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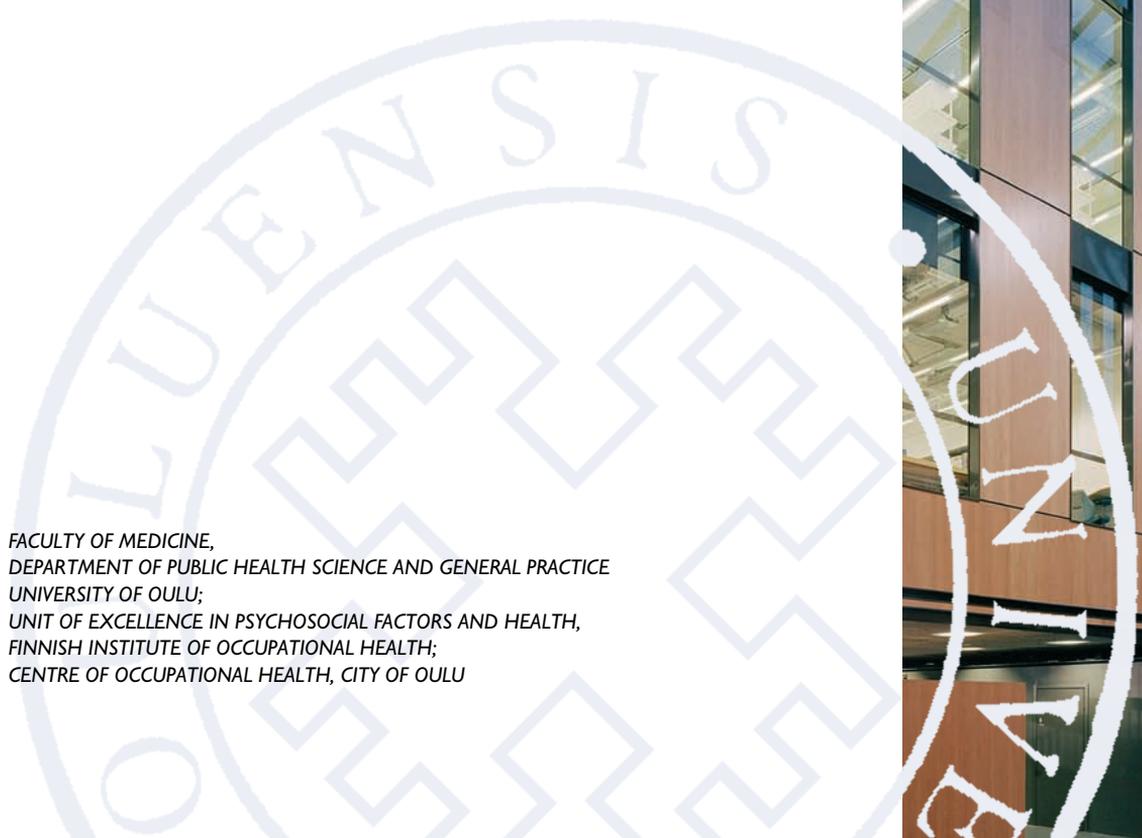
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EMPLOYEE WORKTIME CONTROL AND HEALTH

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LEENA ALA-MURSULA

**EMPLOYEE WORKTIME
CONTROL AND HEALTH**

Academic dissertation to be presented, with the assent of the Faculty of Medicine of the University of Oulu, for public defence in Auditorium 101 A of the Faculty of Medicine (Aapistie 5 A), on November 3rd, 2006, at 12 noon

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Abstract

The potential health effects of employee control over working times are poorly known in the field of work stress research. In this study, worktime control was hypothesized to buffer against stress by promoting successful combination of a full-time job with non-work demands and by enabling the work to be done at times of optimal resources.

The participants were from the 10-Town Study, an ongoing longitudinal cohort study exploring employee health in ten Finnish towns. The survey responses on worktime control and health (baseline survey in 1997: n = 6442, 67%; follow-up survey in 2000–01: n = 32299, 67%) were linked to registered sickness absences from the employers' records. Employee worktime control covered the perceived possibilities to influence the starting and ending times of a workday, the breaks, handling private matters during the workday, the scheduling of shifts, vacations and days off, and the taking of unpaid leaves, each of which was rated on a 1–5 scale. In the follow-up survey, influence on the length of the workday was also assessed. After a factor analysis, the subdimensions of control over daily working hours and control over days off were focused.

It turned out that low worktime control predicted poor subjective health, psychological distress, and medically certified sickness absences for women. For men, low worktime control was not associated with subjective health, but predicted medically certified sickness absences for those with dependent children or employed in manual occupations.

With respect to work stress, the men and women suffering from job strain or effort-reward imbalance had less medically certified sickness absences if they at least had control over their working times.

The men and women with long domestic and total working hours and long commuting hours gained most from high worktime control in that their medically certified sickness absences were reduced. Vulnerability to long domestic and total working hours in terms of such absences was seen among both men and women, but there were few men working long domestic hours. Long paid working hours as such were not associated with sickness absences.

In sum, high worktime control appeared to buffer against health problems and to promote a successful integration of domestic responsibilities with a full-time job. The findings expand the focus of work stress research and emphasize the importance of taking conditions at home into account when analysing employee health.

Keywords: occupational health, personal autonomy, prospective studies, psychological stress, sick leave, time factors, work schedule tolerance

Ala-Mursula, Leena, Työaikojen hallinta ja terveys

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Tiivistelmä

Työaikojen hallinnan merkitys terveydelle tunnetaan työstressitutkimuksen alalla huonosti. Tässä väitöskirjatyössä oletettiin, että työaikojen hallinta voisi vähentää stressiä ja edistää terveyttä helpotamalla kokopäivätyön ja kotona tehtävän työn yhteensovittamista sekä mahdollistamalla työn tekemisen parhaiden voimavarojen vallitessa.

Tutkimus toteutui osana Työterveyslaitoksen Kunta10 -tutkimusta, joka seuraa kymmenen suomalaisen kaupungin henkilöstön työolojen ja terveyden kehittymistä. Koettua työaikojen hallintaa ja terveyttä koskevat kyselyvastaukset (alkukysely v. 1997: n = 6442, 67 %; seurantakysely vv. 2000–01: n = 32299, 67 %) linkitettiin palkanmaksurekistereistä saatuihin sairauspoissaolotietoihin. Työaikojen hallinnan mittari sisälsi alkukyselyssä 5-luokkaisella asteikolla vastaajien kokemaa vaikutusmahdollisuutta työpäivän alkamis- ja päättymisajankohtiin, taukoihin, yksityisasioiden hoitamiseen työpäivän kuluessa, työvuoroihin, lomien ja vapaapäivien ajankohtiin sekä palkattomien vapaiden pitämiseen. Seurantakyselyssä kartoitettiin myös vaikutusmahdollisuudet työpäivän pituuteen. Summamuuttujan faktorianalyysin jälkeen arvioitiin erikseen päivittäisten työaikojen hallintaa sekä loma-aikojen hallintaa.

Tuloksissa huono työaikojen hallinta ennusti naisilla huonoksi koettua terveyttä, psyykkistä rasituneisuutta sekä lääkärintodistusta vaativia yli kolmen päivän mittaisia sairauspoissaoloja. Miehillä huono työaikojen hallinta ei vaikuttanut itsearvioituun terveyteen, mutta ennusti lääkärintodistusta vaativia sairauspoissaoloja, jos heillä oli lapsia kotona tai jos he tekivät ruumiillista työtä.

Hyvä työaikojen hallinta vähensi työstressiin liittyviä sairauspoissaoloja. Stressiä kuvattiin työn kovien vaatimusten ja huonon hallinnan yhdistelmällä sekä koettujen ponnistelujen ja palkkioiden epäsuhdalla.

Eri elämänaalueilla tehtyihin työtunteihin suhteutettuna hyvä työaikojen hallinta vähensi sairauspoissaoloja erityisesti niillä naisilla ja miehillä, joilla oli paljon kotityötunteja, työmatkatunteja tai totaalityötunteja. Sairauspoissaoloilla mitattuna naiset ja miehet olivat yhtä haavoittuvia pitkille kotityö- työmatka- ja totaalityötunneille, mutta miehillä pitkät kotityötunnit olivat harvinaisia. Pitkät palkkatyötunnit sinänsä eivät lisänneet sairauslomia.

Tutkimus tuo työstressikirjallisuuden vallitsevia malleja täydentävää tietoa työn ulkopuolisten tekijöiden merkityksestä työntekijöiden terveydelle. Tulokset kannustavat edistämään työntekijöiden mahdollisuuksia työaikojensa hallintaan sekä terveyden edistämisen että kokopäivätyön ja muun elämän menestyksellisen yhdistämisen näkökulmista.

Asiasanat: työterveys, itsemäärääminen, työaika, stressi, sairausloma, pitkittäistutkimus

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This work was carried out in 2000-2006 in the Department of Public Health Science and General Practice of the University of Oulu, networking with the 10-Town Study of Finnish Institute of Occupational Health. After I had joined the 10-Town Study group in 1996 and first been involved in other potential topics, the puzzle of worktime control finally captured my interest in late 1999. By now, there are numerous people who deserve to be acknowledged.

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Oulu, September 2006,

Leena Ala-Mursula

List of original articles

- I Ala-Mursula L, Vahtera J, Kivimäki M, Pentti J (2002) Employee control over working times: associations with subjective health and sickness absences. *J Epidemiol Community Health* 56:272-8.
- II Ala-Mursula L, Vahtera J, Pentti J, Kivimäki M (2004) Effect of employee worktime control on health: a prospective cohort study. *Occup Environ Med* 61: 254-61.
- III Ala-Mursula L, Vahtera J, Linna A, Pentti J, Kivimäki M (2005) Employee worktime control moderates the effects of job strain and effort-reward imbalance on sickness absence: the 10-Town study. *J Epidemiol Community Health* 59: 851-7.
- IV Ala-Mursula L, Vahtera J, Kouvonen A, Väänänen A, Linna A, Pentti J, Kivimäki M (2006) Long hours in paid and domestic work and subsequent sickness absence: does control over daily working hours matter? *Occup Environ Med* 63: 608-616. doi: 10.1136/oem.2005.023937

Contents

Abstract	
Tiivistelmä	
Acknowledgements	
List of original articles	
Contents	
1 Introduction	15
2 Definitions	17
2.1 Psychosocial factor	17
2.2 Flexibility of working times	17
2.3 Employee worktime control	18
2.4 Health	18
3 Review of the literature	19
3.1 Working hours and health	19
3.1.1 Development of working hours and values attributed to work	19
3.1.2 Paid working hours and health	21
3.1.3 Domestic working hours and health	21
3.1.4 Commuting hours and health	22
3.2 Flexible working times and health	23
3.2.1 Company-oriented flexibility	23
3.2.2 Development of individual-oriented flexibility	23
3.2.3 Effects of individually flexible working times on organizations	24
3.2.4 Evidence on the effects of perceived employee worktime control	25
3.2.4.1 on health-related outcomes	25
3.2.4.2 in relation to company-oriented flexibility	26
3.3 Other psychosocial factors at work and health	27
3.3.1 Job strain	27
3.3.2 Effort-reward imbalance	28
3.3.3 Multidimensionality of control at work	28
3.4 Gaps in the literature	29
4 Aims of the study	31

5	Material and methods	32
5.1	Participants, procedures and study designs.....	32
5.2	Measures of worktime control.....	34
5.3	Other predictors of health.....	35
5.3.1	Work stress	35
5.3.2	Working hours	35
5.3.3	Background variables	36
5.4	Health outcomes	37
5.4.1	Self-rated health.....	37
5.4.2	Psychological distress.....	37
5.4.3	Sickness absence	37
5.5	Statistical methods.....	38
5.6	Drop-out analyses.....	40
5.7	Descriptive statistics.....	40
5.7.1	Measures of worktime control by gender	40
5.7.2	Worktime control by other variables.....	40
6	Results	42
6.1	Worktime control and health outcomes	42
6.1.1	Worktime control and health at baseline.....	42
6.1.2	Worktime control and health at follow-up.....	43
6.2	Worktime control and health by occupational status and family situation.....	44
6.3	Worktime control, work stress and medically certified sickness absence.....	48
6.3.1	Main effects	48
6.3.2	Work stress combined with control over daily working hours.....	49
6.3.3	Work stress combined with control over days off.....	50
6.4	Worktime control, working and commuting hours and sickness absence.....	51
6.4.1	Main effects	51
6.4.2	Various hours combined with worktime control.....	53
6.4.3	In relation to shift work	54
7	Discussion	56
7.1	Main findings.....	56
7.2	Explanations of the gender difference	56
7.3	Why manual employees benefit from worktime control	58
7.4	Why those loaded with work stress benefit from worktime control	58
7.5	Worktime control as a dimension of control.....	59
7.6	Potential pathways between worktime control and health.....	59
7.7	Methodological considerations	60
7.7.1	Context dependency of worktime control.....	60
7.7.2	Sickness absence as an indicator of health	61
7.7.3	Sample and setting.....	61
7.7.4	Role of potential biases in the findings.....	62
7.7.5	Effect sizes.....	63
7.8	Implications for further research	64
7.9	Policy implications	65
7.9.1	On organizational ergonomics	65
7.9.2	Implications concerning domestic working hours	65

7.9.3 Aspects to consider in promoting worktime control	65
7.9.4 Trends of working hours and worktime control.....	66
7.9.5 Summary of policy implications.....	67
7.10 Ethical considerations.....	67
8 Conclusions	69
References	
Original articles	

1 Introduction

This study was motivated by an occupational health physician's general interest in the backgrounds of sickness absence: why - in seemingly similar occasions of suboptimal health - some employees end up taking a sick leave while some do not. Intuitively, this has something to do with the individuals' relationship with their work, wherein the aspects of time and timing of the work could be of importance.

This study belongs to the work stress literature in the field of occupational medicine, and to the scientific tradition of psychosocial epidemiology. It focuses on features and phenomena of working life arrangements and compares the correlations of various exposure levels with measures of health.

The level of job control has been shown to be an important predictor of health across a wide variety of outcomes. More specifically, work stress research has mainly focused on the content-related aspects of job control, such as decision latitude, skill discretion, and participation in decision making. In contrast, the more structural aspect of control over working times has been largely neglected. Earlier reviews on job control have indeed called for a wider scope with respect to various dimensions of control (Ganster 1988) and differing goals of control (Frese 1989).

During the 1990's, major trends towards increasing flexibility and diversity of working times began to emerge, and the issue of control over working times, from both the employers' and the employees' viewpoints, became acute in working life.

When adopting this research theme in late 1999, no direct references to perceived worktime control were available in the medical literature. Tangential evidence was, however, available in the field of organizational psychology and management literature. It appeared that the prerequisite of employee worktime control, individually flexible scheduling, had originally been implemented in order to reduce commuting time and to enhance employee commitment, job satisfaction and productivity, and that these experiments had been evaluated across organizational well-being elements and absenteeism (Pierce 1989) but not directly in terms of health.

In sum, it appeared that the relative importance of this specific dimension of perceived control for health needed to be explored as an important everyday element of perceived psychosocial work characteristics. This gap in the literature was only recently acknowledged by a group of prominent shift work researchers, who pointed out that

individual flexibility of working times would appear, almost by definition, to be good for health, but that no systematic evaluations have been conducted (Costa *et al.* 2004, Åkerstedt & Kecklund 2005).

In a nutshell, this thesis is about employees' perceptions of their temporal autonomy regarding working times, and whether these perceptions are associated with their assessments of subjective health and with objective consequences on registered sickness absence.

2 Definitions

2.1 Psychosocial factor

A measurement that potentially relates psychological phenomena to the social environment and to pathophysiological changes (Hemingway & Marmot 1999).

Such a measurement does not explicitly record the technical elements or backgrounds of the psychological perception of an aspect in the social environment, yet it aims to quantify the extent of that perception, which may then be evaluated in relation to indicators of health.

2.2 Flexibility of working times

Flexible working hours involve a continuous choice on behalf of employers, employees or both regarding the amount and the temporal distribution of working hours (Costa *et al.* 2004).

Company-oriented flexibility meets the needs of employers by, for instance, extension or reduction of working hours compensated later on or by addition or extension of shifts. *Individual-oriented flexibility* meets the needs of employees, providing them with autonomy regarding their starting and ending times, breaks, days off and vacations and the amount of working hours. (Costa *et al.* 2004).

There are numerous working time arrangements providing flexibility (Knauth 1998, Costa *et al.* 2001). An example is *flexitime*, a work scheduling system that comprises individually determined hours at the beginning and the end of the workday and employer-set core hours, when all employees are present, and often also a time bank where overtime can be compensated with less hours some other day within a set time limit.

2.3 Employee worktime control

An employee's perception of his/her possibilities to control the duration, position and distribution of his/her own working times, i.e. autonomy with regard to working times (Knauth 1998).

As a psychosocial factor, employee worktime control comprises the psychological interpretation of the possibilities available in the social environment to exert individual flexibility of working times. In this perception, the organizational policies enabling such control are assumably reflected, though not specifically determined.

2.4 Health

While numerous definitions of health prevail, this study measured the participants' health by three outcomes. Self-rated health was used as a self-assessment of general health. Mental health was studied as caseness or non-caseness of psychological distress. Health functioning was measured using registered sickness absences, which reflect the occurrence of health problems severe enough to lead to occupational disability.

3 Review of the literature

3.1 Working hours and health

3.1.1 Development of working hours and values attributed to work

Anthropologists have reported that, long before the history of paid work, in the early societies of hunter-gatherers, the times of work and leisure were distinguished from each other. Essentially, the earliest structures of working days and weeks were based on the availability of food. (Pierce *et al.* 1989) The value of working time was not an issue to be thought of, as working was a prerequisite for survival. Thereafter, the development of agriculture and the domestication of animals resulted in working from before sunrise to after sunset every day. The gradual oversupply of food then slowly enabled the division of labour and the development of occupational diversity. By the time of the industrial revolution, the concept of paid work, i.e. the exchange of personal time for salary, had become a common practice in work life.

The industrial working week schedules in the early 1800's covered fourteen to sixteen hours per day on six days a week. Since then, a dramatic reduction in both daily and weekly working hours has taken place. The value attributed to work has also changed considerably. As reviewed by Pierce *et al.* (1989), reductions in the industrial working times were not supported by the U.S. public opinion in the early 1800's, as idleness was regarded as a vice. Gradually thereafter, the reduction of working times became supported by arguments such as i. health protection of the working population, ii. increased efficiency and productivity of labour, iii. increased possibilities for education and good citizenship and iv. the creation of new jobs leading to additional growth in society. (Pierce *et al.* 1989)

In the Finnish setting, legislation on eight hours of work on six days per week was achieved in 1917 (Julkunen & Nätti 1999). In the latter half of the 1900's, the yearly working hours were further considerably reduced by the transition to a five-day working week and by gradually increasing the numbers of vacation days and other days off. In the

European Union, working times are now being regulated by the Working Time Directive (1993/104), which limits the working week to 48 hours.

Illustrating the long-term decreasing trend of working hours, in the EU survey of working conditions in 2000, the mean working week in the European Union was 38.2 hours, while in Finland it was 40.5 hours (Paoli & Merrlie 2001). It should be noted that, in all EU countries, the collectively bargained working times were shorter than the average working times because of overtime work (Bielenski 2002 et al). As a new phenomenon, and as a way to respond to the increasing competition in the globalized economy, trends of re-lengthening the contractual working week have also begun to emerge in Europe, for example in France and Germany (Åkerstedt & Kecklund 2005). Meanwhile, a significant minority consisting of one out of five employed men and one out of ten employed women regularly work long hours, namely over 48 hours per week (Fagan & Burchell 2002).

In parallel to the actual working hours, EU surveys have also elicited information about the desired working hours. The preferences appear to fall between 30 and 40 hours per week. Many of the part-timers would prefer working longer hours for individual economic reasons. Simultaneously, the majority of full-time workers report a desire to work less, reflecting the high subjective value of free time. A relatively high standard of living is naturally one prerequisite for refusing longer paid hours. (Bielenski *et al.* 2002)

Women's participation in full-time paid work as well as the societal changes in family structure have also raised interest in the practical possibilities of combining the responsibilities of the two life domains (Bielenski *et al.* 2002) and in the number of hours spent doing domestic work. At the EU level, in most countries, women work shorter hours in paid work, often part-time, but instead spend considerably longer hours doing domestic work than men. This has generally led to longer total working hours for women than for men. (Aliaga & Winqvist 2003) Negatively valued, and illustrating the potential for this resulting in an excessive workload and ill health, this phenomenon has been called the 'double burden' (e.g. Väänänen *et al.* 2004).

Simultaneously, women's participation in both the work and family life domains has been considered not only burdensome, but also valued as positively providing additional health-enhancing socioemotional and economic resources, referred to as 'double attachment'. (e.g. Lahelma *et al.* 2002) In Finland, women have a long tradition of full-time paid employment, which is by now the norm for the Finnish women of working age. (Bielenski *et al.* 2002, Julkunen & Nätti 1999)

Currently, there are trends towards increasingly diverse, flexible and locally bargained working times, the health effects of which remain an open question (Julkunen & Nätti 1999, Costa *et al.* 2004, Åkerstedt & Kecklund 2005) In studying these effects, the distinction between company-oriented and individual-oriented flexibility has been seen as important. Company- and customer-oriented flexibility has clearly been on the rise, (Reilly 1998, Åkerstedt & Kecklund 2005), but employees also seem to increasingly express expectations of having individually flexible working time arrangements (Knauth 1998, Baltes *et al.* 1999).

3.1.2 Paid working hours and health

Long hours of paid work may affect employees' health by impairing their possibilities for sufficient recovery, both mentally and physiologically. Long hours may also pose health risks if exposure to adverse work conditions is prolonged, and if health-related behaviour is affected. (Sparks *et al.* 1997, Spurgeon *et al.* 1997, van der Hulst 2003). Recent reviews and meta-analyses suggest a weak positive correlation between long working hours and ill health. However, the health-related effects of long working hours have been shown to differ according to the outcomes used. Adverse associations have been found for subjective health, cardiovascular disease, diabetes and disability retirement. (Sparks *et al.* 1997, Spurgeon *et al.* 1997, van der Hulst 2003).

The relationship between long hours and health seems complex. Choice and attitudes have been suggested to influence this association, as those working long hours might particularly enjoy their work and/or be especially competitive and healthy. Some selection certainly appears to occur. For example, in the third EU survey of working conditions in 2000, the employees in white-collar managerial jobs worked notably longer mean hours (47.3 per week) than the other groups of employees (Fagan & Burchell 2002), and white-collar managerial people are generally among the healthiest along the socioeconomic gradient of health.

Yet, it is difficult to find evidence that long working hours would be directly beneficial for health (Spurgeon *et al.* 1997). Current evidence does suggest that hours longer than 50 hours per week carry health risks, but less is known of the effects of more moderate overtime, between 40 and 50 hours a week (Spurgeon *et al.* 1997, van der Hulst 2003).

Some studies have found the effects of long working hours more detrimental to women's health than men's. In a Swedish study, women - but not men - working in occupations characterised by overtime work had an increased risk of hospitalization for myocardial infarction and other diagnoses (Alfredsson *et al.* 1985). Swedish studies have also suggested an association of overtime work with increased mortality for women but not men (Starrin *et al.* 1990, Nylén *et al.* 2001). The reasons for such gender differences are unclear, but the importance of exploring workloads in both paid and domestic work has been acknowledged. (Sparks *et al.* 1997, Spurgeon *et al.* 1997, van der Hulst 2003).

In a study on parents of preschool children, overtime work was associated with increased catecholamine excretion at home, reflecting stress among women but not men (Lundberg & Palm 1989). The result was attributed to factors beyond paid work, in terms of gender differences in the total workload and the double burden. This has also been the case concerning the studies suggesting that full-time paid work as such, compared to part-time work, is associated with health risks for female employees (Kinnunen & Mauno 1998, Jansen *et al.* 2004, Nylén *et al.* 2001).

3.1.3 Domestic working hours and health

Whether domestic working hours carry a health risk may be questioned, as the efforts spent in domestic work might actually appear rewarding and recovering. (Väänänen *et al.* 2005). On the other hand, long domestic working hours could become a stressor,

especially when added to the burden resulting from paid work. There is widely and cross-culturally replicated evidence of gender differences in the exposure to domestic hours, in that women work longer domestic hours than men (Aliaga & Winqvist 2003), but whether there are gender differences in the vulnerability to these hours (Bird 1999, Denton *et al.* 2004) remains an open question.

Long domestic working hours were associated with exhaustion and insomnia in a study on Canadian women (Tierney *et al.* 1990) and with malaise symptoms among Scottish women but not men (Hunt & Annandale 1993). In contrast, two U.S. studies reported associations of long domestic hours with depression (Glass & Fujimoto 1994) and psychological distress (Bird 1999) among both genders. In a cross-sectional study using the baseline sample of the Finnish 10-Town Study, long domestic hours were related to increased sickness absences among men (Väänänen *et al.* 2004). To sum up, the evidence on health risks associated with long domestic working hours is scarce and inconclusive.

In addition, indirect evidence of the physiological consequences of the domestic workload has been obtained through Swedish studies illustrating no or minor differences in blood pressure and catecholamine excretion between the genders during the workday but elevated levels of these biomarkers among women after the workday (Frankenhaeuser 1991, Lundberg 1999). These studies have suggested that a high domestic workload combined with a paid workload may cause health risks in the long run because of the 'double burden' (see 3.1.1.).

3.1.4 Commuting hours and health

Long commuting hours between work and home may threaten health, by being a source of discomfort and stress as such, by reducing the time available for sleep and recovery, and by reducing the time available for domestic duties, thereby contributing to stress from the conflicting demands of work and home. (Costa *et al.* 1988a and 1988b)

In a survey on Italian manual workers (n=1167), those commuting for at least 45 minutes in each direction reported higher psychological stress scores, more health complaints and greater absenteeism from work due to sickness than non-commuters. Having to wake up earlier, commuters slept less than non-commuters. Notably, the adversities associated with commuting were more strongly felt by women than men. (Costa *et al.* 1988b)

Interestingly, the reduction of commuting hours has been an important goal in the development of individually flexible working time arrangements (Pierce *et al.* 1989, Knauth 1998).

3.2 Flexible working times and health

3.2.1 *Company-oriented flexibility*

Although not the focus of the present study, the long tradition of company- or customer-oriented diversity of working hours transcending the “normal” day-night work-sleep pattern should be recognized. Ramazzini noted, as early as around 1700, that bakers, innkeepers, midwives and soldiers, for instance, worked such hours (Harrington 2001).

During the last decades, shift work has become increasingly common. Also, despite the general shortening of working hours, a considerable minority frequently work overtime or extended hours (defined as exceeding 48 hours per week) on a regular basis. In fact, the “standard” working hours lasting no longer than 40 hours per week on Monday-Friday daytime schedules have become rather an exception than the rule, being the practice for only 24% of the European workforce (27% of employed and 8% of self-employed workers), as shown by the Third EU Survey on Working Conditions in 2000 (Costa *et al.* 2004). Of all these respondents, 19% reported having schedules including night work, and 46% reported working in the evenings, 52% on Saturdays and 27% on Sundays (Paoli and Merlié 2001). The reasons for these developments towards non-standard working hours include the society’s needs to maintain cover for services and emergencies as well as the economic need to maintain continuous processes and to respond to the competition in the 7-day 24-hour society in globalized economy.

With respect to employee health, shift work disrupting the circadian rhythms is associated with numerous health problems, such as reduction in the quality and quantity of sleep, fatigue, anxiety and depression, cardiovascular diseases, gastrointestinal disorders as well as impaired reproductive health (for an overview, see Harrington 2001).

The health impact of extended hours in terms of long paid working hours was addressed in chapter 3.1.2.

In addition, there is indirect evidence to suggest that company-oriented short-term changes in work schedules may bear health risks in that they associate with general uncertainty on work, a predictor of health problems. (Ferrie *et al.* 2002) Simultaneously, in such circumstances, the possibilities for individual-oriented flexibility are probably reduced.

3.2.2 *Development of individual-oriented flexibility*

Until the late 20th century, the patterns of working schedules remained very uniform and stable, and unquestionably, it was the employer that determined the working hours for an employee after the work contract had been bargained (Pierce 1989).

Individual-level flexibility of working times was pioneered in the form of gliding time (later flexitime) in the German company Messerschmitt-Bolkow-Blohm in 1967, originally to tackle the losses caused by sick listing to perform one’s own duties and the tardiness due to traffic problems. In other words, flexibility was introduced for reasons of organizational functioning and productivity. This experiment was later reported to be

accompanied by a 40% decline in absenteeism, the disappearance of tardiness and a rise in employee morale. Flexitime then spread rapidly and widely in Western working life, with approximately 30% of labour force in Germany, 40% in Switzerland and 20% in France working flexitime in the late 1970's (Pierce 1989).

Since then, changes in family structure and the increasing proportion of women active in the full-time work force have posed further challenges to the individual flexibility of working times. In the EU setting, the importance of flexible working times from individuals' viewpoint has been emphasized in order to promote the quality of life and to achieve a better balance between the work and non-work life domains. (Naegele *et al.* 2003) The large-scale developments in working life seem to have also promoted demanding attitudes towards working conditions in general, such as increasing demands for autonomy concerning the working hours and other aspects of work. (Knauth 1998) Currently, however, the EU Working Time Directive (1996) presents clear thresholds for permitted working hours, but the viewpoint of individual control is not addressed (Costa *et al.* 2004).

In the Third European Survey of Working Conditions of the European Union in 2000, 45% of all respondents and 51% of the Finnish respondents reported having some influence on their working hours (Paoli & Merlie 2001).

3.2.3 Effects of individually flexible working times on organizations

Scientific research to evaluate the pragmatically rooted interventions introducing individually flexible work schedules began in the 1960-70's in the field of managerial science. Reviewing this literature, Golembiewski and Proehl (1978) listed the following findings: interventions introducing flexitime had mainly positive (though mixed) effects on absenteeism, reduced tardiness and staff turnover, decline in overtime, easier commuting, minor problems in communicating with colleagues, but overall positive effects on productivity and morale.

Another review by Pierce *et al.* (1989) not only confirmed the aforementioned positive results of flexitime schedules (combinations of employer-set core time and discretionary time for the employees at the beginning and the end of the day) on organizations, but also explored the various theoretical frameworks used in the studies, such as the enhanced commitment to work, the improved quality of life as well as the work adjustment model focusing on a balance between individual abilities and/or needs and organizational requirements and reinforcement systems. Interestingly, Pierce *et al.* assumed that implicitly in all of these approaches, an intervening variable in the work schedule – employee response relationship, might be the individuals' perception of autonomy regarding working times.

However, in the reviewed studies, the information on the schedules was collected at the level of specific worktime arrangements, not directly measuring perceived time autonomy. There was, however, one exception: a small-scale (n=188) cross-sectional study on clerical employees that both elicited flexible work schedule features from organizational documents and also surveyed individuals' perceived time autonomy (Pierce & Newstrom 1983). The five-item time autonomy scale focused on the extent and

independence of the discretion of personal schedules. Based on series of multiple regression analyses, the authors reported that time autonomy mediated the flexible work schedule – employee attitude relationship in that the employees with higher time autonomy were increasingly job-satisfied and organizationally committed and experienced fewer symptoms of psychological stress. However, time autonomy did not mediate the flexible work system – employee behaviour relationship. In fact, flexible working hour arrangements were linked with increased absenteeism.

The effects on organizational interventions introducing flexitime schedules were recently re-reviewed by Baltes *et al.* (1999). They found that flexitime schedules favourably influenced productivity, job satisfaction and satisfaction with schedule and – as the largest effect – reduced absenteeism. The latter phenomenon most probably also included effects on health. It is, however, worth noting that within this field of literature, absenteeism is treated as a behavioural variable, comparable to attendance, tardiness or turnover, whereas the aspects of health in absenteeism are not directly considered.

Interestingly, in the aforementioned review, positive effects of flexitime schedule interventions were only seen among employees, whereas managers and professionals – who already enjoyed a high degree of autonomy – did not benefit from flexitime interventions (Baltes *et al.* 1999).

3.2.4 Evidence on the effects of perceived employee worktime control

3.2.4.1 on health-related outcomes

At the time when this research project was started in late 1999, no direct hits on employee worktime control and health were found in the medical-psychological literature scanned through the databases of Medline and, for the major part, also PsycLit and Mental Health Collection. Numerous search terms were tried, including the following and their variations: worktime control, control over work scheduling, flexibility in work scheduling, flex(i)time, influence on working times, worktime autonomy, alternative work schedules, worktime arrangements and participative planning of working times. Later, PubMed was regularly screened.

However, previous evidence on worktime control was found in a couple of articles on other work characteristics and health. A Swedish occupational-level study (Alfredsson *et al.* 1985, n=958 096) showed that employees working in occupations characterized by low influence on working times had an increased risk for hospitalizations. Here, the worktime control items covered the influence on working hours, breaks, holidays and private telephone calls, among a list of other work characteristics. Variation in the importance of these items across hospitalizations due to differential diagnoses were found, but associations with worktime control and hospitalizations were found for both men and women.

With an analogous occupational-level measurement, Hammar *et al.* (1994) found that employees in occupations characterized by low influence on working hours had an increased incidence of myocardial infarction (9295 cases, 26101 controls), especially if

their work was simultaneously classified as hectic. The effect was observed among both genders and was slightly stronger among men.

Thomas and Ganster (1995) applied path analyses in a U.S. survey of health professionals (n=398) in acute-care facilities, and found a direct negative association between flexitime schedules and somatic complaints. In addition, indirect effects on depression and cholesterol level through employee control were suggested. However, their results concerning employee control are difficult to interpret in terms of worktime control, as their 15-item control indicator included four items on worktime control added to a wide variety of other aspects, e.g. control over childcare facilities.

Kelloway and Gottlieb (1998) surveyed a sample of Canadian female food distributors and health care workers (n=998) to test whether flexitime schedule is associated with reduced stress, and whether this association is mediated by perceived control over time. They performed multivariate analyses of covariance and reported having received support for this hypothesis. Unfortunately, neither the 5-item time control scale nor the 10-item list of stress symptoms outcome were presented in detail.

Using data from a nationwide U.S. survey on full-time workers in 1992 (n=2905), Fenwick and Tausig (2001) applied multivariate regression models with interaction terms to explore whether a 1-item global measure of employee scheduling control, on a 5-point scale, associates with outcomes of employee well-being. They found that low schedule control was associated with indices of burnout, distress, poor self-rated health and minor physical problems, but not with self-reported sickness absence. Based on interaction tests, they suggested that schedule control, as a dimension of control, could benefit all workers regardless of schedule, family status or gender. It is worth noting, however, that the usually replicable negative associations between health and shift work were not observed in these data.

3.2.4.2 *in relation to company-oriented flexibility*

Recently, an EU research project was launched to respond to the lack of knowledge of the effects of flexible working hours on health and safety, a project funded by the Joint Programme for Working Life Research in Europe (SALTSA) (Costa *et al.* 2001). The project produced definitions concerning flexible working hours (see 2.2 and 2.3), performed reviews of the literature and European legislation concerning working times, reanalysed EU surveys and conducted empirical studies on flexible working times. In the final report of the project, Costa *et al.* (2004) summed up the substudies of the project suggesting that individual flexibility of working times had been found to alleviate the negative effects of company-based flexibility on subjective health, safety and social well-being. However, they did not find an association between individual flexibility of working times and subjectively reported sickness absences. Some of the SALTSA substudies on employee worktime control have been published in Shiftwork International Newsletter (2003, volume 20:2) as congress abstracts, based on cross-sectional study designs with rather small samples, unfortunately not presented in detail. The ones published as an EU report or in peer-reviewed journals will be reviewed next.

Further analyses of the Third European Survey on Working Conditions in 2000 (n=21505) showed that unsociable working schedules (evening or night work, long working days) were associated with an increased risk of experiencing illness symptoms and sleeping problems. Interestingly, simultaneous working time autonomy (over starting and ending times, over holidays) appeared to reduce the subjective experiences of illness, but this effect appeared weak compared to the association between health problems and unsociable hours (Fagan & Burchell 2002, Costa *et al.* 2004).

A Finnish nationwide survey study (n=1790) belonging to the SALTSA project specifically explored the joint associations of the two kinds of working time flexibility with well-being. Using a single-item measure of perceived possibilities for individual flexibility on a 5-point Likert scale and multiple regression analyses, Kandolin *et al.* (2001) found that company-controlled flexibility (overtime or weekend/night shifts) was associated with symptoms of mental stress, but that simultaneous individual worktime control alleviated this unfavourable association. The aforementioned finding remained evident after adjustment for autonomy, support from superiors and interpersonal relationships. In addition, the main finding was pronounced among employees experiencing time pressure in their work. Overtime work was associated with distress among employees lacking individual worktime control, but not among those able to regulate their own working hours.

Another cross-sectional SALTSA study in Germany covering two samples (n=660 and n=528) surveyed the associations of variable working hours and individual influence on working hours with frequencies of health complaints. The results suggested that autonomy only partly compensates for the negative association between highly variable working hours and health, and that the variability of working hours, even when self-controlled, appears to be a health risk. (Janssen & Nachreiner 2004)

3.3 Other psychosocial factors at work and health

As defined (2.1), psychosocial factors at work are measurements potentially linking psychological phenomena to the social environment and to pathophysiological changes (Hemingway and Marmot 1999). By avoiding the unhelpful general term 'stress', research aims to specify theoretical models that could be used to generate and test specific hypotheses. The most prevalent models are presented next, as the relative importance of worktime control as a health predictor will be later studied with respect to these models.

3.3.1 Job strain

Perhaps the most cited model in the work stress literature is Karasek's model of healthy work, which postulates that job control modifies the potentially adverse health effects of job demands. A job with high demands and low control over job content is high-strain work, whereas high demands buffered by high control results in an active job, promoting individual growth, resources and, in the long run, health. (Karasek & Theorell 1990)

Control at work had earlier been explored within the organizational psychological traditions of employee participation in decision making and job enrichment (Ganster 1989). The job strain model is rooted in the research tradition of job redesign to promote employee motivation and well-being through enhancing job autonomy: the degree to which the job provides freedom, independence and discretion to the individual in scheduling the work tasks and in determining the procedures to be used in carrying out the work (Hackman & Oldham 1976). However, in Karasek's widely used instrument for measuring job control, the dimensions of scheduling the working hours are not addressed (Karasek 1985, Karasek *et al.* 1998).

The appealing idea of Karasek's model that job control could act as a moderator of job stressors has achieved considerable but not unambiguous empirical support. (Hemingway & Marmot 1999, de Lange *et al.* 2003) Rather, control alone has often predicted indicators of health. On the other hand, the operationalization of control in the model has been criticized for providing too narrow a spectrum of control, covering only the control elements intrinsic to work and excluding factors affecting scheduling. Also, the part of skill discretion has been questioned: is it more about variable work tasks than about control. (Ganster 1989)

3.3.2 Effort-reward imbalance

Proposed by Siegrist (1996), this recent but prevalent model of work stress, the effort-reward imbalance (ERI) model, focuses on the individual's perception of the balance between his/her efforts at work and the rewards received. The extrinsic component of the ERI model postulates that a longitudinal imbalance is followed by health problems. The importance of individual factors is recognized in evaluating both efforts and rewards. The intrinsic component of the ERI model postulates overcommitment to be especially harmful, as it causes individuals to chronically underestimate their efforts and to overestimate the resources. The ERI model, especially its extrinsic part, has received considerable empirical support both cross-culturally and across a variety of health outcomes (Tsutsumi & Kawakami 2004, van Vegchel *et al.* 2005).

The models of Karasek and Siegrist have been viewed as mutually complementary. In the effort-reward imbalance model, aspects of control are not directly highlighted, but aspects of job control probably affect employees' perception of both their efforts and their non-material rewards. (Bosma *et al.* 1998)

With respect to worktime control, as suggested in earlier research, (Pierce 1989) having control over one's working times/ temporal autonomy may be viewed as a rewarding element at work as such, and the presence or absence of worktime control thus affects the perception of reciprocity between efforts and demands.

3.3.3 Multidimensionality of control at work

Control can be defined as an ability to exert some influence over one's environment, so that the environment becomes more rewarding or less threatening (Ganster 1989). In this

respect, worktime control might, for instance, enable the employee to attend important domestic occasions such as children's school activities or visit a doctor with an elderly family member.

By another definition, control means an ability to make an impact on the conditions and on one's activities in correspondence with some higher-order goal (Frese 1989) The goal-related nature of control is emphasized: without a goal, there is no issue of control. There is also a hierarchy of goals, though they may be multiple and conflicting. Thus, worktime control might be more important for those meeting bigger challenges in successfully combining paid work with domestic demands, especially women.

Aronsson (1989) has suggested that, in addition to viewing control as having an influence on the outcome of work and an opportunity for a meaningful role with respect to the valued outcome, control over potential uncertainty (predictability) as well as the aspects of 'control over' and 'control within' a situation should be distinguished. Following the latter distinction, worktime control deals with the 'control over' aspect of work conditions.

The multidimensionality of the concept 'control' has been recognized largely. In this vein, dichotomies differentiating between intrinsic and extrinsic aspects have been suggested: for example content-related – administrative/formal (Söderfeldt *et al.* 1996, Jansen *et al.* 2004) and task-relevant – peripheral (Sargent & Terry 1998).

Importantly, it has been assumed that the different dimensions could differently contribute to health and well-being. Ganster (1988) has listed the possibly important dimensions of control as follows: control over work tasks (choice, order, quality or quantity of output); pacing and breaks; schedules (working hours, vacations and shifts); physical environment; organizational policies; other people; mobility; as well as over information (predictability).

Ganster (1988) has also posed the question of whether control over one domain in the workplace could compensate for low control in another, and thus act as a compensatory control domain. Baltes *et al.* (1999), on the basis on their meta-analysis, suggested that control over working times might not be important to those with otherwise high control compared to those with less control otherwise. Interestingly, Kandolin *et al.* (2001) found that perceived individual flexibility of working times was especially important for those experiencing time pressure and for those working overtime.

3.4 Gaps in the literature

Earlier, in a review concerning the management literature, the key element in producing the beneficial effects of flexible scheduling systems on organizations had been suspected to be the employees' perception of individual autonomy (Pierce *et al.* 1989). However, with the exception of one small-scale study with mixed results, this idea had not been directly tested using employee-level measures. In the medical literature, a couple of earlier studies on occupational-level aggregates were available. Otherwise, studies directly measuring the perceptions of employee worktime control with respect to outcomes of health have been published only recently, during this thesis project, reflecting the acute nature of the issue.

To estimate the level of employee worktime control, various measures have been used, both single-item global measures and some detailed items, leaving space for more comprehensive worktime control measurement capturing the different subdimensions.

The potential relevance of employee worktime control in relation to the existing work stress literature was also unknown. In this respect, it appeared worthwhile to directly test whether worktime control would be especially beneficial if the possibilities of control were otherwise scarce. (Ganster 1988, Baltes 1999)

Recognizing the call for situation-specific models (Sparks & Cooper 1999), and the need to detect possible differences in exposure and in vulnerability to low worktime control (Denton 2004), it seemed important to identify the subgroups of employees most vulnerable to low worktime control. As the hours spent in paid and domestic work and the total working hours appeared to differ between the genders, special interest was focused to whether there would appear gender differences in the associations between worktime control and health. Seeing to the goal-oriented nature of control, worktime control was expected to be especially important for women, as worktime control contributes to employees' opportunities to integrate working life with private life, and as housekeeping responsibilities are known to concern women more than men.

In sum, the unresolved question appeared to be whether perceived individual control over working times would be a relevant psychosocial factor at work affecting employee health. There was no direct and longitudinal evidence of an association between employee worktime control and health across various outcomes including register-based outcomes, obtained with designs controlling for confounding, and detecting subgroups potentially vulnerable to poor worktime control. The gap in the literature was recently also recognized by senior researchers, who concluded that, in terms of flexible working times, there is a large-scale intervention going on in our societies with unknown effects on employee health. (Costa *et al.* 2004, Janssen & Nachreiner 2004, Åkerstedt & Kecklund 2005)

4 Aims of the study

It was hypothesized, that employee worktime control could reduce stress i. by enabling a successful combination of a full-time job with domestic responsibilities and ii. by enabling the work to be done at times of optimal resources. In line with this hypothesis, answers were sought to the following specific study questions, referred with Roman numerals to the corresponding articles:

1. Is employee worktime control associated with self-rated health, psychological distress and medically certified sickness absence in men and women?
 - a) in a cross-sectional design (I)
 - b) in a longitudinal design (II)
2. Do the associations of worktime control with health differ according to occupational status (I, II) and family status (II)?
3. How do the subdimensions of worktime control - control over daily working hours and control over days off - associate with subsequent medically certified sickness absence? (III)
4. Do the effects of worktime control on subsequent medically certified sickness absence vary by the level of work stress, as indicated by job strain and effort-reward imbalance? (III)
5. Do the associations of worktime control with subsequent self-certified and medically certified sickness absence vary by the levels of paid and domestic working hours, commuting hours and total hours or by the type of work schedule? (IV)

5 Material and methods

5.1 Participants, procedures and study designs

The participants were from the 10-Town Study, an ongoing longitudinal cohort study exploring employee health in ten Finnish towns. The study was started in 1997 as 8-Town Study in Turku, Vantaa, Oulu, Raisio, Nokia, Valkeakoski, Virrat and Naantali, and the first follow-up survey in these towns was performed in 2000. In 2001, the study reached its present composition: Tampere and Espoo joined in, and the study was renamed 10-Town Study.

In the 10-Town study, the participants fill out comprehensive questionnaires on their health, health behaviour, demographic factors and work characteristics. They are also asked for consent to let their responses to be linked to their personal sickness absenteeism data from the employers' registers. This design enables the monitoring of health problems reflected as sickness absences on a day-to-day basis even between the surveys.

In the baseline survey in 1997, the questionnaires were sent to a representative sample of full-time permanent employees, excluding all temporary employees. The response rate was 67% with 6442 respondents. In 2000-2001, all of the full-time employees with work contracts longer than 6 months were recruited. Only employees with shorter work contracts were excluded to ensure longitudinal designs. In 2000-01, 32299 (67%) participants responded to the survey inquiry, and 87% gave consent to link their responses with their records on sickness absence.

The Finnish Institute of Occupational Health (FIOH) sent the questionnaires to the participants in individually addressed sealed envelopes according to the personnel lists provided by the employers' pay centres. These lists are accurate. The respondents returned their filled-in questionnaires and - if they so chose - their consent to link their responses with registered data directly to FIOH by mail. Their personal social security numbers were then changed into identity codes, and the data linking these codes were hidden from the researchers.

The basic idea of this study was to compare how various exposure levels to worktime control are reflected in measures of health. The study designs and the participants in the four original publications are illustrated in table 1.

Table 1. Descriptive characteristics for the samples and designs of the four substudies (I-IV).

Characteristics	I	II	III	IV
Study designs	cross-sectional	longitudinal	longitudinal	longitudinal
Survey years and response rates	1997 (67%)	1997 and 2000 (81%)	2000-01 (67%)	2000-01 (67%)
N	6442	4218	16139	25742
Target populations	representative sample of full-time permanent employees	all employees participating in both surveys	all employees with ≥ 6 months' work contract and with no sickness absences in the year before the survey	all employees with ≥ 6 months' work contract
Women (%)	77	79	75	77
Mean age at baseline (yrs)	45	45	44	45
Manual employees (%)	23	21	16	18
Health outcomes				
Self-rated health	1997	2000	-	-
Psychological distress	1997	2000	-	-
Recorded medically certified sickness absences	1997-98	2001	after the survey year until the end of 2003	after the survey year until the end of 2003
Recorded self-certified sickness absences	-	-	-	after the survey year until the end of 2003
Main study questions				
Associations of	worktime control sum measure	worktime control sum measure	control over daily working hours and control over days off	control over daily working hours
with	health, health behaviours, demographics and other job characteristics including job demands and job control	baseline and follow-up health in different occupational and family situations	subsequent medically certified sickness absences in relation to work stress, as indicated by job strain and effort-reward imbalance	subsequent sickness absences in relation to paid and domestic working hours, commuting hours, total hours, and to shift work

5.2 Measures of worktime control

Worktime control was measured in the 1997 baseline survey on a 6-item scale. The respondents were asked to rate how much they were able to influence the following aspects of their working times:

1. the starting and ending times of a workday
2. the taking of breaks during the workday
3. handling private matters during the workday
4. the scheduling of shifts
5. the scheduling of vacations and paid days off, and
6. the taking of unpaid leave

The scale was aimed to operationalize autonomy with regard to working times (workers' control over the duration, position and distribution of their individual working times) (Knauth 1998). The scale addressed topics that have been regarded as important in research into job control, but have been neglected (Ganster 1988), such as (i) control over work scheduling, e.g. working hours (item 1), vacations and days off (items 5 and 6) and choice of shifts (item 4) as well as (ii) control over work pacing in terms of the scheduling and duration of rest breaks (items 2 and 3).

Responses were given on a 5-point scale (1 = very little, ... 5 = very much). The mean of the six items (2.78, SD 0.9 in study I) was used to measure worktime control in studies I and II. The internal consistency of the scale was good with Cronbach's alpha 0.82.

The scale covered the possibilities for worktime control provided by work contracts in the Finnish public sector. Nevertheless, the scale was completed with an item asking the possibilities to influence the length of the workday in the 2000-2001 surveys. The resulting 7-item scale (mean 2.58, SD 0.9) had good internal consistency (alpha 0.84).

In order to further explore the relative importance of the subdimensions of worktime control, the seven items were then considered as separate measures in a factor analysis (study III) using principal component analysis with varimax rotation and eigenvalue criterion >1 for factor retention. Two factors accounted for 81.7% of the total variance. The first factor '*control over daily working hours*' (55.5% of the total variance, Cronbach's alpha 0.86, mean 2.31, SD 1.2) consisted of control over the length of the workday and the starting and ending times of the workday, and the second factor '*control over days off*' (26.2% of the total variance, Cronbach's alpha 0.67, mean 3.18, SD 1.0) consisted of influencing the taking and timing of vacations and other paid and unpaid leaves. Their mutual Pearson's correlation coefficient was 0.35.

In comparing the effects of worktime control in relation to paid, domestic and total hours (study IV), only the subdimension of control over daily working hours was used, as it was assumed to bear relevance across all types of working hours. Of the original items of the worktime control instrument, the items focusing on the scheduling of breaks and shifts were not studied in detail after the factor analysis.

5.3 Other predictors of health

5.3.1 Work stress

The measures of the job strain model were derived from the Job Content Questionnaire (Karasek 1985). The *job demands* scale (five items, Cronbach's alpha 0.81) dealt with workload and work pace on a 5-point scale (strongly disagree – strongly agree: my job requires working very fast, ... working very hard, I am asked to do an excessive amount of work, I have enough time to get the job done, my job is very hectic). The *job control* scale (nine items, Cronbach's alpha 0.82) included subscales of decision authority and skill discretion, each on a 5-point scale (My job requires that I learn new things, ... involves a lot of repetitive work, ... requires me to be creative, ... allows me to make a lot of decisions on my own, ... requires a high level of skill, On my job I have a little freedom to decide how I do my work, ... get to do a variety of different things on my job, ... have a lot to say about what happens on my job, ... have an opportunity to develop my own special abilities). The means of the aforementioned sum scores were further divided into quartiles. *Job strain* situations were cross-tabulated from the median splits of job control and job demands and categorized as low strain (low demands with high control), active jobs (high demands with high control), passive jobs (low demands with low control) and high strain (high demands with low control) (Karasek and Theorell 1990).

The correlation coefficient of job control with worktime control was 0.18 in the baseline survey (study I). In the 2000-01 survey (study III), the correlation coefficients with job control were 0.24 for control over daily working hours and 0.09 for control over days off, respectively.

With regard to the effort-reward imbalance (ERI) model of work stress, the employees' *effort* at work were measured with a single question "How much do you feel you invest in your job in terms of skill and energy?", and *rewards* from work by three items capturing how much the respondents feel they get in return from work in terms of income and job benefits, recognition and prestige, and personal satisfaction (range 1-5, Cronbach's alpha 0.64). A measure of *effort-reward imbalance* was then obtained by dividing effort by (the means of) the rewards and categorizing the resulting quotient into quartiles.

The correlation coefficients with effort-reward imbalance were -0.11 for both control over daily working hours and control over days off (study III).

5.3.2 Working hours

Working hours were reviewed in study IV by distinguishing between the hours spent in paid and domestic work and in commuting between work and home (Mårdberg 1991).

Paid working hours were summed up from the respondents' reports of their (i) official working hours per day and (ii) mean hours of paid or unpaid overtime and mean hours in another job per day. The daily working hours were multiplied by 5 for the weekly hours in paid work (women: mean 39.0, SD 5.7; men: mean 41.0, SD 7.7) and then further

divided into the following three categories: up to 40, over 40 to 50, and over 50 hours per week. These categories were based on recent reviews (Spurgeon *et al.* 1997, van der Hulst 2003) suggesting health risks for working over 50 hours per week and calling for research on moderately long hours (over 40 hours per week).

The respondents rated their mean daily *domestic working hours* (caring for children and other near ones, cleaning, laundry, doing home maintenance, etc.) separately for working days and days off. The former ratings were multiplied by 5 and the latter by 2 for the weekly hours in domestic work (women: mean 18.4, SD 10.1; men: mean 12.1, SD 9.8). These figures were then further divided into the three categories of up to 10, over 10 to 25, and over 25 hours per week. As no established thresholds of potentially harmful domestic hours exist, these categories were chosen to allow for the possibility to explore the effects of clearly long and short domestic hours and to enable comparisons between women and men.

The respondents' reports of their daily two-way *commuting hours* were multiplied by 5, to obtain the weekly hours spent in commuting between work and home (women: mean 4.1, SD 2.9; men: mean 3.9, SD 2.8). Corresponding to one-way travelling times of up to 15 minutes, over 15 to 45 minutes and over 45 minutes, the weekly commuting hours were grouped into the categories of up to 2.5 hours, over 2.5 to 7.5 hours and over 7.5 hours per week, the latter cut-off point set as in a previous EU survey (Costa *et al.* 1988b).

The *total working hours* per week included the hours in paid and domestic work added to the hours spent in commuting between home and work (women: mean 61.3, SD 11.7; men: mean 56.9, SD 12.6). To explore the effects of the differential exposures, the total working hours were divided into the three categories of up to 50, over 50 to 75 and over 75 hours per week.

5.3.3 *Background variables*

Information on *age*, *gender*, *type of work contract* (permanent/fixed-term) and *occupational status* were obtained from the employers' records. The five-digit coded (Statistics Finland 1997) occupational titles were categorized into upper and lower non-manual and manual statuses.

Self-reports on *educational level* were grouped as university, college, vocational or no vocational education. The survey responses on *work schedule* were classified into three categories: standard hours (weekdays, daytime only), schedules including evening and/or weekend shifts but no night shifts and schedules including also night shifts.

Of the family characteristics, we surveyed *marital status* (married or cohabiting versus single, separated or widowed) and *family type* (no children, only preschool child(ren) 0-6 years of age, only school-aged child(ren) 7-18 years of age or children in both age groups).

The behavioural and biological health risks measured were *smoking status* (current smoker or non-smoker, in study I ex-smokers were also distinguished), *high alcohol consumption* (>200 grams of alcohol per week, except in study I >210g), *sedentary lifestyle* (<30 minutes of fast walking per week) and *overweight* (body mass index >27

kg/m²), except in study I where overweight was further divided into moderate (BMI 25-30) and severe (BMI >30).

5.4 Health outcomes

5.4.1 Self-rated health

Self-rated health was assessed by an overall rating of health on a 5-point scale (1= good, 2= fairly good, 3=average, 4= fairly poor, 5= poor). This measure was dichotomized by grouping the response scores 1 - 2 as a category of good health and the scores 3 - 5 as a category of poor health.

Self-rated health is a widely used concept in medical, epidemiological and health psychological research. It has been a powerful predictor of mortality and morbidity (Idler and Angel 1990, Kaplan *et al.* 1996) and has been shown to be associated with the number of physician contacts per year in a working population (Miilunpalo *et al.* 1997).

5.4.2 Psychological distress

The measure of psychological distress was obtained from the 12-item version of Goldberg's General Health Questionnaire (GHQ-12), which was developed to screen for non-specific psychiatric morbidity in populations (Goldberg and Williams 1988). In the 12 items, the respondents consider common symptoms such as feelings of depression, loss of confidence or sleep disturbances. To indicate psychological distress, we used the cut-off point of at least four of the assessed psychological symptoms being experienced more frequently than usual, as in the studies validating the GHQ-12 against standardized psychiatric interviews (Goldberg *et al.* 1997).

5.4.3 Sickness absence

Data on sickness absence were derived from the employers' routinely kept registers including the dates when each sick leave period started and ended. After checking the employers' sickness absence records and combining the overlapping and consecutive periods, the individual numbers of sick leave periods as well as the individual person-years representing the "days at risk for sickness absence" were calculated by excluding the days absent for reasons other than sickness. Short sickness absences lasting up to 3 days, for which self-certificates are sufficient, were differentiated from the longer ones (over 3 days) that required a medical certificate.

The reliability of these data is high, as municipal employers keep strict records of all sick leave in order to receive statutory compensation from the Finnish Social Insurance Institution. According to the regulations, all sick leave certificates must be forwarded for

recording. The employees on sick leave receive full salary from the first day. Maternity leaves and absences to care for a sick child are not recorded as sick leave. The regulations permit up to 3 paid days off work to care for acutely ill children under 10 years of age, and the annual number of such 3-day periods is not limited.

The frequency-based measurement of medically certified sickness absence has been shown to provide valid information on employee health. Medically certified sickness absence has been found to predict mortality and preterm retirement, whereas such associations have not been found for self-certified sickness absences (Kivimäki *et al.* 2003, Vahtera *et al.* 2004, Kivimäki *et al.* 2004).

The main gender-specific results were found across all of the three health outcomes in studies I-II. Therefore, a decision was made to use the incidence rate of medically certified sickness absences as the only outcome of health in studies III-IV. This approach was chosen, as sickness absences are routinely followed on a day-to-day basis and easily enable longitudinal study designs. In study IV, the occurrences of self-certified absences were also studied to find out whether self-certified absences are used to pursue practical self-control over working times.

5.5 Statistical methods

To study the associations of worktime control with background variables, analyses of variance (I-IV), chi-square tests (II) and Pearson's correlation (III) analyses were used. In the longitudinal study II, the interactions of the trends of worktime control with gender and time were studied by repeated measures analyses of variance. The associations between baseline health status and worktime control at the time of the follow-up (reversed causalities) were studied by analyses of variance.

The worktime control instrument was further explored by considering its items as separate measures in a factor analysis, as explained above.

To depict exposure levels, the measures of worktime control were treated as median splits, and/or quartiles (in studies I, III, and IV) and in tertiles in study II, where the scores of worktime control in the 1997 and 2000 surveys were first divided into tertiles, according to tertiles in 1997. The levels of worktime control were then classified into the following three categories: high worktime control (in both 1997 and 2000), low worktime control (in both 1997 and 2000) and intermediate worktime control (all other combinations of worktime control levels in 1997 and 2000).

Logistic regression models were used to analyse the associations of worktime control categories with self-rated health and psychological distress (I,II). The results were expressed as odds ratios (OR) and their 95% confidence intervals (CI). Adjustments were made for demographics, health behaviours, work-related factors and baseline health status. The analyses were stratified for gender, and subgroup analyses according to occupational, marital, family and baseline health status were performed. Interactions of gender and of occupational, marital and family status with worktime control were tested using the corresponding cross-product terms.

The associations of worktime control and other factors with the occurrence of long (I-IV) and short (IV) sickness absence spells per individually calculated person-years were

studied by Poisson regression models and expressed as rate ratios (RR) and their 95% confidence intervals (95% CI). These figures represent incidence densities of sickness absence spells. Use of the Poisson model implies that the between-employee variance in the rates of sick leave equals the expected rate of sick leave. In studies I - III, the dispersions of sick leaves did not significantly deviate from the model's assumptions. Adjustments, subgroup analyses and interaction tests were performed according to the aforementioned strategies.

To study the joint associations of worktime control and work stress with subsequent sickness absence (III), we formulated combination variables by cross-tabulating the measures of work stress (in quartiles) and the levels of worktime control (median splits). The effects of the resulting eight combinations of work stress with worktime control on subsequent sickness absence were studied by Poisson regression models using the hypothetically least adverse condition (lowest quartile of work stress with high worktime control) as the reference category. The significance of these joint effects was studied using appropriate cross-product terms (work stress x worktime control). Adjustments were made for age, demographics, health behaviours and work-related factors. Analyses were stratified for gender.

To reduce bias arising from differences in response styles and reactivity, the analyses in study III were replicated using aggregated worktime control scores according to work units. Each respondent's work unit was identified from the employers' records based on a 5-level organizational hierarchy classification. For each level, the mean control over daily working hours and the control over days off were calculated. The resulting aggregate scores of the lowest level – that is, work unit – were assigned to each member of the unit. If the number of participants in the unit was nine or less, values aggregated onto the next level were used.

In study IV, the joint effects of the four types of working hours and worktime control were studied by formulating combination variables by cross-tabulating working hours (three categories) and control over working hours (median splits). The effects of the resulting six combinations on self-certified and medically certified absences were studied by Poisson regression analyses with the generalized estimating equations (GEE) method, which takes into account the fact that individual employees were nested within work units. The significance of the joint effects as well as the interactions with gender were studied using appropriate cross-product terms. Adjustments were made for age only, then for age, work-related variables, family-related variables and health risk behaviour. The analyses were stratified by gender, with the exception of the subgroup analyses stratified according to the type of work schedule.

To further quantify the extent to which the individuals' perceptions of worktime control reflect contextual phenomena (study IV), the intra-class correlation of control over daily working hours were estimated, to capture the extent of homogeneity in these perceptions within a work unit (Diez-Roux 2002).

The SAS statistical package was used in all analyses, with the exception that in study I the associations between possible predictors with self-rated health and psychological distress were studied using the SPSS program.

5.6 Drop-out analyses

Drop-out analyses were carried out in each study based on available registered data from the employers' records. In study II, a flow chart on sample attrition was depicted. Summing up these analyses, it was found that, compared to the eligible populations, women and non-manual employees were slightly overrepresented in the samples. In addition, the respondents had less sickness absences than the non-respondents. In the 2000-01 samples, permanent employees were slightly overrepresented compared to those with fixed-term contracts.

However, no substantial differences emerged in any case, and the mean ages were practically the same between the samples and the eligible populations.

5.7 Descriptive statistics

5.7.1 Measures of worktime control by gender

The baseline study in 1997 (I) revealed no gender difference in the mean level of (the 6-item) worktime control: the mean ratings were 2.77 (SD 0.89) and 2.78 (SD 0.86) for men and women, respectively.

With respect to the subdimensions of worktime control in 2000-01 (III), men reported a higher level of control over their daily working hours than women, with mean ratings of 2.41 (SD 1.3) and 2.27 (SD 1.1), respectively. In contrast, no gender differences emerged in terms of control over days off: the mean ratings were 3.19 (SD 1.1) and 3.17 (SD 1.0) for men and women, respectively.

5.7.2 Worktime control by other variables

As shown in table 2, worktime control was related to job control among both genders (study I). However, gender differences appeared in that low worktime control was associated with low education and low job demands among men and with high education and high job demands among women.

Table 2. Mean scores (standard deviations) of worktime control by demographics, health behaviours, and work characteristics adjusted for age.

	Women			p for difference	Men			p for difference
	N	Mean	SD		N	Mean	SD	
Age group (years)				0.000				0.347
18-39	1355	2.86	0.81		355	2.79	0.82	
40-49	1940	2.85	0.85		538	2.81	0.86	
≥50	1614	2.63	0.90		587	2.73	0.96	
Level of education				0.000				0.000
University	1020	2.47	1.00		410	2.79	1.05	
College	1561	3.00	0.81		373	3.14	0.85	
Vocational	1058	2.82	0.75		330	2.67	0.74	
None	1085	2.72	0.82		329	2.48	0.73	
Married or cohabiting				0.268				0.409
Yes	3738	2.77	0.86		1216	2.77	0.90	
No	1084	2.80	0.85		234	2.82	0.88	
Dependent children				0.000				0.066
Yes	2951	2.82	0.86		845	2.81	0.87	
No	1939	2.72	0.86		627	2.72	0.92	
Smoking				0.001				0.024
Never smoker	2290	2.74	0.86		420	2.87	0.92	
Ex-smoker	1739	2.77	0.86		720	2.72	0.88	
Current smoker	831	2.88	0.84		330	2.77	0.86	
Alcohol consumption				0.000				0.127
0-210g/week	4611	2.77	0.86		1161	2.76	0.87	
>210g/week	268	2.98	0.95		305	2.84	0.96	
Body mass index				0.035				0.842
< 25	2848	2.76	0.87		609	2.77	0.90	
25 - 30	1398	2.83	0.86		689	2.79	0.89	
> 30	532	2.78	0.84		160	2.76	0.89	
Sedentary lifestyle				0.745				0.592
No	4113	2.78	0.86		1231	2.78	0.88	
Yes	733	2.79	0.86		235	2.75	0.93	
Job control ¹				0.000				0.000
4 high	1060	2.91	1.01		326	3.00	1.00	
3	1155	2.82	0.86		386	2.95	0.91	
2	1451	2.81	0.77		425	2.73	0.80	
1 low	1221	2.58	0.78		341	2.42	0.73	
Job demands ¹				0.000				0.009
1 low	1346	2.92	0.81		361	2.77	0.88	
2	1056	2.80	0.84		320	2.64	0.84	
3	1349	2.71	0.86		418	2.80	0.89	
4 high	1128	2.67	0.92		376	2.87	0.93	

¹Quartiles

6 Results

6.1 Worktime control and health outcomes

6.1.1 Worktime control and health at baseline

Table 3 presents the cross-sectional associations of the levels of worktime control (in quartiles) with the outcomes of health at baseline. Model 1 presents the figures adjusted for demographics and health behaviour, model 2 is additionally adjusted for job control and demands. According to the latter model, compared to the highest quartile of worktime control, low worktime control associated with a 1.8-fold risk of experiencing poor health and a 1.6-fold risk of psychological distress for women, but not for men. These associations were independent of job control and of similar magnitude compared to those of job control (see study I). Both women and men rating their worktime control below the median level had a 1.2 times higher rate of medically certified sickness absence. This association remained significant for women even after adjustment for prior sickness absence (study I).

The evident gender differences were a starting point for further analyses (study I). The aforementioned analyses were first replicated within a single occupation comprising both men (n=297) and women (n=916), namely teachers. The adjustments followed those used in model 1, table 3. Compared to the highest quartile of worktime control, the ORs of the lowest quartile for poor health were 3.21 (1.54-6.69) for female teachers and 1.71 (0.62-4.72) for male teachers. The corresponding figures for psychological distress were 2.45 (1.33-4.54) and 1.14 (0.44-2.92) for female and male teachers, respectively. Women in the lowest quartile of worktime control had a 1.23 (0.95-1.59) times higher rate of medically certified sickness absence than those in the highest quartile. The corresponding rate ratio was 0.93 (0.58-1.51) for men. Thus, the results within a single occupation were well in line with those found in the total sample.

Table 3. Odds ratios (95% confidence intervals) for poor health and psychological distress and rate ratios (95% confidence intervals) of sickness absences by quartiles of worktime control.

Health outcome	Worktime control	Model 1		Model 2	
		Women	Men	Women	Men
Self-rated poor health	4 (high)	1.00	1.00	1.00	1.00
	3	1.28 (1.04,1.56)	1.23 (0.85,1.76)	1.18 (0.96,1.44)	1.09 (0.76,1.58)
	2	1.59 (1.31,1.94)	1.41 (0.99,2.01)	1.42 (1.16,1.73)	1.39 (0.97,1.99)
	1 (low)	2.21 (1.80,2.72)	1.36 (0.95,1.97)	1.84 (1.49,2.28)	1.22 (0.84,1.78)
Psychological distress	4 (high)	1.00	1.00	1.00	1.00
	3	1.49 (1.22,1.83)	0.94 (0.65,1.38)	1.40 (1.13,1.72)	1.83 (0.56,1.23)
	2	1.57 (1.28,1.92)	1.22 (0.85,1.75)	1.38 (1.12,1.70)	1.18 (0.81,1.71)
	1 (low)	1.99 (1.61,2.45)	1.15 (0.79,1.67)	1.61 (1.29,2.00)	1.00 (0.67,1.48)
Medically certified sickness absence	4 (high)	1.00	1.00	1.00	1.00
	3	1.08 (1.01,1.16)	1.02 (0.87,1.19)	1.06 (0.99,1.14)	0.98 (0.84,1.15)
	2	1.23 (1.14,1.31)	1.23 (1.06,1.43)	1.18 (1.10,1.26)	1.19 (1.02,1.38)
	1 (low)	1.22 (1.13,1.32)	1.20 (1.03,1.41)	1.15 (1.06,1.24)	1.13 (0.96,1.33)

Model 1: Adjusted for demographics and measures of health behaviour (educational level, marital status, presence of dependent children, smoking, alcohol consumption, body mass index, sedentariness). Model 2: Adjusted for all aforementioned and for job demands and job control.

6.1.2 Worktime control and health at follow-up

The longitudinal associations between levels of worktime control in 1997-2000 and health status at follow-up (study II) are presented in Table 4. Among women with a low level of worktime control, the odds ratios for poor self-rated health and psychological distress at follow-up were 1.9 and 1.4 times higher, respectively, than among women with a high level of worktime control, adjusted for age, occupational and family status, health behaviour and baseline level of each health indicator. Similarly, women with a low level of worktime control had a 1.5 times higher risk of medically certified sickness absences at follow-up. Among men, the levels of worktime control were not associated with the health outcomes in the adjusted models.

Table 4. Adjusted¹ odds ratios (95% confidence intervals) for poor health and psychological distress and rate ratios (95% confidence intervals) of medically certified sickness absences at follow-up by the levels of worktime control in 1997-2000.

Health outcome	Worktime control ²	Women	Men
Self-rated health	High	1.00	1.00
	Intermediate	1.58 (1.22,2.03)	0.81 (0.53,1.26)
	Low	1.86 (1.40,2.48)	0.93 (0.56,1.56)
Psychological distress	High	1.00	1.00
	Intermediate	1.18 (0.93,1.48)	1.09 (0.73,1.64)
	Low	1.40 (1.08,1.82)	0.92 (0.57,1.49)
Sickness absence	High	1.00	1.00
	Intermediate	1.36 (1.20,1.54)	1.09 (0.85,1.39)
	Low	1.51 (1.31,1.73)	1.28 (0.97,1.68)

¹Adjusted for demographics (age, occupational status, marital status, dependent children), behavioural risk factors (smoking, alcohol consumption, body mass index and sedentary lifestyle), and baseline level of the health outcome in question. ²Levels of worktime control: high = highest tertile in both 1997 and 2000, low = lowest tertile in both 1997 and 2000, intermediate = all other combinations

To further explore the effects of worktime control on prospective health, the aforementioned analyses were then replicated stratified by the levels of baseline health status (study II). Among the initially healthy women, those with low worktime control had a 1.9 times higher odds ratio for poor self-rated health and psychological distress at follow-up and a 1.3 times higher risk for subsequent sickness absences than those with high worktime control. Among the initially unhealthy women, the associations of low worktime control with poor self-rated health and sickness absences at follow-up were even greater. For the either initially healthy or unhealthy men, no significant associations were found between the health outcomes and worktime control.

The gender differences were further studied by interaction analyses (study II), which showed that the effect of worktime control on self-rated health was dependent on gender (p for interaction=0.043 in the adjusted model). An interaction with gender also emerged for psychological distress in the unadjusted model (p=0.041), although it was nonsignificant when adjusted for baseline distress and other confounders. However, for the incidence of psychological distress among those not distressed at baseline, the effect of worktime control significantly depended on gender (p=0.032). In the total sample of study II, gender interaction with worktime control was not found for sickness absences.

6.2 Worktime control and health by occupational status and family situation

The health effects of worktime control according to occupational, family and marital status (study II) are shown in tables 5 and 6 for women and men, respectively.

In the subgroups of women, low worktime control predicted health problems in both manual and non-manual occupations across all outcomes - with the exception that psychological distress was not associated with worktime control among female manual workers. In regard to marital status, worktime control consistently predicted health among the women with a spouse but not among single women (interaction with marital status on sickness absences, $p=0.01$). In relation to family status, a low level of worktime control predicted poor health and sickness absence among both the women with and those without children at home and psychological distress among the women with children at home.

Among men, low worktime control was not associated with self-rated health or psychological distress, but it predicted sickness absence in two subgroups, with a 1.6-fold absence rate for those with children at home and a 2.6-fold rate for those with manual occupations (interaction with occupational status, $p=0.005$).

Table 5. Subgroup analyses among the women: health status at follow-up by the levels of worktime control in 1997-2000, adjusted¹

Health outcome	Worktime control ²	Occupational status		p for interaction	Marital status		p for interaction	Family status		p for interaction
		Non-manual workers n=2669	Manual workers n=561		Single/separated/ widowed n=719	Married or cohabiting n=2528		No children at home n=1182	Children at home n=2123	
Self-rated poor health ³	High	1.00	1.00	0.091	1.00	1.00	0.360	1.00	1.00	0.452
	Intermediate	1.48 (1.13,1.94)	2.55 (1.24,5.27)		1.53 (0.90,2.59)	1.59 (1.19,2.12)		1.87 (1.21,2.90)	1.44 (1.06,1.97)	
	Low	1.68 (1.24,2.29)	3.54 (1.61,7.80)		1.53 (0.84,2.79)	1.96 (1.42,2.71)		2.28 (1.40,3.72)	1.66 (1.17,2.36)	
Psychological distress ³	High	1.00	1.00	0.696	1.00	1.00	0.612	1.00	1.00	0.882
	Intermediate	1.13 (0.88,1.44)	1.70 (0.83,3.48)		0.93 (0.57,1.51)	1.26 (0.97,1.64)		1.13 (0.75,1.70)	1.22 (0.92,1.61)	
	Low	1.43 (1.08,1.88)	1.38 (0.62,3.07)		1.47 (0.85,2.56)	1.40 (1.04,1.89)		1.29 (0.82,2.03)	1.45 (1.05,2.01)	
Sickness absence ⁴	High	1.00	1.00	0.060	1.00	1.00	0.010	1.00	1.00	0.622
	Intermediate	1.29 (1.13,1.48)	1.59 (1.16,2.16)		1.15 (0.92,1.45)	1.41 (1.22,1.63)		1.29 (1.05,1.60)	1.35 (1.16,1.57)	
	Low	1.36 (1.17,1.58)	1.91 (1.37,2.66)		1.13 (0.87,1.47)	1.59 (1.36,1.87)		1.38 (1.10,1.74)	1.49 (1.26,1.76)	

¹Adjusted for age, baseline level of the health outcome in question and behavioural risk factors (smoking, alcohol consumption, body mass index and sedentary lifestyle) in all cases, and for occupational status, marital status and dependent children where appropriate. ²Levels of worktime control: high = highest tertile in both 1997 and 2000, low = lowest tertile in both 1997 and 2000, intermediate = all other combinations. ³Odds ratio (95% confidence interval). ⁴Rate ratio (95% confidence interval).

Table 6. Subgroup analyses among the men: health status in the follow-up by the levels of worktime control in 1997-2000, adjusted¹

Health outcome	Worktime control ²	Occupational status		p for interaction	Marital status		p for interaction	Family status		p for interaction
		Non-manual workers n=575	Manual workers n=314		Single/separated / widowed n=136	Married or cohabiting n=750		No children at home n=358	Children at home n=538	
Self-rated poor health ³	High	1.00	1.00	0.367	1.00	1.00	0.123	1.00	1.00	0.493
	Intermediate	0.77 (0.48,1.25)	1.17 (0.41, 3.39)	1.47 (0.34,6.41)	0.78 (0.49,1.23)	0.44 (0.21,0.90)	0.44 (0.21,0.90)	1.20 (0.68,2.12)		
	Low	0.84 (0.47,1.52)	1.33 (0.42,4.18)	5.37 (0.93,30.9)	0.80 (0.46,1.37)	1.75 (0.33,1.72)	1.08 (0.55,2.10)			
Psychological distress ³	High	1.00	1.00	0.215	1.00	1.00	0.165	1.00	1.00	0.930
	Intermediate	1.07 (0.68,1.67)	1.56 (0.56,4.37)	0.99 (0.32,3.08)	1.13 (0.73,1.75)	0.70 (0.37,1.37)	1.42 (0.84,2.40)			
	Low	0.73 (0.41,1.30)	1.63 (0.54,4.88)	2.54 (0.68,9.51)	0.79 (0.46,1.33)	0.79 (0.37,1.68)	0.97 (0.51,1.83)			
Sickness absence ⁴	High	1.00	1.00	0.005	1.00	1.00	0.236	1.00	1.00	0.082
	Intermediate	0.86 (0.65,1.15)	2.07 (1.14,3.75)	1.98 (0.91,4.30)	0.99 (0.76,1.29)	0.99 (0.68,1.44)	1.14 (0.82,1.57)			
	Low	1.10 (0.78,1.54)	2.61 (1.41,4.83)	2.16 (0.91,5.10)	1.24 (0.93,1.66)	0.93 (0.59,1.46)	1.62 (1.14,2.29)			

¹Adjusted for age, baseline level of the health outcome in question and behavioural risk factors (smoking, alcohol consumption, body mass index and sedentary lifestyle) in all cases, and for occupational status, marital status and dependent children where appropriate. ²Levels of worktime control: high = highest tertile in both 1997 and 2000, low = lowest tertile in both 1997 and 2000, intermediate = all other combinations. ³Odds ratio (95% confidence interval). ⁴Rate ratio (95% confidence interval).

6.3 Worktime control, work stress and medically certified sickness absence

6.3.1 Main effects

Worktime control and job stress predicted medically certified sickness absences among both genders, as shown in Table 7 (study III). The employees in the lowest quartiles of control over daily working hours and days off had 1.2-1.3 times higher rates of subsequent sickness absences than those in the highest quartiles. Compared with those in low-strain jobs, the women and men in high-strain jobs had 1.2 - 1.3 times higher rates of subsequent sickness absences. The women in the highest quartile of effort-reward imbalance had 1.2 times more sickness absences than those with the least imbalance, and the corresponding figure for men was 1.4.

Table 7. Main effects: Adjusted¹ rate ratios (95% confidence intervals) of medically certified sickness absences by levels of worktime control and sources of stress among those with no absences in the year preceding the survey.

	Women	Men
Control over daily working hours		
4 high	1.00	1.00
3	1.16(1.09,1.23)	1.05(0.93,1.18)
2	1.26(1.18,1.33)	1.18(1.05,1.33)
1 low	1.29(1.22,1.37)	1.26(1.13,1.40)
Control over days off		
4 high	1.00	1.00
3	1.05(0.98,1.12)	1.19(1.05,1.35)
2	1.16(1.09,1.24)	1.20(1.05,1.36)
1 low	1.23(1.14,1.32)	1.26(1.09,1.45)
Job strain		
low strain	1.00	1.00
active job	1.09(1.03,1.15)	1.04(0.93,1.17)
passive job	1.07(1.01,1.13)	1.03(0.93,1.14)
high strain	1.27(1.20,1.34)	1.21(1.08,1.35)
Effort- reward -imbalance		
1 low	1.00	1.00
2	0.99(0.94,1.05)	1.10(0.98,1.22)
3	1.03(0.98,1.10)	1.10(0.99,1.23)
4 high	1.21(1.14,1.29)	1.41(1.26,1.58)

¹Adjusted for age, level of education, occupational status, types of work contract and work schedule, marital status and dependent children, smoking, alcohol consumption, sedentary life-style and overweight.

6.3.2 Work stress combined with control over daily working hours

Table 8 shows the joint effects on medically certified sickness absence of work stress with control over daily working hours (study III). Among women, high demands, low control and high strain were in a stepwise manner associated with higher rates of sickness absence, mainly in combination with low control over daily working hours. Compared to women having both low stress and high control over their daily working hours, women in high-stress jobs had 1.2-1.4 times higher rates of sickness absence if they simultaneously had low control over their working hours, as indicated by individual scores, but no or only a slight increase in the absence rate if their control over working hours was high. The analyses using the aggregated measure of control over working hours largely replicated these results. Significant interactions of job demands, job control and job strain with control over working hours gave additional statistical support to these joint effects.

The findings were less consistent among men. High levels of job demands and effort-reward imbalance predicted higher rates of sickness absences mainly in combination with low control over working hours, when measured individually. Interestingly, low control over working hours also predicted increased sickness absence among the men who had high job control and worked in active jobs. However, none of these results were replicated in analyses using the aggregated measure of control over daily working hours.

Table 8. Combined effects of control over daily working hours (individual measures) with sources of stress: Adjusted¹ rate ratios (95% confidence intervals) for medically certified sickness absences by level of control over daily working hours combined with level of job demands, job control, job strain and effort-reward imbalance.

Sources of stress	Women		p for inter-action	Men		p for inter-action
	Control over daily working hours			Control over daily working hours		
	high	low		high	low	
Job demands			0.017			0.144
1 low	1.00	1.06(0.97,1.14)		1.00	1.07(0.92,1.24)	
2	1.04(0.96,1.13)	1.18(1.09,1.28)		1.01(0.86,1.19)	1.23(1.06,1.42)	
3	1.02(0.93,1.10)	1.27(1.18,1.37)		1.08(0.92,1.28)	1.32(1.13,1.53)	
4 high	1.16(1.07,1.26)	1.40(1.30,1.51)		0.98(0.81,1.17)	1.37(1.16,1.62)	
Job control			<0.001			0.484
4 high	1.00	1.05(0.98,1.13)		1.00	1.27(1.09,1.48)	
3	0.96(0.89,1.04)	1.00(0.93,1.08)		1.00(0.86,1.17)	1.18(1.01,1.37)	
2	0.99(0.91,1.07)	1.25(1.16,1.34)		0.97(0.83,1.14)	1.18(1.02,1.36)	
1 low	0.93(0.85,1.02)	1.23(1.15,1.33)		1.28(1.06,1.54)	1.36(1.18,1.57)	
Job strain			<0.001			<0.001
low strain	1.00	0.96(0.89,1.04)		1.00	0.98(0.84,1.14)	
active job	1.00(0.93,1.08)	1.13(1.05,1.23)		0.85(0.73,1.00)	1.29(1.11,1.51)	
passive job	0.92(0.85,1.00)	1.15(1.07,1.24)		0.85(0.72,1.01)	1.11(0.97,1.28)	
high strain	1.05(0.96,1.14)	1.36(1.26,1.46)		1.20(1.01,1.43)	1.21(1.05,1.41)	
Effort-reward imbalance			0.856			0.330
1 low	1.00	1.18(1.08,1.30)		1.00	1.01(0.86,1.20)	
2	1.00(0.92,1.09)	1.15(1.06,1.25)		1.00(0.85,1.18)	1.18(1.01,1.38)	
3	1.03(0.94,1.12)	1.20(1.11,1.30)		0.99(0.84,1.16)	1.21(1.04,1.41)	
4 high	1.23(1.12,1.35)	1.39(1.27,1.51)		1.24(1.03,1.50)	1.51(1.29,1.77)	

¹Adjusted for age, level of education, occupational status, types of work contract and work schedule, marital status and dependent children, smoking, alcohol consumption, sedentary lifestyle and overweight.

6.3.3 Work stress combined with control over days off

Table 9 shows the joint effects of work stress and control over days off on sickness absence (study III). Among women, low job control, high strain and high effort-reward imbalance predicted high rates of sickness absence in combination with low control over days off, but the associations were absent or weak if control over days off was high. Among men, the effects of work stress on sickness absence were not dependent on control over days off.

Table 9. Combined effects of control over days off (individual measures) with sources of stress: Adjusted¹ rate ratios (95% confidence intervals) for medically certified sickness absences by level of control over days off combined with level of job demands, job control, job strain and effort-reward imbalance.

Sources of stress	Women		p for inter-action	Men		p for inter-action
	Control over days off			Control over days off		
	high	low		high	low	
Job demands			0.131			0.019
1 low	1.00	1.06(0.98,1.16)		1.00	1.06(0.91,1.23)	
2	1.05(0.98,1.13)	1.19(1.10,1.28)		1.14(1.00,1.30)	1.12(0.98,1.28)	
3	1.04(0.96,1.12)	1.25(1.16,1.34)		1.06(0.91,1.23)	1.34(1.17,1.54)	
4 high	1.24(1.15,1.34)	1.34(1.25,1.44)		1.24(1.06,1.46)	1.13(0.96,1.32)	
Job control			0.003			0.366
4 high	1.00	1.11(1.03,1.19)		1.00	1.15(0.98,1.34)	
3	1.00(0.93,1.08)	1.00(0.92,1.08)		1.02(0.88,1.19)	1.05(0.89,1.23)	
2	1.06(0.98,1.14)	1.25(1.16,1.34)		1.06(0.92,1.23)	1.01(0.87,1.17)	
1 low	1.02(0.94,1.10)	1.23(1.14,1.33)		1.19(1.02,1.39)	1.28(1.11,1.47)	
Job strain			0.037			0.115
low strain	1.00	1.03(0.95,1.11)		1.00	0.98(0.83,1.15)	
active job	1.06(0.99,1.15)	1.13(1.05,1.22)		0.94(0.81,1.09)	1.15(0.99,1.35)	
passive job	1.01(0.94,1.09)	1.17(1.08,1.26)		0.99(0.86,1.13)	1.04(0.91,1.19)	
high strain	1.15(1.06,1.25)	1.36(1.27,1.46)		1.23(1.05,1.44)	1.17(1.02,1.35)	
Effort-reward imbalance			<0.001			0.051
1 low	1.00	1.15(1.05,1.27)		1.00	0.97(0.82,1.15)	
2	1.03(0.95,1.12)	1.08(1.00,1.18)		0.98(0.84,1.13)	1.20(1.04,1.40)	
3	1.07(0.99,1.16)	1.13(1.04,1.22)		1.10(0.95,1.28)	1.07(0.92,1.24)	
4 high	1.12(1.02,1.22)	1.43(1.32,1.55)		1.39(1.18,1.64)	1.38(1.18,1.61)	

¹Adjusted for age, level of education, occupational status, types of work contract and work schedule, marital status and dependent children, smoking, alcohol consumption, sedentary lifestyle and overweight.

6.4 Worktime control, working and commuting hours and sickness absence

6.4.1 Main effects

In study IV, the joint associations of worktime control and paid and domestic working hours, commuting hours and total hours with both self-certified and medically certified sickness absence were examined.

The women and men with low control over daily working hours took 1.1 – 1.3 times more self-certified absences than those with high worktime control. The effect on medically certified sickness absences was slightly greater: the rates of subsequent

medically certified sickness absences were 1.4-fold for the women and men with low control over their daily working hours than for those with high worktime control.

Table 10. Adjusted¹ rate ratios and their 95% confidence intervals for sickness absences by the level of control over daily working hours and by the levels of paid and domestic working hours, commuting hours and total² hours (Poisson regression GEE models).

	Self-certified (1-3 days) sickness absences		Medically certified (>3 days) sickness absences	
	Women	Men	Women	Men
Control over working hours				
4 high	1.00	1.00	1.00	1.00
3	1.07(1.02,1.13)	1.22(1.09,1.36)	1.13(1.07,1.21)	1.16(1.01,1.33)
2	1.11(1.06,1.16)	1.17(1.04,1.31)	1.24(1.17,1.31)	1.26(1.10,1.45)
1 low	1.11(1.06,1.16)	1.28(1.14,1.43)	1.38(1.29,1.46)	1.38(1.22,1.57)
Paid hours/week				
<=40	1.00	1.00	1.00	1.00
<=50	0.92(0.88,0.96)	0.79(0.73,0.85)	0.97(0.93,1.02)	0.90(0.82,1.00)
>50	0.78(0.70,0.88)	0.83(0.73,0.95)	0.94(0.83,1.05)	0.96(0.84,1.09)
Domestic hours/week				
<=10	1.00	1.00	1.00	1.00
<=25	1.03(0.98,1.07)	1.01(0.94,1.09)	1.06(1.00,1.12)	1.14(1.05,1.25)
>25	1.02(0.97,1.08)	1.09(0.97,1.22)	1.15(1.08,1.24)	1.27(1.11,1.46)
Commuting hours/week				
<=2.5	1.00	1.00	1.00	1.00
<=7.5	1.05(1.00,1.10)	1.10(1.03,1.19)	1.05(1.00,1.10)	1.04(0.97,1.12)
>7.5	1.07(1.00,1.15)	1.21(1.04,1.39)	1.07(1.00,1.15)	1.16(1.00,1.35)
Total hours ² /week				
<=50	1.00	1.00	1.00	1.00
<=75	1.05(1.00,1.10)	0.99(0.91,1.07)	1.10(1.03,1.17)	1.13(1.03,1.24)
>75	1.07(1.00,1.15)	1.04(0.92,1.16)	1.26(1.17,1.37)	1.23(1.05,1.45)

¹Adjusted for age, occupational status, type of work contract, type of work schedule, marital status, dependent children, consumption of alcohol, smoking, overweight and sedentary lifestyle. ²Paid and domestic working hours and hours commuting

Long hours in paid work associated with fewer self-certified absences but not with medically certified absences. In contrast, long domestic and total hours associated with 1.2- to 1.3-fold rates of medically certified absences, but not with self-certified absences. Long commuting hours were related to increased rates of both medically and self-certified absences. Interestingly, no major gender differences emerged for these associations despite the gender differences in the exposure to the various hours.

6.4.2 Various hours combined with worktime control

Table 11 shows the joint associations of paid and domestic working hours, commuting hours and total hours and the level of control over working hours with the subsequent rates of sickness absence (study IV). High control over working hours reduced medically certified absences only for the women working up to 50 paid hours per week, but not for those with longer paid hours. Among men, high worktime control and fewer medically certified absences were related irrespective of the number of paid hours. The negative association between paid hours and self-certified sickness absence was not dependent on the level of worktime control for either gender.

The effects of low control over working hours and long domestic hours on medically certified sickness absence were additive. Compared with the women with the shortest domestic hours and high worktime control, the women working the longest hours in domestic work had a 1.1-fold rate of medically certified sickness absences if their control over working times was high, but the rate was 1.4-fold if it was low. The corresponding figures for men were 1.4 and 1.6, respectively. Women's self-certified absences were only weakly associated with long domestic hours combined with low worktime control, whereas the few men with the longest domestic hours and low worktime control took 1.3 times more self-certified absences than those with the shortest domestic hours and high worktime control.

Similarly, long total working hours and low worktime control were additively associated with medically certified sickness absence. Compared with the women with the shortest total hours and high worktime control, the women and men exposed to over 75 total hours per week had an absence rate that was 1.2-fold in combination with high control of working hours and 1.5-fold in combination with low worktime control. For men, the corresponding figures were 1.3 and 1.6. Self-certified absences were associated with long total working hours and low worktime control, and the association among women was synergistic (p for interaction 0.022 for the women, 0.264 for the men) in that long total hours predicted increased rates of self-certified absence in combination with low worktime control but not when the latter was high.

Elsewhere, neither interactions between the various working hours and control over daily working hours were found (p -values >0.1), nor interactions with gender (p -values >0.2).

Table 11. Adjusted¹ rate ratios and their 95% confidence intervals for sickness absences by the level of paid, domestic and total working hours combined with the level of control over daily working hours (repeated measures Poisson regression GEE analyses according to work units).

Sickness absences	Working hours/week	Women		Men	
		Control over daily working hours		Control over daily working hours	
		High n=8280(42%)	Low n=11 619(58%)	High n=2558(44%)	Low n=3246(56%)
Self-certified (1-3 days)	Paid hours				
	<=40	1.00	1.06(1.02,1.10)	1.00	1.08(0.98,1.20)
	<=50	0.92(0.87,0.98)	0.98(0.93,1.04)	0.77(0.69,0.87)	0.87(0.78,0.98)
	>50	0.80(0.67,0.96)	0.81(0.70,0.94)	0.77(0.61,0.96)	0.96(0.82,1.11)
	Domestic hours				
	<=10	1.00	1.05(0.98,1.13)	1.00	1.13(1.01,1.26)
	<=25	1.03(0.97,1.10)	1.07(1.01,1.14)	1.05(0.93,1.17)	1.11(0.99,1.25)
	>25	0.96(0.89,1.04)	1.11(1.03,1.19)	1.10(0.86,1.18)	1.30(1.09,1.54)
	Commuting hours				
	<=2.5	1.00	1.04(0.99,1.09)	1.00	1.18(1.11,1.25)
	<=7.5	1.06(1.01,1.11)	1.15(1.10,1.20)	0.99(0.93,1.05)	1.24(1.16,1.31)
	>7.5	1.19(1.08,1.30)	1.27(1.18,1.36)	1.10(0.99,1.24)	1.42(1.31,1.55)
	Total hours ²				
	<=50	1.00	1.04(0.95,1.13)	1.00	1.08(0.94,1.23)
	<=75	1.05(0.97,1.12)	1.10(1.02,1.18)	0.97(0.86,1.10)	1.08(0.95,1.23)
>75	0.97(0.87,1.07)	1.19(1.08,1.30)	0.94(0.79,1.12)	1.22(1.03,1.43)	
Medically certified (>3 days)	Paid hours				
	<=40	1.00	1.21(1.16,1.27)	1.00	1.24(1.11,1.38)
	<=50	0.97(0.90,1.05)	1.22(1.14,1.31)	0.93(0.79,1.08)	1.13(0.98,1.30)
	>50	1.08(0.91,1.28)	1.05(0.91,1.21)	0.99(0.81,1.21)	1.19(1.00,1.43)
	Domestic hours				
	<=10	1.00	1.15(1.05,1.27)	1.00	1.32(1.17,1.50)
	<=25	1.02(0.94,1.11)	1.24(1.15,1.35)	1.22(1.06,1.41)	1.46(1.29,1.67)
	>25	1.11(1.00,1.23)	1.35(1.22,1.48)	1.43(1.14,1.79)	1.61(1.33,1.94)
	Commuting hours				
	<=2.5	1.00	1.17(1.04,1.30)	1.00	1.22(1.08,1.38)
	<=7.5	1.17(1.04,1.31)	1.25(1.11,1.40)	1.01(0.87,1.16)	1.30(1.15,1.48)
	>7.5	1.16(0.93,1.45)	1.45(1.19,1.77)	1.24(0.94,1.63)	1.39(1.13,1.70)
	Total hours ²				
	<=50	1.00	1.13(1.01,1.27)	1.00	1.25(1.07,1.46)
	<=75	1.04(0.95,1.14)	1.29(1.18,1.42)	1.13(0.97,1.31)	1.42(1.22,1.66)
>75	1.22(1.07,1.39)	1.46(1.31,1.64)	1.26(0.99,1.60)	1.56(1.25,1.96)	

¹Adjusted for age, occupational status, type of work contract, type of work schedule, marital status, dependent children, consumption of alcohol, smoking, overweight and sedentary lifestyle. ²Paid and domestic working hours and hours commuting.

6.4.3 In relation to shift work

Table 12 presents the joint associations of working hours and control over working hours with medically certified sickness absences in subgroups by work schedule without gender stratification (study IV). The results of shift workers paralleled those obtained for employees working standard hours, with the exception that shift workers with long domestic working hours had less advantage of high control over working hours.

Table 12. Adjusted¹ rate ratios and their 95% confidence intervals for medically certified sickness absences by the level of paid, domestic and total working hours combined with the level of control over daily working hours (repeated measures Poisson regression GEE analyses according to work units) according to the type of work schedule (total population).

Working hours/week	Standard hours ²		Shift work ³	
	Control over daily working hours		Control over daily working hours	
	High n=9053(46%)	Low n=10 720(54%)	High n=1648(30%)	Low n=3854(70%)
Paid hours				
<=40	1.00	1.25(1.19,1.31)	1.00	1.13(1.04,1.23)
<=50	0.97(0.90,1.04)	1.21(1.12,1.30)	0.94(0.81,1.10)	1.19(1.04,1.36)
>50	1.00(0.86,1.16)	1.09(0.96,1.25)	1.13(0.85,1.51)	1.16(0.93,1.45)
Domestic hours				
<=10	1.00	1.23(1.14,1.34)	1.00	1.17(0.98,1.38)
<=25	1.10(1.02,1.18)	1.35(1.25,1.45)	1.03(0.87,1.22)	1.21(1.03,1.48)
>25	1.17(1.06,1.29)	1.48(1.36,1.62)	1.20(0.96,1.50)	1.26(1.04,1.51)
Commuting hours				
<=2.5	1.00	1.19(1.12,1.26)	1.00	1.18(1.04,1.34)
<=7.5	0.99(0.93,1.06)	1.29(1.21,1.37)	1.01(0.88,1.16)	1.17(1.03,1.32)
>7.5	1.08(0.96,1.22)	1.44(1.32,1.59)	1.22(0.97,1.53)	1.35(1.15,1.57)
Total hours⁴				
<=50	1.00	1.19(1.07,1.31)	1.00	1.20(0.97,1.50)
<=75	1.05(0.96,1.14)	1.35(1.24,1.47)	1.22(1.01,1.48)	1.38(1.14,1.68)
>75	1.25(1.10,1.41)	1.52(1.36,1.71)	1.29(0.96,1.73)	1.56(1.24,1.95)

¹Adjusted for age, gender, occupational status, type of work contract, marital status, dependent children, consumption of alcohol, smoking, overweight and sedentary lifestyle. ²Weekdays, daytime only. ³Work also on evenings/weekends/nights. ⁴Paid and domestic working hours and hours commuting

7 Discussion

7.1 Main findings

The baseline finding of this study was that low worktime control longitudinally associated with poor health among women, but not among men. The robustness of this result across three established health outcomes - poor self-rated health, psychological distress and medically certified sickness absence - added to the plausibility of the finding.

This gender difference was not explained by occupational segregation, as it was also observed within a single occupation. Subgroup analyses showed that worktime control was especially important for the health of women with families or employed in manual work. Men with dependent children or employed in manual occupations also had increased rates of sickness absence if they had low worktime control.

Job strain and effort-reward imbalance predicted increased rates of subsequent medically certified sickness absences, as expected. However, stress-related excessive absences were reduced in combination with high control over the daily working hours and days off, especially among women.

The traditional gender differences in the exposure to various working hours were observed: men worked longer hours in paid work and women in domestic work, resulting in longer total hours for women. Instead, no gender differences emerged in the vulnerability to these hours as reflected by medically certified sickness absences. Long domestic and total working hours were associated with such absences among both genders, whereas long paid working hours as such made no difference. Importantly, the unfavourable associations of long domestic, commuting and total hours with increased rates of medically certified sickness absences were reduced in combination with high control over daily working hours among both genders.

7.2 Explanations of the gender difference

The fact that the gender difference in benefiting from worktime control was replicated within a single occupation, gave support to the interpretation that the result stems from

reasons beyond work life, from the traditional gender differences in non-work circumstances.

In understanding working women's health, the potential situations of 'double attachment' or 'double burden' (see 3.1.1.) appeared complementary rather than conflicting viewpoints in the light of this sample. Among these full-time employees at baseline (study I), the age-adjusted figures showed that the women without dependent children had 1.3-fold odds for poor self-rated health than those with children at home, and that single women had 1.2-fold odds for psychological distress compared to those living with a spouse, which speaks for the advantages of 'double attachment'.

Obviously, the possibility to end up with a 'double burden' was also apparent. Double burden may lead to a practical work overload that may pose health risks. Although the family roles as such were associated with good health, an extensive practical overload in terms of long domestic hours added to full-time work clearly predicted increased rates of medically certified sickness absences. And importantly, it was these employees loaded with double burden that particularly benefited from high worktime control.

The challenges in combining full-time work with domestic responsibilities have not only been studied from the viewpoint of practical overload but also in relation to multiple roles in the literature concerning work-family conflict or work-family interference. Indirectly, the results of this study are also understandable in the light of this evidence. Work interferences with family have been found to create tension even within the work domain, and work-family conflict has been shown to consistently associate with many stress- and health-related outcomes. (Allen *et al.* 2000)

Conceptually, work-family conflict and/or family-work conflict are interrole conflicts that occur when the demands associated with one domain are incompatible with the demands associated with the other domain, for example in terms of time and timing. Work-family conflict and family-work conflict are generally considered distinct but related constructs. Work-family conflict has generally been considered more common than family-work conflict, even in the Finnish setting (Kinnunen & Mauno 1998), suggesting that family boundaries appear more permeable than work boundaries among both genders. (Frone *et al.* 1992).

Unfortunately, direct measures of work-home conflict or spillover have not yet been used in these studies on worktime control. It is, however, reasonable to hypothesize with respect to the findings on the various types of hours that high worktime control may have buffered for work-family conflict among those with a high degree of 'double burden'. Indeed, in an EU survey report, influence on working times was suggested to buffer for perceived problems in work-family balance due to unsocial worktime arrangements. (Fagan & Burchell 2002) More recently, a Dutch multi-wave study showed that demanding worktime arrangements, such as shift work and overtime work, appeared to predict the onset of work-home interference over time, whereas supportive or facilitating elements of working times, such as the ability to take a day off when wanted, seemed to protect against work-home interference (Jansen *et al.* 2004).

Control over working times may practically contribute to the employees' opportunities to successfully manage the work – non-work interface, to integrate working life with private life, and to control not only the load of paid work but also the total workload. As housekeeping responsibilities continue to fall on women more than men, the important role of worktime especially among women is to be expected, considering the goal-

oriented nature of control (Frese 1989). More specifically, the gender difference in the importance of worktime control appeared to be linked to the prevalent gender roles in domestic work rather than biological sex, as also the men working long domestic hours benefited from high worktime control. However, there were few men under such circumstances.

7.3 Why manual employees benefit from worktime control

The greater importance of worktime control for manual employees' health than for non-manual employees' health was a logical finding in that both female and male manual employees worked longer hours in domestic work than non-manual employees. Manual workers may have fewer opportunities to obtain paid help to cover non-work responsibilities, and the successful management of the work – non-work interface may depend more on their own activities. These circumstances further emphasise the importance of the optimal timing of paid working hours.

In the same vein, in a French study, the generally positive health association of combining paid work with family ('double attachment', see 3.1.1) was lacking at the lower levels of the occupational hierarchy, which finding was analogously suggested to originate from less financial resources to ease the burdens of unpaid work. Interestingly, a review of work-family conflict paid attention to the fact that most studies on work-family conflict have used samples belonging to middle-class or higher socioeconomic status and have failed to achieve knowledge of the urban underclass, despite the fact that individuals with lower incomes may lack the resources for conveniences such as cleaning services that can mitigate work-family conflict. (Allen *et al.* 2000)

On the other hand, worktime control could be especially important for employees with less control otherwise (Baltes *et al.* 1999), which is the case for manual employees. This potential explanation is discussed below.

7.4 Why those loaded with work stress benefit from worktime control

The fact that long paid working hours as such were not associated with medically certified absences, unlike job strain and effort-reward imbalance, supports the idea that the content-related psychosocial factors at work are especially important for health.

The findings of study III suggest that worktime control may, to some extent, help in coping with important sources of work stress, such as job strain and effort-reward imbalance. Capturing a specific control dimension, worktime control may reduce stress by enhancing perceived work-related autonomy, especially when an employee has otherwise little control over work (Baltes *et al.* 1999, Fenwick & Tausig 2001) or is in an unsatisfying work situation. It may also be, as suggested in the earlier managerial literature, that employee worktime control may be regarded as a rewarding characteristic of work in itself, enhancing the perception of reciprocity towards the efforts at work.

These associations were more consistently observed among women. Interestingly, in this respect, a distinction between the time-based and strain- and behaviour-based

dimensions of work-family conflict has been suggested. (Greenhaus & Beutell 1985) The aspect of time-based conflict results from a situation where the actual hours or scheduling of work disrupt or limit participation in family roles. Strain-based work-home conflict, on the other hand, means that strain or fatigue in one role affects performance in the other. Thus, the experience of work-related strain could set further challenges to the efforts to successfully combine full-time work with domestic demands. As women face more domestic demands, the observed greater importance of worktime control in reducing stress-related absences among women is understandable also from this point of view.

7.5 Worktime control as a dimension of control

This study provided longitudinal evidence of the significant role of worktime control in predicting especially female employees' health. The findings add to the prevalent work stress models and emphasize the relevance of taking factors beyond work life into account when evaluating employee health.

Reflecting the goal-oriented nature of control, we found support for the assumption that the importance on health of worktime control, a specific dimension of control, indeed varied according to needs. Worktime control was important for women's health especially in that it appeared to alleviate the double burden of full-time work with long domestic working hours. In addition, the employees exposed to work stress maintained lowered rates of medically certified sickness absences if they at least had high worktime control. Therefore, support was also found for the assumption that worktime control could be a compensatory control domain in cases of otherwise low control (Ganster 1989, Baltes 1999 et al).

The 6-item worktime control sum measure and the two subdimensions of control over daily working hours and control over days off each associated with subsequent health with similar magnitudes. There were no gender differences in the mean levels of worktime control sum measure or control over days off in the total samples, whereas men reported a higher level of control over daily working hours than women. Interestingly, although job control usually associates linearly with the occupational hierarchy, this was not the case in relation to worktime control. University educated women reported the lowest levels of worktime control. Corresponding distributions have also been reported elsewhere in relation to control over the scheduling of breaks (Matthews *et al.* 1998) and to overall working time autonomy (Fagan & Burchell 2002).

7.6 Potential pathways between worktime control and health

As hypothesized, a high level of employee worktime control could promote health by reducing stress. In practice, control over working times may be used to achieve a better fit of private needs (child care, domestic work, hobbies, education) with hours in paid work. This, in turn, may reduce the stress resulting from conflicting demands of work and non-work circumstances.

Optimal timing of working hours may also be used to avoid problems with traffic and to reduce commuting time. Besides being a stressor itself, long commuting time reduces the time available for non-work activities and may therefore further expose the person to work-family conflict. In addition, long commuting time may shorten the time available for sleep.

High worktime control provides employees with better possibilities to adjust their working times to their circadian type. This may promote better sleep and reduce stress on arrivals to work.

Within work, high worktime control may enable working at the times of best possible resources and support, thus prohibiting the accumulation of particularly stressful work situations.

Chronic stress, in turn, has been linked with a number of potential pathophysiological processes leading to, for example, cardiovascular diseases (e.g. Bosma *et al.* 1998), metabolic syndrome (Chandola *et al.* 2006), susceptibility to infections (Cohen *et al.* 1991) as well as sleeping problems posing further threats to health and safety (Kalimo *et al.* 2000).

To prevent the harmful effects of stress, periods of rest (importantly, sleep) and recuperation are needed, both short-term periods such as an evening rest, as well as longer periods, such as vacation (Lundberg 2005). Therefore, a potential pathway between worktime control and health could be the level of recovery after work, which may well be impaired as a result of poor worktime control if, for example, there are difficulties in combining paid work with domestic demands. Chronically poor recovery after work has recently been recognized as a predictor of health problems (Kivimäki *et al.* 2006).

7.7 Methodological considerations

7.7.1 Context dependency of worktime control

Whether employees' perceptions of the extent to which they can exert control over their environment actually reflect the objective presence of such control may be questioned. Having identified an absence of research that explicitly links various organizational conditions (such as flexitime) with control beliefs, Thomas and Ganster (1995) compared the survey-reported ratings of employee control with qualitative data on the existing practices provided by supervisors and concluded that individual reports of family-supportive policies accurately reflected the policies practiced in each institution.

In this study on such a large sample, it was not possible to list all of the various practices that give workers control over their working times. It nevertheless appeared implausible that the perception of worktime control could depend on the characteristics of an individual only and be independent of work unit level regulations and circumstances.

The assumption that perceived worktime control reflects the actual possibilities to exert such control was indirectly supported in study III, as the results on measures aggregated by workplaces replicated the results obtained using individual measures.

More specifically, in study IV, the estimated intra-class correlation (29.4%) implied a high degree of homogeneity in the perceptions of worktime control within a work unit.

With respect to measuring worktime control, the aforementioned indications of high context dependency together with the alpha figures showing high internal consistency supported the validity of the worktime control measure as a relevant psychosocial factor at work, reflecting actual work characteristics and relating them to measures of health.

7.7.2 Sickness absence as an indicator of health

In the articles III-IV, sickness absence was used as the only outcome of health, as consistent results were obtained across all the three measures of health in the substudies I-II and as the use of registered sickness absence data on a day-to-day basis provided an opportunity to build longitudinal study designs. In addition, with the use of routinely collected objective data on sickness absence, the risk of selective recall bias was eliminated.

Obviously, some sick leaves represent voluntary absenteeism unrelated to physical or mental illness, (Vahtera *et al.* 2001) while some employees work while ill and record no absences. (Kivimäki *et al.* 2005) However, recent evidence suggests that data on medically certified sickness absence may be a useful measure for following health prospects within and between employees. Medically certified sickness absence has been found to predict all-cause mortality more powerfully than established self-reported health measures and available objective measures of physical illnesses and medical conditions. It also strongly predicts several specific causes of death and early retirement. In contrast, no such associations have been found for self-certified sickness absences. (Kivimäki *et al.* 2003, Vahtera *et al.* 2004, Kivimäki *et al.* 2004)

The aforementioned evidence suggests that self-certified absences reflect not only minor health problems, but also behavioural patterns and/or organizational functioning, and therefore encourages the analysis of self- and medically certified absences separately.

7.7.3 Sample and setting

In the setting of this study, i.e. ten towns in Finland, working times were regulated in a number of ways. The trade unions have bargained with the employers' unions about the length of the working week. Teleworking is rare, as most work is service work with clients/patients/pupils etc. performed at workplaces, and working hours therefore represent an important everyday aspect of the working conditions.

The sample is large and provides occupational diversity, with over 1000 different occupational titles. The 1997 survey questionnaire was sent to a large representative sample, and in the follow-up survey a total sample was collected. The work environment was relatively safe, and the participants had permanent or longish (over 6 months) work contracts.

The fact that all participants were full-time employees was a special advantage with respect to studying the effects of worktime control in relation to domestic demands, as it

helped to avoid the risk of selection bias due to switching to part-time work because of domestic reasons. This has been considered a special problem in, for example, studies on work-family conflict, which have suggested that employees experiencing work-family interference might have already chosen different worktime arrangements. (Jansen *et al.* 2004)

Moreover, this full-time predominantly female cohort represented no exception in Finnish working life, and was thus not selected in this sense. As reviewed in an EU survey in 1998, the smallest difference in the working hours between men and women in dependent employment was found in Finland, where women have a long tradition of full-time employment and work the longest hours in Europe, and where only 13% of them are employed part-time. (Bielenski 2002 *et al.*, see also Julkunen & Nätti 1999). Nor are there gender differences in the employment participation rates throughout the range of working age. (Lahelma *et al.* 2002)

In a way, it was an advantage that there were so many women in the sample, as the important role of worktime control was expected among women. However, from the viewpoint of comparing the statistical power of the results between the genders, it would have been ideal if the gender division had been even.

Compared to the size of the sample, there were fewer shift workers than in the general population.

7.7.4 Role of potential biases in the findings

Biases may originate from the effects of selection, confounding and reversed causality as well as from biased measurements of the phenomena in question.

Apart from the characteristics of the study cohorts discussed above, the study samples with sufficiently high response rates appeared to represent the eligible populations well. During the follow-up, however, some selection occurred, as low worktime control at baseline was associated with dropping out from the study cohort. Therefore, the results are, to some extent, underestimates. Summing up the dropout analyses of the four substudies, women and non-manual employees were slightly overrepresented in the samples than in the eligible populations, and the respondents had less sickness absences than the non-respondents (see also study II, figure 1). In the 2000-01 samples, permanent employees were slightly overrepresented. However, no substantial differences emerged in any case, and the mean ages were practically the same in the samples and the eligible populations.

The potential bias from confounding was controlled for by extensive adjustments for work and family characteristics and health behaviours potentially relating to both worktime control and health. This could be argued to be overadjustment, as these factors may reflect different aspects of a single process, and as adverse work characteristics tend to accumulate in particular jobs. The findings therefore represent conservative estimates of the effects of worktime control.

In addition to the adjustment strategies, the bias originating from confounding was reduced by performing subgroup analyses in relation to gender and indicators of family and occupational status. In this respect, the comparison of initially healthy and initially

unhealthy subgroups was of special importance in evaluating the predictive value of the worktime control levels (study II).

To reduce bias in estimating worktime control originating from confounding due to differences in reactivity or response styles, an important strategy was to compare the results by using individual measures and those aggregated by workplaces (study III).

Reversed causality could have explained the results if, for example, the employees with poor health had perceived lowered levels of worktime control or had been in danger of ending up in jobs not allowing worktime control. However, in this study, baseline health was not associated with worktime control at follow-up by any indicator (study II), which fact speaks against reversed causality as a source of bias.

Although the possibilities of unmeasured third factors behind the results can never be ruled out, in the light of the aforementioned arguments, uncontrolled third factors remain unlikely explanations for the results.

Problems related to invalid measurements were minimized by choosing established and validated measurements, with the exception that, in relation to the ERI model, only the extrinsic component was measured, as the dimension of overcommitment was not rated (Siegrist *et al.* 2004). The cases of worktime control and sickness absences were discussed above. With respect to working hours, a limitation that is difficult to avoid originated from the use of self-reports of working times. With respect to domestic hours, no alternatives were available, either. Especially the ratings of domestic hours may have been biased by social desirability, and there is also evidence suggesting that the hours are interrelated in such a way that, in cases of heavy paid workload, domestic hours are reduced (Mårdberg 1988). In relation to long paid working hours, unfortunately, extra work to another employer and overtime work (whether paid or not) were not differentiated, although it is plausible that they have different consequences on the work load (Nylen *et al.* 2001). Also, the actual and desired working hours do not necessarily coincide, and the degree of voluntariness may have affected vulnerability. However, the observed zero correlations of the various working hours (study IV) enabled studying of the various hours separately.

7.7.5 *Effect sizes*

It has been suggested by Khlal *et al.* (2000) that, in parallel with the healthy worker effect, the healthy spouse and healthy parent effects should also be recognized. Had this been the case, the observed associations between worktime control and health with respect to the family characteristics would have been underestimates rather than overestimates. The extensive adjustments may also have contributed to the conservative estimates, as stated.

Comparison of the magnitudes of the effects shows that the survey-based worktime control associated more strongly with the survey-based measures of health than with the register-based absences. It is possible that common method variance is partially responsible for the higher effect size in the first case.

As Zapf *et al.* (1996) have argued, given the complexity of the origins of ill health, relatively small correlations between subjective and objective stressors are plausible and

to be expected. Nevertheless, the figures concerning the associations of worktime control and health were not small, as they were of at least the same size as those of the established psychosocial sources of work stress. Moreover, the observed effects obtained by triangulating subjective and objective measures were of considerable size with respect to working life, as they concern large proportions of the working population. Three quarters of the cohorts of this study were women, which emphasises the practical implications of these results.

7.8 Implications for further research

With respect to the tradition of work stress research, these results suggest that it is important to take into account the conditions outside work when employee health is analysed. (Hall 1982, Jansen *et al.* 2004)

With respect to research on worktime control, the further exploration of subgroup differences in benefiting from worktime control appears worthwhile, specifically the possible mediating role of work-family conflict /interference /spillover, which can be analysed by using direct measurements of such perceptions. This would be important, as there have generally been no differences between men and women in the experience of work-family conflict, though evidence of differences in the total workloads is obvious. For example, in a recent Finnish study, only upper white collar women suffered from higher work-family conflict than upper white collar men. In other occupational groups, men and women equally often suffered from work-family conflict (Kinnunen *et al.* 2004).

Importantly, the relevance of worktime control in relation to differing life role values, such as orientation towards work or home or both, needs to be evaluated. In this vein, there is recent evidence from the British Whitehall II Study that control at home could be an important health predictor for women (Chandola *et al.* 2004). The relation of perceived control at home with worktime control remains an open question.

To gain a better insight on the generalizability of these results, the hypotheses should be tested in other samples: in samples with a more even gender distribution, in other country-specific contexts, among short-term and private sector employees, and with a specific focus on shift workers with more detailed assessments of the various shift systems.

Further studies should also address the roles of sleep problems and impaired recovery after work as potential pathways between worktime control and health.

Finally, the usefulness of promoting worktime control and the practical aspects of executing such interventions should be evaluated in properly conducted intervention studies of sufficient length to permit evaluations of possible long-term effects.

7.9 Policy implications

7.9.1 On organizational ergonomics

Providing employees with control over their working times may be seen as an issue of organizational ergonomics, defined as the design of work processes and organizational policies compatible with the needs, abilities and limitations of people (IEA Council 2006). Considering the large-scale changes in family structure and the increasing input performed by women in the work force as well as the economy- and availability-rooted new demands on working times, this issue seems acute. As Kelloway & Gottlieb (1998) put it, jobs can be redesigned in ways that optimize the conditions favourable for stress reduction and family role functioning. The aspect of employee influence in scheduling working times has also been highlighted in the EU guides on work stress (European Commission 2002).

7.9.2 Implications concerning domestic working hours

The SALTSA group of researchers investigating flexible working times stated that the potential consequences of different working time arrangements are influenced more by their interactions than by any direct effect of a single factor. In line with this, changes in the arrangements of working time are essentially related to changes in leisure, social or family time. Thus, of direct relevance to working time policy are the action policies aiming at a more equal distribution of paid and unpaid work between men and women (Bielenski *et al.* 2002). Bird (1999) found a u-shaped relation between psychological distress and domestic working hours for both genders and therefore suggested that increasing men's few domestic hours would promote women's health while not impairing men's health. In any case, several studies have suggested that family boundaries are more permeable than work boundaries among both males and females (Frone *et al.* 1992), indicating that, in case of conflicting demands, some domestic work is simply left undone.

7.9.3 Aspects to consider in promoting worktime control

Reviewing the organizational effects of interventions introducing flexitime systems, Baltes *et al.* (1999) found that less flexible flexitime systems appeared more favourable than highly flexible schedules. Less flexible schedules resulted in larger effect sizes of favourable organizational outcomes than more flexible schedules. They stated that it is imperative in evaluating the effects to link the work-related findings with trajectories of job and life satisfaction, including those associated with non-work contexts, such as family life. Moreover, the effect patterns seemed context-dependent not only in relation to family functioning and leisure activity, but also in relation to historical time: incentives

that motivate and satisfy older workers may be irrelevant to younger workers. Older employees may be more affected by the advent of an alternative work schedule than younger employees, who may have come to expect such considerations on the part of their employer as self-evident. Also, the time since interventions is important. The employees may adjust their perceptions and desire even more discretionary time. In other words, an increase in needs may occur.

Kandolin *et al.* (1996) introduced a project of participative planning of shifts increasing individual flexibility and decreasing short inter-shift intervals among Finnish nurses. At follow-up, employees' perceived strain had decreased, but the majority of participants were still willing to return to the former system, ignoring their feelings of strain in favour of longer continuous periods of free time.

That too much flexibility may be problematic has also been suggested by Janssen & Nachreiner (2004), Costa *et al.* (2004), and in an interesting way by Steward (2000) in her small-scale interview study of teleworkers, showing that teleworkers had to make efforts to reconstruct the conventional work boundaries to ensure any leisure time, as work was invading their previously free time but not disappearing from their conventional office times.

Thomas & Ganster (1995) quoted a previous study from the early 1980's, where flexitime had addressed the needs of single childless adults better than the complex demands of working parents. Policy changes must actually provide employees with enough control over salient aspects of their job or home life to ensure that more rewarding or less threatening circumstances will follow. It may be that the simpler the employees' family circumstances, the more relative impact some more control seems to have in helping them balance their work and family life.

Importantly, Kecklund and Åkerstedt (2005) noted that flexible scheduling, the prerequisite for employee worktime control, may be difficult to apply in small work units since a large pool of employees is needed and they need to be relatively easily interchangeable. Also, flexible scheduling is only possible for tasks that do not require simultaneous team work: in essence, promoting a high level of worktime control does not seem to be easily applicable to all parts of the work force.

7.9.4 Trends of working hours and worktime control

As reviewed by Bielenski *et al.* (2002), the standard eight-hour five-day working week was gradually developed to protect employees, to ensure a living wage by guaranteeing a minimum working time, to provide an adequate level of employment-related social security transfers, and to lead to a clear distinction between private and working time enabling the planning of work-free time. For employers, the standard working time was an external regulatory mechanism, forming the 'natural' framework within which work was organized and taken for granted. Today, working hours are influenced by labour market situation, the way the work is organised, household situations such as the presence of children and the model of sharing domestic work, household economic situation as well as individual characteristics.

Within the framework of social protection, Bielenski *et al.* (2002) noted that there is an absence of any information on the scheduling of working time. The SALTSA group also paid attention to the fact that the EU Working Time Directive does not address questions of flexibility (Costa *et al.* 2004). Interestingly, Bielenski *et al.* (2002) listed several preconditions of the situation where employees would truly be able to choose between different working times: i. a reliable childcare system, ii. sufficient hourly wages or iii. social compensations equal for men and women, and iv. flexible organisation of work and working time according to personal needs. Moreover, they suggest that protection is required against excessively long working hours.

Now, employer-oriented and customer-oriented flexibility of working times as well as lesser predictability of work contracts are already here and seem to be spreading (Julkunen & Nätti 1999, Reilly 1998, Aronsson 1999). The new question is whether the social functions of traditional standard working time will continue to be important in the future, or whether they may need to be replaced. The social functions of the old full-time norm could be fulfilled in a different way, for example by guaranteeing some individual-oriented flexibility of working times.

In this longitudinal study, a declining trend of worktime control over time was seen, especially among women (study II). The repeated measures analyses of variance showed that the mean scores for worktime control in 1997 and 2000 were lower for women than for men, and that there was a significant declining trend in worktime control over time, which was stronger among women than among men.

7.9.5 Summary of policy implications

To sum up, the findings of this study suggest that providing employees with control over working times may promote both employee health and successful combination of full-time paid work with domestic responsibilities. Moreover, as the negative consequences of work stress on sickness absence were lowered in combination with good control over working times, the results suggest that worktime control may help employees to cope with strenuous work life. From the point of view of organizations, the results also indicate that providing employees with worktime control could save considerable costs through fewer sickness absences. The current trends towards increasing flexibility and diversity of working times present both promising and threatening prospects for employee health, depending on the possibilities of worktime control given to employees.

7.10 Ethical considerations

The employees of the towns studied participated voluntarily in the 10-town study and gave informed consent to link their responses to the records of sickness absences. They were also free to cancel their consent at any time. Special care was taken to ensure the anonymity of the respondents. It took approximately half an hour to fill out the comprehensive questionnaire, and this could be done during the workday by permission of the municipal employers supporting this research project and expecting the project to

provide information on important issues to promote well-being in work life. Participation in the study probably did not cause any major impairment on public services, as it appeared likely that the participants filled in the questionnaires during the breaks or used their free time.

The 10-Town study research project does not publicise data concerning individual towns, but the towns make use of their town-specific results according to their needs by using special reports and compact discs containing organization-specific results provided by the project. This reduces the need to perform other surveys on organizational well-being.

Scientific autonomy within the study project was guaranteed in such a way that the sponsors of the study had no role in the decision making concerning the research topics, designs, the interpretations of the results or the approval of the articles. It is ethical to make proper use of a research project of this magnitude, and the data are actively being used both locally, as described, and in numerous international articles.

The Ethics Committee of the Finnish Institute of Occupational Health approved the research project in January 1997.

8 Conclusions

1. For women, low worktime control was a risk factor for poor self-rated health, psychological distress and increased medically certified sickness absence, especially for women with families or employed in manual work. For men, low worktime control was not associated with subjective health, but predicted medically certified absences for those with dependent children or employed in manual occupations.
2. Both subdimensions of worktime control, i.e. control over daily working hours and control over days off, were important in reducing medically certified sickness absence.
3. With respect to work stress, the employees suffering from job strain or effort-reward imbalance had decreased rates of stress-related absences if they at least had worktime control.
4. The men and women reporting long domestic and total working hours and long commuting hours gained most from high worktime control in that their medically certified absences were reduced. Vulnerability to long domestic and total hours in terms of such absences was seen among both men and women, but there were few men working long domestic hours. Shift workers with long domestic working hours benefited less from high worktime control than those working standard hours. Long paid working hours as such were not associated with sickness absence.
5. The findings expand the focus of work stress research and emphasize the importance of taking conditions at home into account when analysing employee health.
6. The current trends towards increasing flexibility and diversity of working times present both promising and threatening prospects for employee health, depending on the possibilities of worktime control given to employees.
7. In sum, a high level of employee worktime control appeared to buffer for health problems and to promote a successful integration of domestic responsibilities with a full-time job.

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- I Ala-Mursula L, Vahtera J, Kivimäki M, Pentti J (2002) Employee control over working times: associations with subjective health and sickness absences. *J Epidemiol Community Health* 56: 272-8.
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