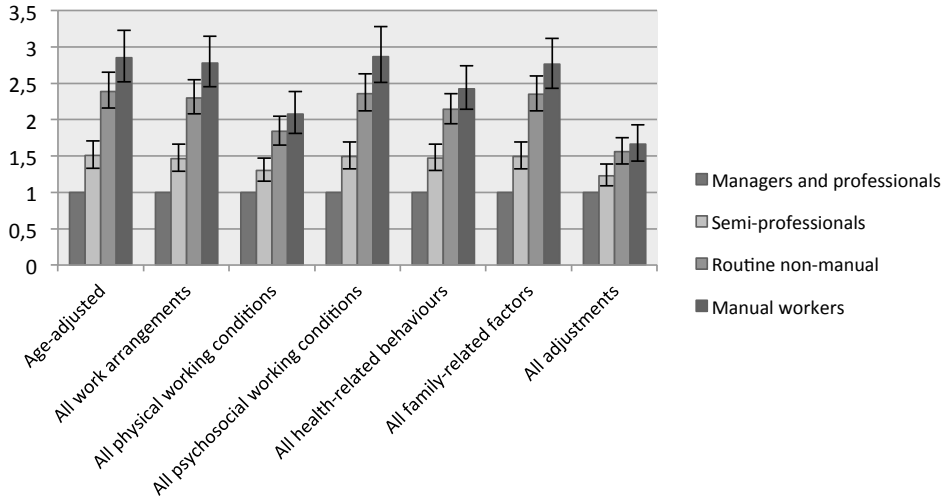


Figure 11. Rate ratios (95% CI) for the risk of sickness absence by occupational class after adjustment for working conditions, health-related behaviours, and family-related factors. Women.

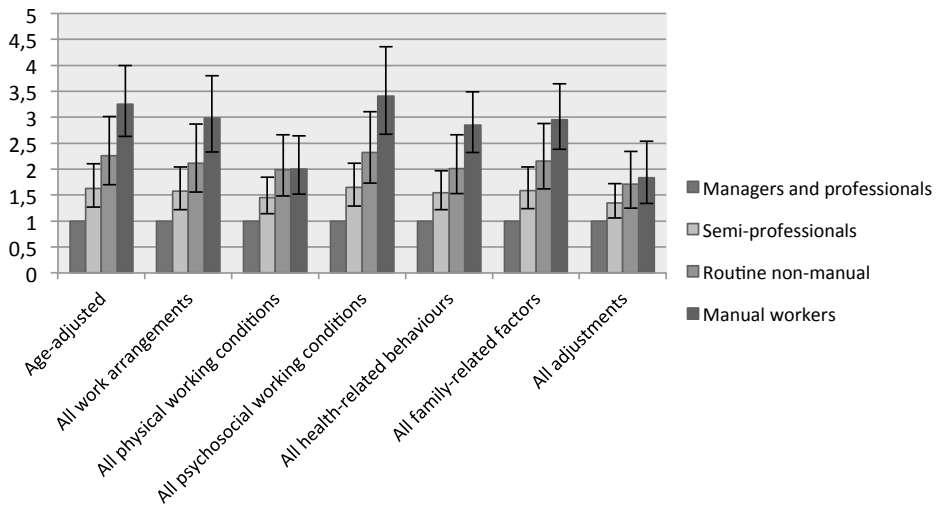


Figure 12. Rate ratios (95% CI) for the risk of sickness absence by occupational class after adjustment for working conditions, health-related behaviours, and family-related factors. Men.

Potential explanations were analysed for both one group at a time and all groups together. The results for women indicate that work arrangements, and psychosocial and family-related factors did not affect differences in sickness absence (Figure 11). Instead, physical working conditions predicted occupational class differences in sickness absence clearly and health-related behaviours to a much lesser extent.

The results for men were mostly similar compared with women. As there were fewer men than women in the study population, the confidence intervals were wider and only few results reached statistical significance. For men, only physical working conditions were clearly independent predictors of subsequent differences in sickness absence but also health-related behaviours attenuated socio-economic differences (Figure 12).

6 DISCUSSION

In this study, the relationships between socio-economic determinants of medically certified sickness absence and their explanatory factors were examined. Specific aims were to analyse (1) changes over time, (2) interrelationships between key socio-economic position determinants, (3) work injury absence as a contributor to overall socio-economic inequalities in sickness absence, and (4) working conditions, health-related behaviours, and family-related factors as explanatory factors for occupational class inequalities in sickness absence. A large data set of 32.500 women and men annually from the personnel registers of the City of Helsinki, Finland was used. In addition, survey data and their follow-up were used to examine explanatory factors. Four days or longer medically certified sickness absence was used as an outcome variable.

6.1 *Main findings*

Large and consistent socio-economic gradients in sickness absence were evident for all socio-economic position measures, showing that low education, occupational class, and individual income were all associated with higher absolute and relative sickness absence rates. Age-adjusted sickness absence rates increased from 1990 to 1999, and absolute socio-economic inequalities in sickness absence widened. Changes from 2001 to 2011 indicated that educational differences in sickness absence decreased.

For both women and men, education and occupational class were independent determinants of medically certified sickness absence. For men, occupational class was clearly the strongest determinant of sickness absence. In both genders, education and occupational class practically explained the effect of income. Clear pathways on the effects on sickness absence through socio-economic position measures were found. This finding means that the socio-economic position develops during a longer time period through the life course and determines subsequent sickness absence.

It was also found that socio-economic inequalities in work injuries were consistent and greater than in other-cause sickness absence. All socio-economic determinants, namely education, occupational class, and individual income, predicted future work injuries. As in other-cause sickness absence, occupational class was the strongest individual determinant for both women and men.

Also, in analyses where the study population consisted of survey respondents and was followed up with register data, occupational class inequalities in sickness absence were large and consistent. Physical working conditions and health-related behaviours were the strongest explanatory factors affecting occupational class inequalities. The effects of psychosocial working conditions were opposite to each other and the effects of family-related factors were negligible. The results help in estimating potential targets for interventions.

This study provided novel evidence on the associations of the key socio-economic determinants of sickness absence. Socio-economic inequalities in sickness absence are wide and consistent across all socio-economic position measures, but occupational class inequalities are the widest. Socio-economic inequalities tend to increase over time. The found pathway on the effects on sickness absence through education, occupational class, and income is a new and important result that has not been found before. Socio-economic inequalities in work injury absence are wider than other-cause sickness absence, but their relative importance in overall socio-economic inequalities is small. Physical working conditions and health-related behaviours explain part of the occupational class differences in sickness absence.

6.2 Trends in socio-economic differences in sickness absence

The overall rates of age-adjusted sickness absence clearly increased from 1990 to 1999. More detailed analysis showed that the period from 1990 to 1994 was relatively stable, but the rates increased from 1994 to 1999 for most socio-economic groups. Additional preliminary analyses indicated that the overall sickness absence rates continued to increase for women and remained at the same level for men from 2001 to 2011.

What are the possible explanations for the overall increase of sickness absence? It seems that the most likely options do not explain the results. First, the overall health of the Finns in the 1990s developed favourably, as studies on self-rated health and mortality trends show (Rahkonen et al. 2004, Martikainen et al. 2005). Second, changes in the age or socio-economic structure of the employees might have occurred, but these factors have been taken into consideration in statistical stratification and analyses. The reduction of the proportion of the temporarily employed from 1991 to 1994 might have had a varying effect on socio-economic differences, as the temporarily employed have less sickness absence than the permanently employed (Virtanen et al. 2001) and are more common in high education and low income groups. As the proportion of the temporarily employed increased again from 1994 to 1999, however, this explanation is unlikely. Third, worsening working conditions might have caused negative effects on health, but the working conditions among the employees of the City of Helsinki remained stable in the 1990s (Helsingin kaupunki 2001). Fourth, changes in the legislation concerning sickness absence benefits were small and restrictive (Kela 2001), so increasing economic incentives should not explain the increase. Therefore, possible explanations for the increasing sickness absence trends in the 1990s in Finland must be sought elsewhere. The effects of economic recession and changes on attitudes and norms are discussed here in more detail.

At the beginning of the 1990s, Finland faced its most severe recession since the 1930s. The effect of the threat of unemployment on sickness absence has been studied. A British study from the 1980s found that the threat decreased sickness absence among employees under 40 years old and increased sickness absence among the older ones (Beale, Nethercott 1988). Increased stress was hypothesised to have negative effects on health but the younger employees

could adjust their sickness absence behaviour. The findings from Ireland in the 1980s indicated that economic depression could have reduced sickness absence among construction industry employees (Brenner, Ahern 2000). Evidence from a Swedish study suggests that labour market conditions might affect male employees' behaviour so that they become more wary about being absent from work (Knutsson, Goine 1998). The findings of this thesis showing that sickness absence increase was modest at a time of increasing unemployment, from 1990 to 1994, and rapid during decreasing unemployment, supports these previous studies of both women and men.

The overall attitude towards working life might have changed and younger generations might not want to sacrifice one's own health because of work. No studies exist on this subject or on changes in presenteeism, however. It could also be the case that medicine as a science has developed, so that mental and musculoskeletal health problems in particular are more widely recognised and treated more comprehensively and efficiently than before. In addition, mental health problems might have become more acceptable and less stigmatised than before. No studies, however, have analysed how these changes have affected sickness absence.

The results showed that the absolute socio-economic inequalities in sickness absence increased from 1990 to 1999. For the 1990s, a similar increase has been found in socio-economic inequalities in mortality in Western countries (Mackenbach et al. 2003). In the case of self-rated health, however, the socio-economic inequalities remained largely the same in a study of 10 European countries (Kunst et al. 2005). In a study including Finland, Sweden, Norway and Denmark, educational and labour market status inequalities in both limiting long-standing illness and self-rated health tended to decrease or remain stable from 1986 to 1994 (Lahelma et al. 2002). The preliminary analyses presented in this thesis indicated that educational inequalities in sickness absence decreased among both women and men, and occupational inequalities decreased among men in the 2000s. Respectively, the income differences remained almost at the same level. The findings differ from the results on the trends in life expectancy by income, which showed that the inequalities increased in the 2000s (Tarkiainen et al. 2012). Why are the results for sickness absence different from other health outcomes? One possible explanation is that employees differ from the general population, which is often studied in other health outcomes. The results from this study indicate that the increase in inequality in the 1990s is mostly explained by the more rapid increase of sickness absence rates among the lowest socio-economic position groups. Change towards more tolerant attitudes and norms regarding sickness absence might have taken place after a period of increasing unemployment. Negative selection of employees might also have had a role in the development. For men, the results from the 2000s indicated that the decreasing overall levels in sickness absence among the low education group and manual workers led to decreased inequalities. For women, the increase of the sickness absence in the high education group resulted in decreased educational inequalities. The findings may reflect the overall rise in the educational level of employees or the change in the occupational composition of the manual employees in a less sickness absence-prone direction, especially among men.

Socio-economic inequalities in sickness absence were large and consistent in all measured socio-economic position measures. The findings were in accordance with a Swedish study on educational differences in sickness absence (Floderus et al. 2012, Mittendorfer-Rutz et al. 2013). Also, the results on occupational class differences were similar to studies from Britain (North et al. 1993, Feeney et al. 1998), Finland (Vahtera et al. 1999), France (Melchior et al. 2005) and Spain (Moncada et al. 2002). Results on income differ from previous research, however.

A Swedish study on the association of income and sickness absence in the Malmö region in 1985 showed that the lowest income group and highest income groups had lowest rates of sickness absence (Isacsson et al. 1992). No difference was made according to the employment status, so overrepresentation of e.g. students and part-time workers could explain the results. Conversely, this thesis included only full-time employees. The findings on women were similar, as the lowest income groups had less sickness absence than middle income groups. It could be that lowest income groups cannot afford to be absent as much as others. Other possibilities are that these employees are more inexperienced or temporarily employed and therefore feel more insecure about their employment and are wary of being absent.

6.3 Interrelationships in socio-economic determinants of sickness absence and work injury absence

Novel findings, which have not been studied before, were found by socio-economic determinants of sickness absence. All three socio-economic position indicators predicted subsequent long sickness absence and work injury absence. When all three indicators were analysed at the same time, education and occupational class were individual determinants of long sickness absence. Of these two indicators, occupational class was even stronger, especially among men. It was also evident that the socio-economic inequalities in work injury absences were greater than in other-cause sickness absence. Also this result is new and has not been studied previously.

The results showed that education is an independent determinant of medically certified sickness absence, as suggested by two previous studies (Floderus et al. 2012, Mittendorfer-Rutz et al. 2013). A novel result is that education also predicts work injury absence. Why should education predict sickness absence and work injury absences? We can assume that education provides people generally with better information on health and well-being. Possibly more educated people are more prone to read or comply with safety regulations or directions. The finding may relate to the fact that in the public sector education is often a prerequisite for certain occupations. For example, teachers, nurses, and firemen need specific education or training. Therefore, it is plausible that education considerably contributes to the further occupational class and income. Especially in public sector workplaces, such as the City of Helsinki, higher education or qualifications are often a prerequisite for supervisory positions or for the career ladder. Therefore, more educated employees maybe more

positioned in less work injury-prone jobs. However, Chandola and colleagues considered that health selection unlikely increases the found occupational class differences (2003).

Occupational class was an independent determinant of medically certified sickness absence in both genders, but the effect was stronger and more prominent among men. The same applied also to work injury absence. The finding is in accordance with previous studies on sickness absence (North et al. 1993, Feeney et al. 1998, Moncada et al. 2002, Melchior et al. 2005) and work injuries (Lafamme, Eilert-Petersson 2001). The effect of occupational class was partly explained by education, but was only slightly modified by individual income. Previous studies suggest that adverse working conditions are more common among lower occupational classes and partly explain differences in work injuries (Melamed et al. 1999, Oh, Shin 2003). Especially in white-collar occupations, daily work tasks can be modified more freely to meet partly reduced work ability caused by sickness. For example, a designer working mainly with computers could work with a mildly injured knee, but a nursing assistant in a home for the elderly could not. An expert in city planning might be able to modify their working day to mitigate the effects of a sprained ankle, but a fireman could not. Wide differences in sickness absence rates between groups in the same workplaces, such as kindergarten teachers and childminders, need further analyses, however. Also, selection could lead people with better health into better occupational positions (Chandola et al. 2003).

The effect of individual income on medically certified sickness absence and work injury absence was largely explained by education and occupational class in both genders. The most likely explanation for the finding is that in the public sector in Finland, binding collective bargaining contracts define wages according to occupational title and tenure. Practically no studies on sickness absence have analysed the effect of income in this sort of detail so comparisons with previous studies are difficult. It must also be kept in mind that individual income, used in this study, differs from other income measures, such as household income or wealth.

It was evident that the overall effect of socio-economic inequalities in work injuries on total socio-economic inequalities in sickness absence was not great. There is still room to reduce work injuries, however, as the results on occupations show. Certain occupations, such as specialist teachers, designers, and musicians, had low or no work injuries at all during follow-up. Conversely, bus drivers, cooks, and firemen had very high work injury rates. Differences between occupations were naturally larger than between occupational classes.

Few explanatory studies exist on different occupations and sickness absence, but Kristensen made attempts in this direction (Kristensen 1991). According to Kristensen, a level of Taylorisation explains many of the variations in sickness absence between occupations. High Taylorisation means that supervisors or managers make all the decisions and planning regarding the work. If this is regarded as similar to low job control, it is almost the only psychosocial working condition factor which has been shown to be associated with sickness absence in a systematic review (Allebeck, Mastekaasa 2004b).

Lahelma and colleagues studied pathways leading to socio-economic inequalities in limiting long-standing illness and self-rated health (2004). The approach has not been used in sickness absence research before this thesis, however. The results of this thesis support the findings of Lahelma and colleagues that education, occupational class, and income are not interchangeable as indicators of socio-economic position, and must be taken into consideration separately. The results differ, however, so that income was not an individual determinant of long sickness absence and work injury absence, as it was in the case of limiting long-standing illness and self-rated health. The difference may be because household income differs from the individual income used in this thesis.

The results also support other studies showing that socio-economic position indicators are not interchangeable but reflect different socio-economic position dimensions and are associated differently with several health outcomes (Singh-Manoux, Clarke & Marmot 2002, Laaksonen et al. 2005, Martikainen, Blomgren & Valkonen 2007). For sickness absence, no previous studies exist that have taken education, occupational class, and income into consideration simultaneously. One study from Israel included information on education and the white-collar/blue-collar dichotomy, as determinants of work injuries (Melamed et al. 1999). In this thesis, the effect of income was decreased considerably, but the effect of education and occupational class remained strongly associated with work injuries. This result is also new and has not been found before.

6.4 Explanations of occupational class differences in sickness absence

The basis for understanding socio-economic differences in sickness absence is that underlying poor health, as measured by other health indicators, is more common in lower socio-economic groups (Mackenbach et al. 2003, Kunst et al. 2005, Tarkiainen et al. 2012). Explanatory factors of socio-economic differences of sickness absence have usually been studied partially and in narrowly focused ways. Studies taking into account several factors at the same time are rare.

The results showed that physical working conditions markedly explained occupational class differences in sickness absence in both men and women. The effect was somewhat stronger in women, however. The effect of work arrangements on the occupational class differences in sickness absence was small and only directional among male manual workers. The findings were in accordance with previous studies from Norway (Hansen, Ingebrigtsen 2008) and France (Niedhammer et al. 2008). In one Finnish study, control over working times was associated with sickness absence (Ala-Mursula et al. 2002).

The results also showed that the effect of psychosocial working conditions was negligible. The results are in accordance with previous studies from several countries, where only small or heterogeneous results were found, depending on different factors in the working conditions category (Melchior et al. 2005, Christensen et al. 2008, Hansen, Ingebrigtsen 2008, Niedhammer et al. 2008).

Traditional health-related factors explained part of the occupational class differences in sickness absence, in both women and men. The results from Danish (Christensen et al. 2008) and British (North et al. 1993) studies were similar, but the effects were somewhat smaller.

Family-related factors explained only a few of the occupational differences in sickness absence. This is contrary to a previous Swedish study (Blank, Diderichsen 1995).

In all, the explanatory factors accounted for 40 to 60% of the occupational class differences in sickness absence, depending on the occupational class and gender. As explanatory studies in inequality studies on sickness absence have been few, this is a remarkable finding. It is evident, however, that the included explanatory factors are not able to explain all of the differences. Other possible explanations might be found in, for example, attitudes and values on sickness absence, as some studies suggest (Svallfors, Halvorsen & Andersen 2001). These attitudes and values may differ between occupational groups, workplaces (Grinyer, Singleton 2000, Virtanen et al. 2000), and societies, and it is difficult to measure them and estimate their relative importance.

6.5 Methodological issues

This thesis has also to be evaluated according to the reliability and accuracy of the data and the statistical methods used. This is essential to be able to assess the reliability and generalisability of the results.

This thesis has several strengths. First, the register-based data can be considered as reliable and accurate, especially as individual level information is available. Second, the data set is large and allows complicated statistical methods to be used. Third, sickness absence is nowadays an established health indicator. Medical certification is needed for four days or longer sickness absence spells, which was used as an outcome in this study. Therefore, the results can be considered as more objective and reliable, especially as compared with self-reported sickness absence (Burdorf, Post & Bruggeling 1996, Svedberg et al. 2010). Fourth, the data include annual information over a long period, so time series analysis is possible and changes over time can be assessed. This also allows follow-up of the participants and more direct assessment of causality, as compared with cross-sectional analyses.

This thesis also has some limitations. First, the data consist of information on only one, albeit large, public sector workplace in a Northern European country. One should be careful in generalising the results to other countries, as social security regulations governing sickness absence entitlement, restrictions, and income benefits differ markedly. Although the City of Helsinki is a large employer and covers many areas of operation, other workplaces might have different occupational structures and working conditions, so one should be cautious about applying the results to other workplaces or the private sector in general. Second, in analyses, where only register data were used, only limited information on possible explanatory factors was available. Third, in the analyses

where register data were linked to the survey data, the majority of the information used was self-reported by the participants directly. The response rate to the surveys was 67%, of whom 78% gave their written consent to the linkage. A comparative study of the respondents vs. non-respondents revealed, however, that no marked differences existed between background indicators and sickness absence rates (Laaksonen et al. 2008a). Fourth, using sickness absence as a health indicator, the results cannot be generalized to the general population. Changes in other factors affecting sickness absence, such as social security rules, sickness certification practices, and changes in attitudes and norms, may affect overall sickness absence rates differently from trends in other health indicators. Therefore, one must be cautious when interpreting the results for trends in sickness absence.

Socio-economic inequalities in health are underestimated in settings where only an employed population has been studied (Dahl 1993). This healthy worker effect supposes that employees with poorer health are selected out from work. At the same time as they are selected out from work, they cannot be reached by studies that consider only the employed population. This argument may also apply to sickness absence research, as the study population are employees and must be at work to be able to be absent from work. There is variation by country and social security rules in terms of how long an employee can be absent from work. In Finland, for example, after one year of absence, an employee must either be granted a disability pension or return to work. In Sweden, no limit has been set on the length of sickness absence. Therefore, employees with objectively poor health may remain on the workforce. The magnitude of the healthy worker effect in this study cannot be directly estimated, as there is no control population outside the study group of middle-aged employees. The main focus of this study was, however, to examine socio-economic determinants of sickness absence. The healthy worker effect can be expected to decrease the found socio-economic inequalities in sickness absence rather than the other way round and therefore does not have major effects on the conclusions inferred from the results.

6.6 Overview of socio-economic determinants of sickness absence

Overall, this study showed that socio-economic inequalities in sickness absence are wide and consistent, as the lowest socio-economic groups have sickness absence rates two or three times higher than those of the highest groups. From the results of this study, it can be calculated that if all employees had similar sickness absence rates to those of the highest groups, overall sickness absence rates would be reduced by 41 to 46% among men and 32 to 39% among women depending on the socio-economic position measure used. Further, if we apply the previous figures to the estimated costs of sickness absence as a percentage of the GDP, the potential savings in socio-economic inequalities in sickness absence are equal to 3.5 billion euros in Finland. When the previous figures are applied to the estimated loss of working days annually because of sickness absence and the total workforce, the potential savings in socio-economic inequalities in sickness absence are equal to the working time of 37.800 employees in Finland. Although socio-economic inequalities in sickness

absence could not be eliminated totally, these figures accentuate the benefits of interventions to reduce inequalities.

The results from previous research can be summarised in a conceptual model of the determinants of sickness absence. The conceptual model can be analysed from structural, causal, and intervention perspectives. In addition, attitudes and norms can be assumed to affect sickness absence.

This study aimed to examine relationships between socio-economic determinants of sickness absence and different explanatory factors relating to them. Specific attention was paid to analysing time trends, pathways between key socio-economic determinants and sickness absence, socio-economic inequalities in work injury absence, and explanatory factors of occupational differences in sickness absence. The results from this study can also be assessed from the viewpoint of the conceptual framework of the determinants of sickness absence. The study made several contributions to the previous body of evidence.

First, the results of the study are in accordance with the structural viewpoint of the conceptual model. The factors involved in the study include family level, individual level, and work level determinants. As the outcome was medically certified sickness absence, occupational health care is also indirectly involved. The results indicate that the strongest determinants were individual level indicators such as age, gender, education and health behaviours. Occupational class, income, and physical working conditions were significant work level determinants of sickness absence.

A major contribution of this study relates to the causal pathways of the socio-economic determinants of sickness absence, namely education, occupational class, and individual income. The study showed that these factors are not interchangeable although they are interrelated to each other. The causal pathway begins in early adulthood, when educational level is usually completed, and continues in occupational position. Income seems to be explained by these previous steps so that it practically had no individual effect after adjustment for the previous socio-economic position measures. The effect of occupational class was explained only partly by a wide set of explanatory factors, such as family-related factors, health behaviours, physical working conditions, and psychosocial working conditions. The results of this study support the conceptual model in that causal pathways of the development of sickness absence exist and form a continuum ranging from individual to work levels and further to sickness absence. Nevertheless, socio-economic inequalities in sickness absence remained even after adjustments.

This study did not involve interventions and therefore intervention or feedback involved in the conceptual model could not have been tested. More research is needed to test the effects of interventions and the feasibility of the conceptual model in these situations. Interventions aiming to affect sickness absence could elucidate the practical causes and consequences of sickness absence. Affecting sickness absence also means affecting socio-economic inequalities in sickness

absence, as the aim is usually to reduce sickness absence rates, especially among those who have the highest rates.

Sickness absence research has provoked discussion on sickness presenteeism, which has usually been defined as a situation where an employee has been at work when it is acknowledged that an employee should have been at home because of sickness (Dew, Keefe & Small 2005). A Swedish study indicated that age, gender, and education did not affect sickness presenteeism (Aronsson, Gustafsson & Dallner 2000). Instead, sickness presenteeism was more common in the healthcare and education sectors. If employees had to do their work by themselves after sick leave, this increased sickness presenteeism.

Socio-economic differences in sickness presenteeism remain an unexplored area in research, but have to be kept in mind when differences in sickness absence are analysed. From the perspective of the conceptual model, some of the socio-economic differences in sickness absence could be explained by sickness presenteeism in higher socio-economic groups. Results from sickness presenteeism indicate that attitudes and norms, developed in all levels in the conceptual model, may affect sickness absence behaviour. Broadly viewed, sickness absence behaviour includes several aspects, such as willingness to seek medical help or support from co-workers when needed, sickness presenteeism, and return to work ability after a long sickness absence. That being so, the conceptual model runs parallel to the theory developed by Thulesius and Grahn (2007). Attitudes and norms were not directly analysed in this study, however.

The five requirements listed by Kristensen (1991) are all met in the conceptual model. The conceptual model includes factors in all levels, and it is not purely deterministic or voluntaristic in character. Sickness absence is seen as a neutral phenomenon, factors other than sickness or health status determine sickness absence, and psychosocial working conditions are included in the model.

The changes over time found in this study indicate that sickness absence and socio-economic inequalities in sickness absence are not a static phenomenon but explanations for the change need to be sought from other sources than those which traditional public health research has used. Taking account of traditional background indicators, such as age, gender, health behaviour, and socio-economic position, provides only limited explanations. Analysing the effects of attitudes and norms and further sickness absence behaviour in different levels may help our understanding of changes over time and the differences between countries and subgroups within one country.

The conceptual model of sickness absence is based on previous research and tested by empirical evidence in this study. The conceptual model may be of help in designing potential targets for interventions aiming to reduce sickness absence and socio-economic inequalities in sickness absence.

7 CONCLUSIONS

This study on socio-economic determinants of sickness absence follows the continuum of Finnish research on socio-economic inequalities in health, especially the modern one (Lahelma, Karisto & Rahkonen 1996).

Socio-economic inequalities in health, including sickness absence, begin to form in early life and develop throughout the lifecourse of an individual. Work constitutes a major part of life for most people. Sickness absence can be seen as part of the bigger picture of socio-economic inequalities in health, as sickness absence reflects health status, but also work ability and ability to manage in everyday life. Sickness absence provides an opportunity to affect socio-economic inequalities in health.

From the findings on multiple socio-economic position measures on medically certified sickness absence, certain implications for further research follow. If we presume that education is a strong determinant of further occupational class and income, analysis could be focused on pathways and earlier determinants, which promote high education. It would be important to analyse, for example, childhood socio-economic position or parental education as determinants of sickness absence and their modifying effects on the associations already identified.

The findings on work injuries showed that the socio-economic inequalities in work injuries are large for all socio-economic position measures. The differences between occupations show that work injuries are a possible avoidable source of socio-economic inequalities in health.

The findings indicate that physical working conditions and health-related behaviours are key factors affecting occupational class differences in sickness absence. All explanatory factors explained 40 to 60% of the found differences. This is a feasible explanation, but socio-economic inequalities still remain. The finding indicates that if all employees could have physical working conditions and health-related behaviours as good as those of the highest socio-economic groups, major improvements could be achieved in the overall sickness absence rates.

The results suggest ways of reducing sickness absence. All employees, especially those in lower occupational classes, should benefit from, for example, tailored work arrangements when at risk of sick leave. Although general working conditions have improved, physical and chemical exposure could still remain and new risks have emerged. Better planning of work processes should alleviate physically strenuous work. Where applicable, tools and utilities should be applied to relieve direct physical strain. This might have improved many previous manual work tasks and manufacturing industries, but is still a work in progress in many service occupations. For example, kindergartens, kitchens, and healthcare facilities employ many routine non-manual and manual employees, where improved practices would be of help.

One might think that in Finnish society health promotion and health education would be readily available and everyone would be aware of the importance of health-related behaviours, such as weight control, moderate alcohol consumption, and non-smoking. The results from this study indicate, however, that health-related behaviours are still important factors that generate occupational class differences in sickness absence. Health promotion includes actions on the levels of the municipalities, workplaces and occupational health care. In addition, social determinants of health-related behaviours, such as safe and supportive family background and educational opportunities, are important.

As high education is associated with lower sickness absence, higher education could be promoted. Despite the fact that the general educational level has increased in Western societies, however, the overall rates of sickness absence have not decreased. No studies exist on how professional training or education for the working-age population affects health.

Sickness absence rates differ between occupations and occupational classes. Promoting working conditions and reducing occupational risks are the responsibility of employers, authorities, and employees themselves. Although work time arrangements and psychosocial working conditions did not independently affect the risk of subsequent sickness absence very much, their combined effect was remarkable. Employees should be provided with necessary authority and tools to manage their own job and work tasks, especially in the case of sickness or other reduced work ability.

The fact that income is not individually associated with sickness absence indicates that low-income employees can afford to be absent from work. From another perspective, it can be assumed that economic disincentives, such as introducing a qualifying day on sick leave benefits, should be substantial in order to be effective on a large scale.

In future studies, focus should be concentrated on several areas throughout the lifecourse. First, factors in childhood and in early adulthood should be examined in more detail. Are there mechanisms by which a younger person is steered along an unfavourable track? Second, what are the more profound mediating and explanatory factors through which low socio-economic position affects socio-economic inequalities in sickness and work injury absence? Third, what are effective intervention and feedback channels through which we can reduce sickness absence and socio-economic inequalities in health? Fourth, attitudes and norms including sickness absence behaviour should be introduced to the agenda of sickness absence research.

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