Stockholm University

## The Highs and Lows of Work-Time Control

Exploring the role of control over working hours for health
Sophie Charlotte Albrecht


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Academic dissertation for the Degree of Doctor of Philosophy in Public Health Sciences at Stockholm University to be publicly defended on Friday 10 December 2021 at 13.00 in lärosal 18, hus 2, Albanovägen 12 and online via Zoom, public link is available at the department website.


#### Abstract

Flexible work-time arrangements are thought to create ways of aligning work and private life and facilitate recovery. While temporal flexibility is found to generally bolster work-life balance, its effects on health outcomes are less well known. The present thesis seeks to examine if and how perceived control over working hours benefits workers' health. Utilising a large Swedish cohort study, four empirical studies explored the association of work-time control (WTC) with subsequent mental and physical health as well as the underlying mechanisms and moderating influences.

Study I assessed the factorial structure of an instrument to measure WTC and found two sub-dimensions: control over daily hours (the length, starting and ending times of a workday) and control over time off (the taking of breaks/time/days off, paid and unpaid). Levels of control per sub-dimension were described by demographic and work-related factors for a large sample of Swedish workers. In particular, shift, public sector and female workers reported low levels of WTC.

Study II examined effects of control over daily hours and time off on depressive symptoms. Increasing control over time off was related to decreasing depressive symptoms over time, whereas only initial level of control over daily hours was associated with lower levels of depressive symptoms. For both sub-dimensions of WTC, the direction of this effect was predominantly from perceived control to subsequent depressive symptoms; reversed processes were of less importance.

Study III focused on work-life interference as one step on the causal chain between WTC and depressive symptoms and musculoskeletal complaints, respectively. For both sub-dimensions of WTC, part of the effect on depressive symptoms went through work-life interference. Reversed processes played a role between depressive symptoms and work-life interference only. Control over time off was found to mitigate work-life interference and subsequent depressive symptoms more than control over daily hours, albeit with generally small effects. Regarding musculoskeletal complaints, effects were even smaller and work-life interference appeared to be less important.

Study IV assessed gender differences in the impact of WTC on work-life interference and exhaustion regarding the mediating role of overtime hours. In a sample of knowledge workers, higher control over time off was associated with lower subsequent work-life interference and exhaustion, while control over daily hours was unrelated to both outcomes. Although men worked more overtime hours than women on average, no evidence was found for men with high control over time off/daily hours to perceive more work-life interference/exhaustion due to increased overtime compared to women.

This thesis found that higher levels of WTC were beneficial for a range of health outcomes, which was partly explained by fewer work-life conflicts. While these effects were generally small, control over time off in particular was consistently associated with favourable outcomes in health, work-life balance and working hours. Given that the level of workers' discretion over working hours varies starkly by work and demographic factors, enhancing the availability of flexible worktime arrangements is in the interest of public health. WTC, with a particular focus on employees' ability to take time off from work, may improve the daily work-life interface and support a sustainable working life.


Keywords: flexible work, flexible work-time arrangements, autonomy, psychosocial working conditions, longitudinal, mental health, physical health, work-life balance.

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Time is an illusion.
Lunchtime doubly so.
Quote by Douglas Adams The Hitchhiker's Guide to the Galaxy
(said by Ford Prefect)

## List of Scientific Papers

## Study I


#### Abstract

Albrecht SC, Kecklund G, Tucker P, Leineweber C. Investigating the factorial structure and availability of work time control in a representative sample of the Swedish working population. Scandinavian Journal of Public Health. 2016; 44(3):320-8.


## Study II

Albrecht SC, Kecklund G, Rajaleid K, Leineweber C. The longitudinal relationship between control over working hours and depressive symptoms: Results from SLOSH, a population-based cohort study. Journal of Affective Disorders. 2017; 215:143-51.

## Study III

Albrecht SC, Kecklund G, Leineweber C. The mediating effect of work-life interference on the relationship between work-time control and depressive and musculoskeletal symptoms. Scandinavian Journal of Work, Environment and Health. 2020; 46(5):469-79.

## Study IV

Albrecht SC, Leineweber C, Kecklund G, Tucker P. Prospective effects of work-time control on overtime, work-life interference and exhaustion in female and male knowledge workers. Submitted manuscript.

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over daily hours was unrelated to both outcomes. Although men worked more overtime hours than women on average, no evidence was found for men with high control over time off/daily hours to perceive more work-life interference/exhaustion due to increased overtime compared to women.

This thesis found that higher levels of WTC were beneficial for a range of health outcomes, which was partly explained by fewer work-life conflicts. While these effects were generally small, control over time off in particular was consistently associated with favourable outcomes in health, work-life balance and working hours. Given that the level of workers' discretion over working hours varies starkly by work and demographic factors, enhancing the availability of flexible work-time arrangements is in the interest of public health. WTC, with a particular focus on employees' ability to take time off from work, may improve the daily work-life interface and support a sustainable working life.

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## Abbreviations

| CFA | Confirmatory factor analysis |
| :--- | :--- |
| CFI | Comparative fit index |
| CI | Confidence interval |
| COR | Conservation of Resources |
| DAG | Directed acyclic graph |
| EFA | Exploratory factor analysis |
| FIML | Full information maximum likelihood |
| FPS | Finnish Public Sector |
| ICT | Information and communication technology |
| ILO | International Labour Organization |
| ISCO | International Standard Classification of Occupations |
| LFS | Labour Force Survey |
| MAR | Missing at random |
| MBI | Maslach-Burnout Inventory |
| MCAR | Missing completely at random |
| MD | Mean difference |
| MNAR | Missing not at random |
| OR | Odds ratio |
| RMSEA | Root mean square error of approximation |
| SCB | Statistics Sweden (statistiska centralbyrån) |
| SCL-90 | Hopkins Symptom Checklist |
| SCL-CD | Symptom Checklist-core depression <br> SEI |
|  | Swedish socio-economic classification (socioekonomisk in- |
| SEM | delning) |
| SLructural equation modelling |  |
| SMBE | Swedish Longitudinal Occupational Survey of Health |
| Shirom-Melamed Burnout Questionnaire |  |
| SSYK | Swedish Standard Classification of Occupations (standard för |
| SWES | Svensk yrkesklassificering) |
| Swedish Work Environment Survey |  |
| WTC | Work-time control |

## Introduction

Lennart Levi describes the natural rhythm of stress as an ebb and flow of strain in any individual's life (Levi, 2006). Stress has a negative connotation, but may be normal and even beneficial from an evolutionary perspective. Unsurprisingly, many forms of ill-health are now known to be closely tied to stress-and work stress has received increased attention in that regard. Much of the literature focuses on how we can prevent work stress or its repercussions on health and which work environments are more or less stressful. In the pursuit of making work less stress provoking, it is easy to forget that stress reactions within individual homeostatic limits are normal; repeated or consistent pressure from external forces, stress becoming distress, can lead to pathology (Le Moal, 2007; Levine, 2005).

The work in this thesis focuses on one aspect of work that allows individuals a degree of control over their working hours. Work-time control may enable workers to react to external pressures and individual needs, align work and private life and foster a general sense of autonomy. Increasing the level of control workers have over their working hours could be a useful tool, at state-, union- or enterprise-level, to improve the work environment by enabling individuals to perceive control over stressors (Spector, 1998). At the same time, full discretion over working hours is sometimes discussed as being linked to overworked, pressured and chronically stressed individuals, which suggests that highly flexible working hours could potentially be damaging individuals' health and well-being.

In the first section of this thesis, the historical developments of work time are outlined to highlight the trends in quantity and flexibility of working hours over time. Concepts of work, the psychosocial work environment and work stress are discussed in the following sections, before taking a closer look on flexible working hours and the perceived control over work hours (work-time control). After reviewing theoretical pathways between work-time control and health, previous evidence of effects of control over working hours on different outcomes is presented. A section on the cost of high levels of work-time control specifies the potentially unfavourable effects that could come with high degrees of autonomy over working hours. In the last section of the background, the knowledge gaps in the literature regarding work-time control are highlighted and aims of the studies included in this thesis are outlined. After
a detailed description of methods and materials used in the studies and a summary of the results, a section elaborates on key limitations and weaknesses of this research. Finally, findings, implications and recommendations are discussed and set into context of recent developments in working time schedules.

## Background

## A brief history of work time and flexibility

During the last 100 years, standards of regulated working hours have remained remarkably unchanged-until today, about half of the world's countries subscribe to the 8 -hour workday (Eurofound, 2012a; International Labour Office, 2018). Before the $20^{\text {th }}$ century, dramatic developments affected when and how many hours were worked. Several industrial revolutions altered possibilities and availability of work. These developments shaped most of a working adult's life. In contrast to the mere quantity of working hours, a more subtle trait of work changed and advanced as well, and continues to alter the structure of working lives to this day: the flexibility over working hours.

Before the first industrial revolution, the majority of people worked as farmers and manufacturers within self-sufficient, small villages. Estimates of days worked per year are about 250/260 days per annum, at less than 11 hours per day and five days a week (Angeles, 2008; Voth, 2001). Work tasks were not guided by fulfilling a certain hourly quota, but rather by the requirements of the task itself. Agricultural work was often dependent on daylight, season and weather. Most likely, work was intense and long during some periods, while allowing for recovery and rest during others (Freudenberger \& Cummins, 1976). Similarly, construction workers in the early $18^{\text {th }}$ century worked likely about 200 days per year-with work being insecure and temporal (Stephenson, 2020). A number of church and secular holidays allowed for breaks of work (Ewert et al., 2015; Freudenberger \& Cummins, 1976). This may seem as if workers had more leisure time than today's average worker; but work in the pre-industrial era was far from easy. Frequent famines, insufficient nutrient intake and illness made for a harsh life (Freudenberger \& Cummins, 1976).

During the $19^{\text {th }}$-century industrial revolution, work suddenly became feasible 24 hours a day, with factories featuring electric light and machines running non-stop to ensure maximum output. For a growing number of workers, this meant that natural breaks during the day (with the sun setting) and during the year (during the colder months) disappeared. Additionally, a large number of people started working in shifts, up to 16 hours a day, 6 days a week. Employees had little discretion to decide on timing of their working hours. Legal reforms and the work of unions started to improve the situation of workers
slowly over time, but concerned only the number of working hours. In Sweden, average weekly working hours went from 70 hours in 1870 to 56 hours 30 years later (Huberman \& Minns, 2007).

In the $20^{\text {th }}$ century, office work became more and more common, and the era of "9-to-5" began. Significant improvements were brought by Conventions of the International Labour Organization (ILO). Member countries of the ILO could ratify these conventions and further implement them in national legislations. A maximum of 8 working hours per day and 48 hours per week was established by the ILO for industrial workers first (in 1919), with office and commerce sectors following soon after. Subsequently, the Fourty-Hour Week Convention (1935) demanded a maximum of 40 hours per week without reducing an individual's standard of living (International Labour Office, 2005).

In Sweden, workers had demonstrated already decades before (in 1890) under the slogan " 8 hours work, 8 hours leisure, 8 hours rest" (Spross, 2019). The earliest law came 30 years later, ordering a maximum of eight hours work per day and 48 hours per week; but it left out a number of occupations (for instance, healthcare and farm workers) and only about half of Swedish inhabitants (particularly office workers) actually worked about 8 hours per day after that (Isidorsson, 2001; Spross, 2019). Further shortening of maximum daily/weekly working hours for other groups took up to another 30 more years. The weekly working hours were reduced stepwise until the 40 -hour work week (and a regular work-free Saturday) was established in Sweden in 1971/1973 (Isidorsson, 2001).

In the mid- $20^{\text {th }}$ century, the conventions of the ILO concerned other dimensions than number of working hours, in particular scheduling of work, rest periods and holidays (Bosch, 1999). It was recognized that measures to ensure workers' health and safety as well as needs for leisure time needed to go beyond the mere number of working hours. At the same time, this required a careful balance with demands from employers. Two conventions for industry (1921) and commerce and office workers (1957) called for continuous rest breaks of at least 24 hours in every 1 -week period. A minimum of three weeks of paid holiday was first introduced in 1970. Further conventions until the beginning of our current century concerned regulations regarding night work, parental leave, part-time work and young people at work. While these protocols ensured that workers got sufficient rest from work, they did not necessarily leave the decision up to the individual when such breaks were needed or taken.

Today, the Working Time Directive (2003/88/EC) regulates national legislation in member states of the European Union regarding weekly working hours (a maximum of 48 hours), rest periods (at least 11 consecutive hours in any 24 hours), annual leave (at least four weeks paid) and night work (a maximum of eight hours night work within 24 hours). During the last 40 years however, working hours have become less standardised and more variable and
differentiated (Messenger, 2011)—driven by forces from economic, technological, but also cultural developments. Standards have become the minimum rather than the average. Flexibility of work started out as a benefit mostly on the employers' side, but fairly young developments shift the power to decide when to work more towards the individual (International Labour Office, 2005).

Part-time work can be seen as an early form of flexible work-although the working hours itself may not be flexible at all and it comes with a cut in salary compared to fulltime hours. Northern European countries and the Netherlands were first to significantly increase the number of part-time workers until their share of the working population made up over $30 \%$ by the end of the 80 s (Brewster et al 1997). Further south in Europe (as well as in Ireland), this share was much lower at the time (about $10 \%$ ). A large proportion of part-time workers were women who were able to combine care for children and paid work that way (Bosch, 1999). Interestingly, Sweden was one of the first countries starting to convert part-time jobs back to fulltime ones, which stands in contrast to some other Scandinavian countries (Anxo, 2009; Bosch, 1999).
'Real' flexible working hours first emerged in Germany, in the Sixties (Rubin, 1979). Instead of fixed starting and ending times of work, employees had to be present at work during certain core hours (e.g. 10am to 12 am and 1 pm to 3 pm ) and could choose when to begin and stop work during glide times ('Gleitzeit', e.g. 7am to 10 am and 3 pm to 6 pm ). The degree of flexibility given to employees strongly varied: from a simple choice of when to start work with an automatically determined ending time, to broad bands of flexible start and ending times, choice without need for approval or prior notice and options to take over credit or debit of working hours into the next week. Naturally, flexibility depended to some degree on the nature of work. Flexitime models could not be offered to all types of workers, as some jobs required continuous presence (e.g. within healthcare) or involved operations that depend on each other (like assembly-line work; Rubin, 1979).

Benefits from flexitime models could be seen on several ends. Mothers could more easily take up work again and combine this with family life, businesses were able to have longer opening hours and employees were less likely to work overtime hours (which also benefitted the employer pay-wise). Across Europe, use of flexible working forms was increasing-however, countries started at very different levels and use of flexibility differed starkly (Brewster et al., 1997).

The real surge of flexible working hours started when the Fourth Industrial Revolution brought a wave of technological innovations-arguably the most important one being the invention of the internet which made automation and global as well as machine-to-machine communication feasible, thereby creating entirely new information- and knowledge-related jobs. Temporal and spatial flexibility of work is increasing to this day (Plantenga \& Remery, 2010)first and foremost, but not exclusively, for occupations using information and
communication technology (ICT; Bouzol-Broitman et al., 2016). This is underscored by new forms of working such as the quickly growing gig economy (on-demand work with temporary contracts) that comes with both high levels of flexibility and more insecure working conditions (International Labour Office, 2018).

To some degree rules and regulations on the societal level appear to lag behind actual trends in flexible working hours brought forward by collective bargaining and informal agreements with employers. At the same time, average access to flexible work arrangements varied largely between EU countries in 2015 (Bouzol-Broitman et al., 2016). In 2019, the Work-Life Balance Directive (EU/2019/1158) forced national legislations to be implemented within three years regarding the legal right to request flexible work arrangements for all parents of children under the age of eight and all carers. This includes flexible work schedules, remote working arrangements and reduced number of working hours. The directive highlights that flexibility over working hours (and particularly the benefits of them) have been closely tied to workers' needs to balance work and family responsibilities, thereby strongly focusing on working parents of young children. Reconciling paid work and childcare is arguably an important aspect; flexible work arrangements potentially improve the situation of working parents and allow labour force participation. Unfortunately, all other groups of individuals trying to balance work and any nonwork needs and responsibilities are left out. Some countries in the EU made the right for flexible work arrangements universal, meaning extending the right to any working individual and for any reason (for instance, the Netherlands, Belgium, France and Germany; Hegewisch, 2009; International Labour Office, 2007).

We may well only be at the beginning of the 'era of flexible work'-or, viewing it from the lens of pre-industrial time, going back to more flexible working hours and beyond. Post-industrial working-time regimes are progressing, ever faster so since the global COVID-19 pandemic (Forbes et al., 2020; Sostero et al., 2020). This thesis takes a snapshot of data spanning over one decade-before the crisis of the pandemic changed flexible working patterns for a large part of the workforce. Although flexible work-time arrangements have become more available to workers, not every individual was awarded with or benefitted from more control over working hours; implementation depends strongly on the type of work (Sostero et al., 2020). In some occupations, increasing flexibility over work time is challenging. For others, implementation is simple but repercussions of infinite autonomy may include working more, rather than less, and could hamper a good balance between work and non-work time. The current labour sectors naturally differ largely in the extent of flexibility over working hours; from very little discretion over timing of work to highly autonomous working hours.

## Work and time

A large part of a working individual's daily life is determined by their working hours (Anttila et al., 2015; Fagan et al., 2012). Fagan (2001) categorises working time schedules by three components: the number of work hours, the timing of work hours, and the degree of working time autonomy. These components underline that work time is a key element for the structure of people's daily lives: it not only determines hours of work, but inevitably also the time available for domestic work, family, private leisure and recovery.

The first two components, the number and the timing of work hours, have repeatedly been found to impact workers' health and work-life balance (Kivimäki et al., 2015; Virtanen, 2012). Long working hours, for instance, naturally decrease the amount of spare time left and intensify work-family conflict (Jansen et al., 2003; Oinas \& Anttila, 2021). Timing of work hours can mean that scheduled shifts, like early morning, late evening or night-time shifts, can not only interfere with circadian rhythms (Härmä, 2006), but also with participating in family and social life, and can thereby deteriorate health and work-life balance (van Amelsvoort et al., 2004).

The third component, working time autonomy, concerns the extent to which workers can affect both timing of their work hours and (at least shortterm) number of work hours. When individuals can self-determine working hours, they can tailor hours of work so that they better fit their private life and/or need for recovery. In contrast, a low degree of autonomy can further increase the influence that working times have over the structure of daily lives. This highlights that a lack of control over working hours can lead to conflicts between work and private life, impaired recuperation and in general, negative effects on health-particularly if working hours do not automatically have sufficient fit with an individual's needs. On the other hand, if workers have some degree of discretion to schedule and interrupt work, conflicts between private and work life as well as ill-health may be prevented or mitigated, as individuals can more flexibly react to personal needs.

## Work-for better, for worse

Work has long been studied as a factor of both health and ill-health. Lack of work-unemployment-is associated with a number of health complaints, among them depression, anxiety, alcoholism, and even with death in the form of cancer, heart attacks, stroke and suicide (Herbig et al., 2013; McKee-Ryan et al., 2005; Paul \& Moser, 2009; Wilson \& Walker, 1993). The conditions of work also vary widely-from daytime to night-time work, from only sitting to only standing, from mentally engaging and challenging to repetitive and passive work, from a socially supportive work environment to bullying, from rewards to pressure. While being jobless contributes to a number of adverse
outcomes, working in a particular work environment can be positive or negative for health.

Unfavourable work conditions can lead to mental and physical ill-health, while favourable ones can bolster good health and well-being. Early on, these factors had mostly been studied within the physical work environment, regarding for instance chemical exposures (Marmot et al., 2006). Since the 1980s, research has recognized that factors in the psychosocial work environment play an important role in an individual's well-being and health, both mentally and physically (Rugulies, 2019). The following section further examines the psychosocial work environment and different theories predicting work stressors to affect health and well-being.

## The psychosocial work environment and work stress

## Psychosocial work environment

Psychosocial means the interaction of psychological and social factors at hand in any individual's environment (Chandola, 2010; Marmot et al., 2006). Siegrist and Marmot suggest that a psychosocial environment is 'the sociostructural range of opportunities that is available to an individual person to meet his or her needs of well being, productivity and positive self-experience'(Siegrist \& Marmot, 2004, p. 1465). This definition recognizes the overlap in this research field between sociological (sociostructural conditions and collective behaviour) and psychological (individual behaviour, needs and motivation) frameworks.

Out of the large number of psychosocial environments we are exposed to in our lives (e.g. kindergarten, school, university, family, peer group, team sport), the psychosocial work environment plays unquestionably an important and long-lasting role in the adult age. Moreover, it can be related to the social gradient in morbidity and mortality that persists in the majority of countries (Clougherty et al., 2010; Siegrist \& Marmot, 2004).

Psychosocial work conditions can be a number of factors at work, acting as stressful or protective factors in an individual's health and well-being. No clear consensus on a definition of the psychosocial work environment has been reached - maybe in part because research comes from a variety of disciplines (Rugulies, 2019). Hemingway and Marmot define psychosocial factors as 'a measurement that potentially relates psychological phenomena to the social environment and to pathophysiological changes' (Hemingway \& Marmot, 1999, p. 1460). Recently, Rugulies proposed a definition encompassing both the societal and individual level of the psychosocial work environment, namely 'as an intermediate step in a causal pathway linking economic, social and political structures with health and illness through psychological and psycho-physiological processes' (Rugulies, 2019, p. 3).

The earliest research within psychosocial work environments concerned workers' perceived demands, control and (later on) support at work (Job-De-mands-Control/-Support model; Karasek, 1979; Karasek \& Theorell, 1990). Job control (or decision latitude) is predicted to be protective against ill-health, whereas the combination of high job demands and low control (labelled 'job strain') negatively influences health outcomes, for instance coronary heart disease (Kivimäki et al., 2012), psychological distress (Dalgard et al., 2009) and depressive symptoms (Theorell et al., 2015). A different framework, the Ef-fort-Reward Imbalance model, focuses on perceived rewards in contrast to effort expenditure at work (Siegrist, 1996). Effort expenditure that exceeds perceived rewards (material, social or psychological ones) was found to hamper a number of health factors, for instance cardiovascular mortality (Kivimäki et al., 2002), musculoskeletal symptoms (Lee et al., 2014), exhaustion (Leineweber et al., 2021) and psychological distress and physical complaints (Shimazu \& de Jonge, 2009).

More recently, other factors of the psychosocial work environment have received attention in terms of effects on health, for instance long working hours (Virtanen et al., 2012), job insecurity (de Witte, 2016), organizational injustice (Elovainio et al., 2005), bullying (Verkuil et al., 2015) and sexual harassment (Nielsen \& Einarsen, 2012). Evidence for effects on mental and physical health may still be limited for some of these factors, while others show stronger and consistent relationships with health. One of the difficulties in assessing associations is that a psychosocial work environment consists of a multitude of factors on different levels which often are related and can multiply, counteract or reciprocally affect each other. In turn, this makes it challenging to disentangle the effect of one specific psychosocial work condition onto one single outcome.

## Work stress

Work stressors are psychosocial work factors that cause stress-a psychobiological and immunological response-which in turn is related to psychological and pathophysiological changes (Chandola, 2010; McEwen, 1998). Stress responses can become apparent in a number of mental and physical symptoms of ill-health. Work stress has received more attention as an important public health concern, particularly since profound developments in technology and increased globalization have shaped modern organisations and ways of working, and with it a blurring of boundaries between work and non-work time (Kompier, 2006).

Several theoretical frameworks focus on explaining and predicting work stress, such as the previously mentioned Job-Demands-Control-Support model and Effort-Reward Imbalance model. These models focus on a fairly specific set of work-related factors, such as job demands and job control. Other frameworks have integrated the interplay between work and non-work
time and capture a broader range of challenging and beneficial aspects of different work conditions. The following sections explore two job-stress frameworks that can be used to explain and predict effects of the psychosocial work environment on individual health and well-being as well as organizational outcomes. Finally, a more general view of work stressors that are in conflict with basic human needs is discussed.

## Job Demands-Resources model

In the Job Demands-Resources model (Demerouti et al., 2001), job demands are the sum of effort-expending and energy-depleting factors in any job that result in physiological and psychological costs over time. Job resources, on the other hand, include any positive aspect of a job that can counteract these costs, help in achieving work goals or foster personal growth and development. If job demands remain chronically high and cannot be compensated by job resources, an individual's energy depletes which can lead to ill-health and motivational problems. Further on, this can even hamper organizational outcomes. Job demands are not negative per se, but can become stressful and overwhelming when an individual cannot recover from them (Meijman \& Mulder, 1998). Likewise, demands and resources can also concern private life and non-work time, with an imbalance potentially affecting the work domain negatively (Geurts \& Demerouti, 2003).

## Person-Environment Fit theory and Barnett's Fit Model

Two approaches focus more on the individual and its relationship with work and health. This perspective is not new and can already be found in Lazarus’ view on stress: not a stimulus in itself causes a stress response, but cognitive appraisal of and coping mechanisms with a specific stimulus can make an environment stressful to an individual (Lazarus \& Folkman, 1984). In the same vein, the Person-Environment Fit theory (Caplan, 1987; Edwards et al., 1998) predicts that individual outcomes result not from just a specific environment or just a particular person, but from the combination and relationship of the two. Work demands, for instance, become only too high when they exceed an individual's ability to cope with them. In other words, if a discrepancy exists between the person and their environment, fit is hampered and unfavourable health, well-being and organizational outcomes become more likely.

Barnett built upon the Person-Environment Fit theory and added the workfamily interplay (Barnett et al., 1999). More specifically, 'fit' lies on the causal chain between work-related factors and health-related outcomes and is the degree to which individuals can actually fulfil their work needs, non-work needs and needs of close others. If the work environment hampers the ability to realise plans to reconcile work and non-work/family needs, this can result in distress, conflicts and particularly psychological ill-health. In essence, fit depends on the individual's strategies regarding non-work time and accessible workplace possibilities to fulfil these commitments.

## Basic human needs

Stressful psychosocial work conditions are assumed to be in conflict with basic, human needs of well-being, productivity and positive self-experience; particularly self-esteem and self-efficacy (Siegrist \& Marmot, 2004). Self-esteem may diminish if the psychosocial work environment does not allow for success and accomplishments, social approval and belonging as well as rewards and reinforcements (Baumeister \& Tice, 1985; Deci \& Ryan, 1987; Hallsten et al., 2005). Self-efficacy means an individual's belief to be able to accomplish a task or succeed in a challenge (Bandura, 1977). The psychosocial work environment can promote a sense of self-efficacy by offering opportunities to experience mastery and autonomy (Deci \& Ryan, 1985, 1987) and practice skills (Siegrist \& Marmot, 2004). On the other hand, if work puts the individual in a restrictive, non-challenging or overwhelming situation with control entirely in the hands of the employer, this likely hampers self-efficacy beliefs. In turn, if any of these basic needs are threatened, individuals may experience stress and develop symptoms of mental or physical ill-health (Siegrist \& Marmot, 2004).

## Flexible work hours

As described in the historical overview in the first section, innovations in the fourth industrial revolution not only created a number of new occupations within knowledge and information sectors, but also shaped new ways of working. Profound developments in ICT enabled people to work at any time and from anywhere, while at the same time boosting globalisation (Kompier, 2006). New ways of working are characterised by different types and degrees of flexibility, for instance working hours flexibility (when to work), workplace flexibility (where to work, i.e. at home, while commuting, at the office, in a café) and mode of communication flexibility (how to work, e.g. face-toface versus online meetings, work at a computer/laptop versus tablet/smartphone; Baane et al., 2010).

These factors have been both praised and condemned. They enable workers to make autonomous decisions while increasing company output and productivity (Godart et al., 2017); but the possibility to work anytime and anywhere may well lead to information overload as well as stress and conflicts with private life and even increase social inequalities on the societal level (Demerouti et al., 2014; Warren, 2015). Both arguments have some supporting evidence which underlines that flexible work hours can be a double-edged sword.

Flexible work hours, and new ways of working, can come with a multitude of flexible work-time arrangements that can impact how individuals combine work and private life and when they work and recover. Whereas new ways of working are characteristic of the modern office worker, flexible work-time arrangements are not exclusive to knowledge and information sectors (Beers,

2000; Sostero et al., 2020). To add to the confusion, flexibility can be em-ployer-based (flexible timing, change and length of work hours and contracts) versus employee-focused (job content, working hours, time off, vacation, overtime; Costa et al., 2006; Ganster, 1989; Nijp et al., 2012). These two are not mutually exclusive, but require a careful balance if the goal is to satisfy needs from both employers and employees. Employer-based flexibility means the company can determine and vary employees' working times more according to the company's (and customers') needs (termed as variability). This can be implemented, for instance, in the form of shift work, overtime hours, oncall work, weekend work, short-notice shifts and temporary or zero-hour contracts (Benach et al., 2002; Tucker, 2021). Benefits are usually on the side of the employer with increases in productivity and decreases in economic costs (Arnold \& Bongiovi, 2013; Askenazy, 2008; Houseman, 2001).

In contrast, employee-oriented flexibility (termed as flexibility) targets the individual's autonomy over aspects of working hours so they better fit an individual's needs (Costa et al., 2004). This form of flexibility can come in different ways and levels. Flexitime contracts ('Gleitzeit') are types of employment introducing a degree of control over working hours, usually before and after certain core hours during the day. Most recently, trust-based working hours have become more popular within the knowledge-work sector, particularly at large tech corporations: employees are completely free in choosing when to work and when not to work, as long as work tasks are fulfilled (Godart et al., 2017). Research has generally found beneficial effects of higher flexibility for workers, for instance regarding work-life balance (Nijp et al., 2012) and stress and burnout (Grzywacz et al., 2008), and indicated that flexibility may mitigate negative effects from work stress on health (Ala-Mursula et al., 2005).

This thesis focuses on one aspect of employee-based flexibility concerning the degree to which workers can control working hours regarding time and timing at work and off from work. The following sections elaborate on this type of control.

## Work-time control

The concept of work-time control (WTC) expands on the dimension of job control from the Job-Demands-Control-Support model (Karasek, 1979; Karasek \& Theorell, 1990), with a focus on control over time and timing of work instead of the way how work is done (Kelly \& Moen, 2007). In the literature, a consensus is lacking with regard to the definition of WTC. Different terms are even used to describe WTC, e.g. schedule control, workers' autonomy, flexitime or work-time influence. To name a few definitions, WTC can be defined as the 'influence of a worker on the duration, position, and distribution of his individual worktime' (Knauth, 1998, p. 14), 'employees' degree
of flexibility and choice over time, timing, and sometimes location of their work' (Moen et al., 2008, p. 416), 'perceived ability to control their working time' (Kubo et al., 2013, p. 148), and 'possibility to meet the needs of employees, providing them with autonomy regarding factors in the start and end times of their shifts, breaks, days off, holidays, and the total number of work hours' (Nätti et al., 2014, p. 732).

These definitions correspond regarding the contrast of individual-based versus employer-based control, i.e. categorising WTC as a type of individual-based/employee-focused control. Most definitions also include the notion that WTC is perceived rather than objectively measured (objective being, for instance, as part of the official work contract). The dimensions that are included in WTC differ between definitions. While some researchers define WTC as the control over time and timing of work, others also include the location of work (e.g. telework, home office). For consistency and since the majority of studies in the literature investigate location of work separately, this thesis uses a synergy of most existing definitions with an adapted version of Knauth's definition: WTC refers to an individual's autonomy regarding duration and distribution of working time.

## Dimensionality of work-time control

A large number of studies calculate an overall index score or use a single item to measure WTC (Nijp et al., 2012; Nätti et al., 2014; Salo et al., 2014; Takahashi et al., 2012)-although most definitions in the literature imply a multi-dimensionality underlying the concept of WTC. From the proposed definition in the previous section, there is a distinction between control over duration and distribution of working time. A small number of studies have examined the factorial structure of WTC, which is naturally contingent on using a multi-item measure. For one scale of WTC, often used in Finnish, Swedish and Japanese samples, researchers have reported best fit for a two-dimensional model, differentiating between control over daily working hours (the length and starting and ending times of a workday) and control over days off (the scheduling of vacation and paid/unpaid leave; Ala-Mursula et al., 2005). Other research has investigated the dimensionality of a broad range of flexible worktime arrangements; in a German sample, two factors were described as timeautonomy (the control over varying working times) and time-restriction (the control over overtime hours and taking time off; Kattenbach et al., 2010), while a pan-European study found flexibility in starting and ending times of work loading onto a different factor than the availability of taking leave from work (Chung \& Tijdens, 2013). Another research group measured two WTCdimensions separately, labelled as flextime (control over start and ending times of work) and leave control (control over days off and vacation; Geurts et al., 2009). These results correspond well with our proposed definition: while
duration focuses on when to work (time and timing at work), distribution entails when not to work (time off from work). The underlying dimensions of WTC are henceforth labelled control over daily hours (the duration and starting and ending times of work) and control over time off (the takings of breaks and scheduling time/days off from work).

## Perceived work-time control and its distribution

The number of companies offering work-time flexibility to employees (oftentimes in the form of flexitime contracts) has substantially increased during the last two decades (Eurofound, 2012b; Eurofound \& International Labour Office, 2017; Riedmann et al., 2010). Even though regular working hours are still the norm for most fulltime, daytime workers (Eurofound, 2012b), employers allow for more and more variation around this standard at the discretion of the employee. Introducing work-time flexibility in organizations can be driven by both company- and employee-focused goals (Beckers et al., 2012; Härmä, 2006); reasons for companies to make this change most often concern employees' work-life balance, followed by adaptations to varying workloads, coping with commuting problems and reductions of paid overtime (Eurofound, 2012b).

While average objective levels of WTC have increased over time, flexibility may not be equally available to all employees within a company (Brescoll et al., 2013). Moreover, systematic differences are found between working sectors, occupations, socioeconomic levels and even family status, gender and other psychosocial conditions (Costa et al., 2004; Sverke et al., 2017). Only a small number of studies have actually investigated the levels of WTC in regard to demographic background and work characteristics. The few studies that exist observed large systematic differences in the extent workers could self-determine their working times that even persist when comparing cross-national samples (Lyness et al., 2012). Higher levels of WTC have been reported for upper-white collar and daytime workers, individuals with high levels of education and those in low strain or active job situations and low levels of effortreward imbalance (Ala-Mursula et al., 2002; Takahashi et al., 2011). One of the groups that have repeatedly been found to report lower WTC levels are women (Ala-Mursula et al., 2006; Nätti et al., 2014; Salo et al., 2014; Takahashi et al., 2011). A Finnish study for instance found lower degrees of WTC in female public sector employees-however only regarding one dimension of WTC, control over daily hours (Ala-Mursula et al., 2005).

Another group often found to report low levels of WTC are shift workers. In a large cross-sectional sample of Japanese workers, $53 \%$ of shift workers rated their control over daily hours as high or moderate, while this was the case for $76 \%$ of daytime workers (Takahashi et al., 2011). Results from a sample of Finnish public sector workers were more extreme: only $11 \%$ of employees working shift or night work reported high or very high levels of WTC
compared to $20 \%$ of those working regular daytime hours (Salo et al., 2014). In the same cohort, control over daily hours differed between daytime and shift workers while control over time off was more equally distributed (AlaMursula et al., 2005).

A study on Swedish workers showed that WTC also varies considerably between different economic sectors; working in the business sector was associated with the lowest levels of regulation (i.e. high WTC), while highly regulated working hours were more often present in manual labour/industry sectors and the (female-dominated) health-care sector (Allvin et al., 2013). Men more often reported unregulated working hours (including high levels of WTC, but also low regulation of time, space, performance, and collabora-tion)-even when controlling for the fact that unregulated working hours were more common in male-dominated occupations.

Results on the influence of family situation on perceived WTC are rather inconclusive. Some studies observed higher WTC for married individuals and those with dependent children at home (Takahashi et al., 2011), while others found no difference (Ala-Mursula et al., 2006; Salo et al., 2014). It seems likely that the need for flexible work-time arrangements in general increases with having children living at home. However, in how far WTC is needed by parents depends largely on any country's parental leave policies, cultural traditions on how to combine work and family as well as frequency of part-time work.

Results on the association between age and WTC are inconsistent with some studies reporting that older employees perceived lower control in at least one dimension of WTC (Ala-Mursula et al., 2005; Salo et al., 2014) while others found no difference (Nätti et al., 2014).

## Pathways between work-time control and health

Time has become an important aspect of wealth in contrast to, but also complementing, wealth in goods (Reisch, 2001). Time off work is an essential factor of good health and well-being, particularly if it can be used to recover from strain, fulfil family responsibilities and participate in creative and social activities (Winwood et al., 2007). If time to actively and passively recover from work stress is insufficient, this can contribute to poor health (Geurts \& Sonnentag, 2006). To some extent, income can be traded in for time by working fewer hours. But in order to optimize both wealth in time and recovery, workers need the right number and timing of work hours-which can be facilitated by higher levels of WTC.

Several perspectives and frameworks allow for predicting higher levels of WTC to favourably affect outcomes of health and well-being. First, WTC enables individuals to better adapt work-time to their private life, to family responsibilities and to work hours of close others (Hughes \& Parkes, 2007;

Reisch, 2001). Drawing on Barnett's Fit Model (see section 'Person-Environment Fit theory and Barnett's Fit Model'), certain job conditions may cause stress and conflicts only if they are mismatched with needs and responsibilities in private/family life (Barnett et al., 1999). Enhanced fit between work schedules and private life allows workers to align both domains, which prevents conflicts and stress-related symptoms. Consequently, WTC should have positive effects on individuals' well-being and health by facilitating alignment of work and non-work commitments and reducing work-life conflict (Härmä, 2006; Nijp et al., 2012). While control over daily hours should specifically benefit daily alignment of working hours with private life, control over time off would facilitate scheduling family vacations or taking time off from work to fulfil other responsibilities.

Second, WTC may increase quality and opportunity to recover from strain at work-both inside and outside of work (Beckers et al., 2012). The EffortRecovery Model explains the influence of work stressors on workers' wellbeing (Meijman \& Mulder, 1998). Expending effort at work results in productivity gains but also costs in physio- and psychological outcomes for the individual. Workers need to recover from depleting energy during work breaks or after work. If time for recovery is insufficient, workers expend more effort which in turn builds up bigger need for recovery. As control over daily hours allows workers to self-determine working hours to fit personal needs (for instance, working less or later during a day to recover more) and control over time off allows to take breaks and schedule leave (i.e. recover in- and outside of work when needed), opportunities to recuperate increase and thereby buffer against negative health outcomes associated with stress, exhaustion and fatigue (Geurts \& Sonnentag, 2006).

WTC may also benefit workers' health by generally enhancing the psychosocial work environment (or buffering against unfavourable work conditions) which in turn affects health outcomes. Relevant factors that could be improved by WTC are job and social climate, work demands, job satisfaction, and morale of workers (Joyce et al., 2010). Additionally, theories on the psychological sense of control suggest that the mere perception of control (regardless of actual use of control) is beneficial for motivation and well-being (Deci \& Ryan, 2008; Ryan \& Deci, 2006). Workers who perceive to be in control over their working hours would already gain positive effects on psychological wellbeing, even if they don't actually change working hours. Likewise, being in control over working hours may promote a sense of self-efficacy which in turn would benefit health, well-being and motivation at work (Ryan \& Deci, 2006; Siegrist \& Marmot, 2004; Skinner, 1996).

These frameworks mostly focus on potential psychological benefits of WTC. Yet, WTC (like other psychosocial work conditions) can be related to outcomes in physical health as well, in particular musculoskeletal symptoms. This can be explained by the chain of effects via work-life interference and
insufficient recovery on the one hand, but also via direct decreases in biomechanical load. Stressors at work cause a stress response that includes increased muscle tension and inhibited muscle tissue repair. If stress and the related short-term biological and chemical reactions persist over a longer time, musculoskeletal disorders can develop (Hauke et al., 2011). Not only may WTC relate to lower levels of general work stress (e.g. by promoting a sense of control or enriching the psychosocial work environment), but also affect biomechanical load and muscle tension directly: by taking breaks and time off from work when individuals perceive physical strain. In turn, damage to muscle tissue can be prevented or repaired early, thereby preventing onset of musculoskeletal complaints and other physical disorders.

The flexibility that WTC offers could potentially benefit some groups more than others. As shift workers often have varying work schedules, being able to self-determine work time might play a crucial role in counteracting worklife conflicts arising from non-standard working hours (like early morning, late evening, and night shifts; Hill et al., 2001; Hofäcker \& König, 2013). Control over daily hours and time off would allow workers to avoid for instance tight work schedules or too many consecutive working days. The conflict between working times and social needs could be buffered or prevented by enhancing WTC-especially for women (Hofäcker \& König, 2013). In 2010/11, Swedish women reported to work more unpaid labour (overall and in specific regarding domestic work and childcare), while men still worked more paid hours-though distribution between paid and unpaid labour had improved over the previous decades (Statistics Sweden, 2020). The fact that women report slightly more work-life interference in general (Leineweber, Baltzer, Magnusson Hanson, \& Westerlund, 2012) could be associated with this. With increased levels of WTC, women have been found to report lower levels of work-life conflict (Hofäcker \& König, 2013). If high levels of WTC can facilitate a good balance between work stress and biological need for rest and recovery, higher WTC could also benefit in particular older employees, who might be more vulnerable to high workloads and build up a larger need for recovery.

Figure 1 summarises the theory on explanatory processes underlying favourable effects-but also unwanted potential negative consequences-of higher levels of WTC on health. Based on models presented in the literature (Brunner \& Marmot, 2006; Hauke et al., 2011; Rugulies, 2019), it is first of all assumed that the level of WTC depends on a number of social, political, economic and work-related structural factors. In turn, WTC relates to increases in work-life balance, recovery, sense of autonomy and self-efficacy, favourable psychosocial work environment (including job-related attitudes) and reduced physical strain (for instance, due to less biomechanical load). On the downside, higher WTC may lead to increased overtime hours and lower boundary control of work. These associations can be affected by individual
characteristics such as gender (or related female/male characteristics), personality, work conditions (e.g. culture at work), private life (e.g. childcare responsibilities) and health status (e.g. pre-existing chronic conditions). Finally, changes in psychophysiology and pathophysiology as well as health-related behaviours determine workers' health and well-being.

To conclude, a number of frameworks and related concepts predict that higher control over daily hours and time off benefits an individual's health and well-being. For some groups, these effects may be stronger than for others. After setting WTC into context of the psychosocial work environment, the following sections review evidence on associations between WTC and work-life interference, mental and physical health.

The role of work-time control in the psychosocial work environment

The psychosocial work environment comprises a number of factors that naturally are related and affect each other; WTC intertwines with other structural and psychosocial factors on several levels. From the explanatory model displayed in Figure 1, it becomes apparent that WTC reflects an individual's perceived level of control over working hours, which is affected by upstream factors: in how far is temporal flexibility embedded in contracts or agreements and the company culture? In Rugulies' framework, these meso-level workplace structures impact subsequent meso-level psychosocial factors at work which in turn are experienced and appraised by the individual (Rugulies, 2019). WTC theoretically can be measured on all three levels-though the individual perception is likely the vital information regarding effects on health. For example, an organization might have a flexible work policy allowing individuals some discretion over time and timing of work, but employees may be unaware of this or the culture at work and reinforcements may instead promote regular working hours, thereby impacting an individual's actual perceived control over working hours (more on this in the section on 'Measuring control over working hours').

Higher individual control over working hours may be more likely to coincide with some structural and psychosocial factors, such as the possibility to work remotely, the culture of flexible work, perceived trust and justice in the organization, voluntariness of any overtime hours and higher job demands and job control (Ala-Mursula et al., 2002; Kelly \& Moen, 2007; Lott \& Chung, 2016). The latter concept, job control, is naturally closely related to flexible work-time arrangements, with the difference that job control focuses on control over how work is done, whereas WTC targets when work is done (Kelly \& Moen, 2007).

Figure 1: Explanatory model of the effect of work-time control on workers' mental and physical health and

Apart from concurrent conditions, WTC can play a role in both the perception of other psychosocial work factors and their effects on health. Drawing on the Job Demands-Resources model (Demerouti et al., 2001), WTC is a job resource that workers can use to counteract work stress-for example, to recover from high demands at work or schedule work to receive support. Demands may not be evaluated as too strenuous if an individual has enough discretion to distribute the load and recuperate when needed. Some intervention studies shed light on the implementation of high control over working hours and effects on other psychosocial work factors. A Danish study on the implementation of self-rostering found mostly positive effects, for instance on social support, quantitative demands, work pace and perceived justice of work schedules-though effects appeared dependent on how much employees were encouraged to rethink and change the arrangement of working hours and private life, i.e. drastic changes in daily structures of work and non-work time were more challenging than smaller adaptations (Albertsen et al., 2014; Hansen et al., 2015). An intervention study on Swiss nurses reported increases in perceived autonomy and empowerment after introducing a self-rostering system (Wright et al., 2017). In contrast, a Dutch intervention study introducing flexible working hours in time and place as well as a focus on results found no effects on job demands, autonomy or support in the implementation group-however, levels of WTC also remained unchanged (Nijp et al., 2016).

At the same time, some research has examined whether WTC moderates effects of work stress on health. WTC, at that, could aid in coping with stressful work situations. For instance, one longitudinal study on Finnish public sector workers saw a reduction in sickness absence among workers (in particular women) with unfavourable psychosocial work conditions such as high job demands, low job control, the combination of the two (high strain), and high effort-reward imbalance when levels of control over daily hours or time off were high compared to low (Ala-Mursula et al., 2005). Similar results were found in a cross-sectional sample of Swedish employees on work-life bal-ance-albeit not regarding job demands (Bjärntoft et al., 2020).

Overall, WTC relates to other conditions of the psychosocial work environment on several levels and through different pathways. Higher degrees of control over working hours are likely supporting a positive appraisal of jobrelated attitudes and in some cases factors such as job demands and autonomy. Moreover, WTC can be related to a buffering effect against adverse effects of other psychosocial work factors.

## Effects of work-time control

The previous sections explained the various pathways through which WTC can be related to health and well-being. In the following, evidence is presented
regarding effects on work-life interference, outcomes of health and, briefly, job-related attitudes.

## Work-life interference

In essence, work-life interference means the conflict between responsibilities from work and private life/family. Different terms are used in the literature focusing on different aspects of work-life interference. 'Work-life balance' highlights well-aligned work and non-work time. 'Work-life conflict' emphasizes conflicts arising between obligations stemming from work and private life. 'Family-to-work interference' focuses on private/family matters interfering with work, and 'work-to-family interference' describes the opposite.

The concept has received a growing amount of attention since the industrialization and even more so since women form an active role in the labour sector and segregation between work and non-work roles has become less synonymous with segregation by gender (Geurts \& Demerouti, 2003; Zedeck \& Mosier, 1990). In addition, work and non-work time have less clear boundaries (Geurts \& Demerouti, 2003). Both factors mean that combining the two domains of work and private life may cause conflicts (Galinsky \& Stein, 1990). This is particularly, but not exclusively, true for working parents and within that group more often a problem for mothers and single parents (Byron, 2005). Work-life conflict also appears to be a more frequent problem for the upper working class: professionals report higher levels of work-life conflict than non-professional workers. This gradient holds across a number of European countries (McGinnity \& Calvert, 2009).

A useful framework to understand the aetiology of conflicts in the work/non-work interface and their relation to health is the Conservation of Resources model (COR; Hobfoll, 1989). Originally used to describe work stress in general, it can also be applied to work-life interference and related outcomes (Grandey \& Cropanzano, 1999). The COR model proposes that individuals strive to obtain and conserve a wide range of resources from different domains-relating to objects, conditions, energies and personal characteristics. If a resource is lost, threatened to be lost or not acquired after expending resources, individuals perceive a stress reaction. Between work and non-work roles, resources are connected, meaning loss in one domain can affect capability to fulfil the role in another domain (Grandey \& Cropanzano, 1999). For instance, conflicts at work can leave fewer resources for family responsibilities, in turn having less time for family means another loss of resource. This process can initiate a downward spiral and cause a number of health issues such as depression, anxiety, burnout and physical tension (Hobfoll, 2001). Simply holding different roles is not predicted to cause stress in itself as each role may come with a set of resources aiding in fulfilling other roles.

Factors that can positively affect workers' work-life balance include lower number of working hours and shared responsibilities on the individual level,
family-friendly culture and flexible work policies on the organizational level and parental leave, childcare and flexible work legislation on the societal level (Geurts \& Demerouti, 2003). Naturally, the mere availability of flexible working hours may not prevent work-life conflicts from happening. As described in the previous chapter, WTC can make a difference in work-life interference if individuals use their control to reconcile private and work responsibilities. The ability to do so may also depend on the family-friendliness of a workplace, as well as workload and number of working hours (Albertsen et al., 2010). Put in the context of the COR model, control over working hours may aid (under certain prerequisites) in retaining and gaining resources in both work and private life.

In a systematic review from 2012, evidence of the association between WTC and work-life balance was deemed as moderate to strong (Nijp et al., 2012). Higher levels of WTC have repeatedly been observed to yield positive effects on work-life balance (Hughes \& Parkes, 2007; Lyness et al., 2012). In a Swedish study over the span of two years, women with stable low WTC and both genders with decreasing levels of WTC reported higher work-life interference than those with stable high or increasing control (Leineweber et al., 2016). In a 1 -year follow-up study of two US-American companies, work-life interference was found to mediate the relationship between WTC and subsequent exhaustion ( Yu, 2017). A large cross-sectional study found Finnish and German health-care sector workers to benefit from particularly control over taking breaks in terms of work-life interference (Karhula, Wöhrmann, et al., 2020).

Moreover, flextime and flexplace were found to buffer against negative effects of long working hours on work-family balance (Hill et al., 2001). This result highlights the moderating role that WTC could play between unfavourable work characteristics (e.g., high workload, overtime hours, effort-reward imbalance) and increased work-life interference (e.g. Hughes \& Parkes, 2007). In a meta-analysis on different types of flexible work-time arrangements, flextime availability (meaning the opportunity to control daily hours) had the strongest effect on work-to-family interference, followed by flextime use (meaning actual use of control over daily hours), flexplace use (actually working from home) and flexplace availability (the opportunity to work from home) in that order (Allen et al., 2013).

Within shift-work schedules, WTC is sometimes assumed to potentially cause unhealthy choices, for instance long shifts or quick returns (short rests of about eight or nine hours between shifts). In order to reconcile work and family life, shift workers may prioritise work-family fit of schedules over ergonomic and healthy shifts. In a Finnish study however, these concerns could partly be overcome: hospital workers with high WTC did not largely differ from those with intermediate and low control regarding unsocial shift working hours-but they did have a slightly higher variability and frequency of shifts, for instance more quick returns and weekend/night work (Karhula et al.,
2019). Most noteworthy in this context was that the researchers found those with high WTC less likely to perceive work-life interference in contrast to shift workers with intermediate or low control. This speaks for the notion that even a higher variability of shift schedules and slightly more unsocial working hours may still benefit those individuals who choose to work these hours. Shift workers with high WTC tailor working times to their own, personal needs which can buffer against work-life interference. The question remains however, in how far the benefits from fewer work-life conflicts counteract potential negative effects on health from unsocial and unergonomic shift working characteristics.

In summary, the weight of available evidence points towards favourable effects of WTC on work-life balance. Some findings indicate that work-life interference may play a mediating role in the relation between WTC and health. WTC may aid in retaining important resources in the work and nonwork domain and, to a degree, buffering against unfavourable work character-istics-depending on workplace culture, demands and total amount of working hours.

## Health outcomes

In the literature, effects of WTC on health-related outcomes have been investigated both in the negative and positive direction: lower levels of control relating to more/worse adverse outcomes versus higher levels of control relating to fewer/diminished adverse outcomes or better results in health and well-being. This latter part touches upon an ongoing discourse regarding the definition of health. In the quest of achieving globally better human well-being and health, the World Health Organization notably defined health not only as the mere absence of ill-health or disease, but as a 'state of complete physical, mental and social well-being’ (World Health Organization, 1948). Researchers from various disciplines discuss whether health and ill-health, or well-being and ill-being, are bipolar opposites or distinct entities (e.g. Ryff et al., 2006). Put into context of flexible working hours, while WTC is theorised to affect health, research more frequently concerns effects on ill-health such as depression, psychological distress and musculoskeletal symptoms-and this is also true for studies included in this thesis. In part, the scarcity of evidence on outcomes of excellent health and positive functioning may be due to a lack of consensus in theoretical conceptualizations and measurements of these concepts (Chari et al., 2018). It may also reflect the uncertainty in research regarding the ideal level of WTC for optimal functioning and health for individuals. While there is large potential for future research to examine the truly positive effects of higher levels of WTC on health (and not just mitigation of ill-health), the study of prevention of ill-health among workers is still meaningful and worthwhile: in a large sample of employed individuals in Sweden, almost $70 \%$ had some sort of complaint or illness (Wikman et al., 2005).

The previously noted systematic review (Nijp et al., 2012) found, in contrast to the relationship with work-life interference, less consistent evidence regarding effects of WTC on health. Predominantly, research has focused on mental and stress-related disorders. Evidence in that regard is summarised in the following paragraphs, first focusing on studies using self-reported measures of mental health, then compiling findings regarding objective measurements of mental health and other health-related outcomes, i.e. general health, physical health, health behaviour.

A number of studies found WTC to be inversely related to mental health complaints. In a one-year follow-up study, stable high or increasing levels of WTC were associated with fewer depressive symptoms, longer sleep duration and less fatigue after one year (Takahashi et al., 2012). A cross-sectional study found a positive relation between WTC and lower levels of mental distress (Kandolin et al., 2001); overtime hours were only associated with general distress when WTC was low, whereas in demanding family situations general distress was found to decrease with higher levels of WTC. Another cross-sectional study found that the combination of high WTC and low variability of work schedules (more regular working times) was associated with better sleep quality, fatigue recovery, and work-life balance (Kubo et al., 2013). When variability was high, sleep quality was poorer even with high WTC.

However, many studies failed to find an association between WTC and mental health outcomes (Nijp et al., 2012). A longitudinal study observed an effect of low WTC on psychological distress in women, but not in men (AlaMursula et al., 2002). A number of cross-sectional studies observed null-findings regarding effects of WTC on, for instance, psychological distress (Jang et al., 2011) and stress and burnout symptoms (Tucker et al., 2015). In a crosssectional study on junior elder-/health-care workers, no effects of WTC on mental health or vitality were observed among daytime workers, whereas low/moderate levels of control in combination with shift working hours were associated with worse mental health and vitality (Nabe-Nielsen et al., 2011). This finding indicates that shift workers with lower levels of WTC may be in a particularly vulnerable position.

Most longitudinal studies focus on the association from WTC to subsequent (mental) health, but there are some arguments for reversed causation. Several studies showed reciprocal effects between other psychosocial working conditions and mental health, for instance between job strain and depression/distress (Ibrahim et al., 2009) and job demands and psychological distress (Dalgard et al., 2009). These results indicate that in particular depressive symptoms are likely to affect ratings of job characteristics, especially since depression relates to loss of perceived control (Glass \& McKnight, 1996). If mental health complaints partially account for lower ratings of WTC, results may have systematically overestimated the impact of WTC on mental health. This could explain at least some inconsistencies in the findings.

A number of studies from the research group around Ala-Mursula discuss the influence of WTC on several aspects of health in a Finnish sample of public sector workers (Ala-Mursula et al., 2002, 2005, 2006). For instance, lower self-rated health, more psychological distress and higher sickness absence rates were observed with lower levels of WTC, but in women only (AlaMursula et al., 2002). In a further study, the relation between sickness absence and domestic, commuting, and total working hours was found to be moderated by WTC (Ala-Mursula et al., 2006). In the same cohort study, researchers found high WTC to be associated with a decreased risk of going on disability pension due to musculoskeletal disorders over a mean follow-up of more than four years (Vahtera et al., 2010). Moreover, higher levels of WTC were indicated to be helpful in coping with informal caregiving and adverse effects on sleep, whereas low WTC related to risk of sleep disturbance in a sample of ageing public sector workers (Virtanen et al., 2021).

Other evidence on effects of WTC on different outcomes of health and well-being is mixed-potentially in part due to a lack in prospective studies and no consensus on how to measure WTC. A cross-sectional study found no evidence for an effect of WTC on self-reported health in hospital employees across Europe, and likewise no interaction effects of WTC and work stress on health (Pisljar et al., 2011). In an intervention study, increases in WTC were associated with lowered sickness presenteeism, but not with self-reported health (Moen, Kelly, \& Hill, 2011). In the same study, sleep quality and energy levels of employees improved, and WTC indirectly affected exercise frequency by reducing work-home spill-over, albeit rather small effects. Another intervention study found no effect on any health and well-being outcome, but WTC was measured with a single item only (Nabe-Nielsen et al., 2011). Among a sample of shift workers, low WTC, in particular control over time off, was unrelated to physical activity (Cheng et al., 2020).

Few studies have examined the associations of WTC and self-reported outcomes of physical health. In a sample of carpenters, increases in musculoskeletal disorders were observed for those with low WTC (Lemasters et al., 1998). In European workers, WTC was inversely associated with a number of health outcomes such as muscular pains, head- and stomach aches, and fatigue (Costa et al., 2006). Results were more favourable for health if high WTC was paired with low variability of working hours (i.e. standard working hours). Finally, among several psychosocial work factors, a longitudinal study on a Swedish cohort found that increasing low levels of WTC had the biggest potential to reduce sickness absence (about 11\%) for a range of occupations (Aronsson et al., 2019).

Evidence in the literature is inconsistent regarding effects of WTC on outcomes of health. Longitudinal studies and even more so those with more than two waves of data are scarce. In addition, WTC is measured heterogeneously between studies, further hindering clear conclusions about which aspects of working time autonomy potentially benefit health or aid in preventing ill-
health. Particularly longitudinal studies find WTC to be associated with different outcomes of general, mental and physical health and to a degree alleviate stressful work or non-work conditions, indicating its potential role for a sustainable working life.

## Job-related outcomes

Though not the focus of this thesis, WTC has been related to a number of jobrelated attitudes and organizational outcomes. Several theoretical models can be used to explain beneficial effects. Again, drawing on the COR framework (Hobfoll, 1989), WTC may present a tool for individuals to manage and protect their resources. In turn, levels of WTC can be related to an individual's job attitudes, for instance intention to quit their job (turnover intention), commitment to and trust in the organization, performance, motivation, morale and job satisfaction (Baltes et al., 1999; Dilmaghani, 2021; Golden, 2011; Rhee et al., 2020). Seen from a social-exchange lens, part of these effects may also be explained by reciprocation: employees that are given higher degrees of choice over working hours may reciprocate to employers with increased commitment to work (relating for instance to performance or number of hours worked, more on this in the following section 'The cost of high work-time control'). More generally, WTC can bolster a sense of autonomy which is predicted to enhance motivation, satisfaction and productivity by the self-determination theory (Deci \& Ryan, 1985).

Predominantly, effects of WTC on job satisfaction have been examined, with a systematic review finding limited to moderately strong evidence for a positive association (Nijp et al., 2012). More recently, different types of flexible work-time arrangements (including flexibility in when, where and how much to work) were related to increases in both job satisfaction and organizational commitment in a large cross-sectional sample of British employees (Chen \& Fulmer, 2018). Perceived flexibility was proposed to offer both symbolic and substantive value and thereby affecting job-related outcomes. Out of the different arrangements, flexibility in scheduling of work (i.e. control over daily hours) was associated the strongest with job satisfaction. Another cross-sectional study on employed U.S. adults found positive effects on job satisfaction for both the ability to take time off during work and to change starting and ending times of work (Kim et al., 2020). In contrast, an intervention study on implementing self-rostering systems found mixed results in regards to job satisfaction, with no change in two groups and a decrease in job satisfaction in one group (Hansen et al., 2015).

Discussing research on job-related attitudes in detail lies beyond the scope of this thesis. In essence, WTC has been related to beneficial outcomes in that regard, in particular regarding job satisfaction. These relationships are interesting to keep in mind as explanatory pathways for subsequent effects on health and well-being.

## The cost of high work-time control

In the literature on flexible work-time arrangements, the reader quickly discovers ongoing discussions about potential adverse effects of higher flexibility on work-life balance and health. This section explores first, under which conditions WTC is found to be more or less beneficial to workers and second, whether there are drawbacks or risks that come with very high levels of control over working hours.

The generally positive impact of WTC could be moderated by some factors. For instance, an intervention study that introduced self-rostering at workplaces observed that shift-work employees did not necessarily choose the best working schedules in terms of recovery (Garde et al., 2012)-though these findings may not be generalisable to daytime workers. However, other research reported only marginal differences in working hour characteristics (i.e. more non-ergonomic shift schedules) between hospital employees utilising self-rostering or traditional shift scheduling (Karhula, Turunen, et al., 2020). Cross-sector European results showed that the most favourable outcomes for health and well-being are achieved with not only higher levels of WTC, but also low variability (i.e. low employer-based control over working hours) of working schedules (Costa et al., 2006). A different study on knowledge workers found that influence at work buffered against work-life interference only if the workplace was family-friendly (Albertsen et al., 2010). With less fam-ily-friendly employers, the effect even seemed to be reversed and produced more conflicts over time. In summary, higher degrees of WTC are related to more beneficial outcomes in workers' work-life balance, health and well-being under certain conditions: low employer-based control over working hours, family-friendliness of the employer, and few compromises in terms of healthy and ergonomic working hours.

Some indications suggest that there could be pitfalls with very high levels of control over working hours, potentially leading to worse outcomes than medium levels of WTC. More regular daily rhythms may allow for more stable functioning_physiologically, psychologically and socially (Arlinghaus \& Nachreiner, 2014; Costa et al., 2006; Reisch, 2001). Very high levels of WTC (and in particular, control over daily hours), i.e. high time sovereignty, could be disruptive to this homeostatic state and enable workers to decide on time and timing of working hours on a daily basis. Responsibility for choosing work schedules is put entirely on the individual. This can be problematic if workers choose suboptimal working hours for themselves regarding recovery and work-life balance. The act of choice and volition in itself has been argued to deplete an individual's resources for self-regulation (Baumeister, 2002). More choice may come with pitfalls such as subsequent worse health-related behaviour (Iyengar \& Lepper, 2000).

High levels of WTC could contribute to working more and longer hours. Overtime hours have been associated with higher degrees of control over
working hours (Takahashi et al., 2011). Gender differences are suggested in that regard. For instance, one study found that men with very high levels of WTC tended to increase their identification with and commitment to workwhich included higher weekly working hours (Hofäcker \& König, 2013). In contrast, women were found to use high levels of WTC to increase work-life balance, possibly by using flexibility to enhance fit of working and private life. In general, excessive working hours in relation to high degrees of flexibility have mostly been problematised with regard to knowledge-intensive sectors; ambiguous norms and culture of using flexibility may play an important role (Tucker, 2021). Flexible work-time arrangements could be perceived as a benefit that triggers reciprocation behaviour such as increased effort and time commitment. A study on German panel data however concluded that workers with complete time sovereignty increased their effort only modestly, and that this was more a reflection of increased intrinsic motivation than reciprocity (Beckmann et al., 2015).

Long working hours may in turn affect health, but a differentiation needs to be made between voluntary and involuntary overtime. The latter has been related to higher levels of fatigue and lower job satisfaction, while that was not the case when overtime was worked voluntarily (Beckers et al., 2008). On the one hand, the effect of overtime hours on health could be moderated by WTC. High WTC may buffer against negative effects on health stemming from long working hours, while overtime would hamper health more if WTC is low. This notion is supported by a study showing that control over scheduling buffered against negative health effects due to work overload (Shultz et al., 2010). Likewise, studies found that more overtime hours were unrelated to sleep outcomes with a trend towards better sleep (Åkerstedt, Fredlund, et al., 2002; Åkerstedt, Knutsson, et al., 2002). On the other hand, WTC itself may influence number of overtime hours (i.e. higher control leading to longer working hours), which in turn could affect health outcomes. As previously mentioned, gender differences are suggested in that regard: men, but not women, with high perceived levels of WTC potentially work more voluntary overtime hours (Hofäcker \& König, 2013; Lott \& Chung, 2016). This could ameliorate both work-life conflict and health outcomes among men.

On the continuum of WTC from very low to very high, ideal levels for health and well-being might not be at the very high end of the scale-or depend strongly on individual preferences, motivation, needs and adaptive strategies. Research on boundaryless work-characterised by high levels of autonomy at work in terms of content, time and space (Allvin et al., 2013)—has shown that feeling in control over boundaries between work and private life is crucial for those working in flexible, modern organizations in terms of work-life balance (Kossek et al., 2012; Mellner et al., 2014). Yet, the perceived boundary control seems to depend on the fit between preferred and actual management of boundaries, i.e. segmenting (separating) or integrating (blending) work and private life, as shown by a Swedish study (Mellner et al.,
2014). Working flexibly in time and space was related to lower boundary control only for those who preferred to keep the two domains apart. Some gender differences were indicated: men appeared to benefit more from upholding boundaries between work and private life in terms of work-life balance, but this may reflect a more traditional model of gender-labour division. Self-regulation was highlighted as essential for high boundary control, regardless of gender and individual preferences for boundary management. These findings give reason to believe that very high WTC may not pose a problem per seas long as it fits individual preferences and capabilities to self-regulate and maintain healthy boundaries between work and private life. That this can become problematic is highlighted in a recent study observing a relationship between boundaryless work and subsequent antidepressant subscriptions for women, but not for men (Hall et al., 2019). Women may be more likely to use flexibility towards increased domestic activities and unpaid responsibilities, instead of improving recovery and mitigating build-up of strain.

In summary, some indications point towards the repercussions of higher levels of WTC: higher variability of working hours, more overtime work and lower boundary control. These effects appear to depend on individual characteristics and circumstances, gender roles, preferences and work-related aspects, which could hamper workers' health.

## Knowledge Gap and Aims

Evidence points towards beneficial effects of increased levels of control over working hours on work-life balance. But systematic reviews have recognised the need for more, particularly prospective studies on the relation between WTC and health (Joyce et al., 2010; Nijp et al., 2012). Moreover, a consensus is lacking on the measurement of WTC and its sub-dimensions, and few studies are available that used longitudinal designs with data over more than two waves. Finally, very high levels of WTC could lead to blurring of boundaries between work and personal life and increased working hours, thereby potentially contributing to work-life interference and ill-health.

The overall aim of this thesis is to study the relationship between control over working hours and health. In particular, it will i) investigate the scale to measure WTC and describe levels of WTC perceived by groups of workers, ii) utilise longitudinal data to examine if WTC is associated with later mental and physical health, and iii) explore underlying mechanisms (mediating variables) and influence of third variables (moderating variables) on this relationship.

## Study-specific aims

## Study I

The first study aimed to examine the underlying factorial structure of a scale to measure WTC and describe levels and differences between workers, depending on social situation, demographic variables and work-related conditions in a cross-sectional, approximately representative sample of Swedish working individuals.

## Study II

In Study II, effects of control over daily hours and time off (sub-dimensions of WTC) on subsequent depressive symptoms were studied. To investigate the direction of such an effect, causal, reversed-causal and reciprocal pathways between the constructs were compared.

## Study III

The third study aimed at testing the mediating role of work-life interference in the relationship between WTC (control over daily hours and time off) and depressive symptoms and musculoskeletal complaints.

## Study IV

In Study IV, gender was examined as potential moderating factor in the association of WTC with work-life interference and exhaustion via overtime hours.

## Methods and Material

The following sections describe the data material including the study population, measures of variables of interest, statistical methodology and ethical considerations. An overview of aims, study samples, methods and materials per study is presented in Table 1.

## Data and study population

The data used in the empirical studies of this thesis come from the Swedish Longitudinal Occupational Survey of Health (SLOSH) - a prospective cohort study focusing on psychosocial factors relating to employment, work environment, social conditions and health and well-being. The aim of SLOSH was initially to provide nationally representative and longitudinal data regarding the Swedish working population and their work environment in order to investigate underlying causal processes between work and health. This also included different work-related factors, social position, aging, work-life balance, coping, health-related behaviours and sleep (Magnusson Hanson et al., 2018). Participants are biennially followed up to enable researchers to detect changes and mechanisms among these factors.

SLOSH is based on participants in the Swedish Work Environment Survey (SWES), which is a cross-sectional, biennial questionnaire study. The sample of SWES, in turn, is drawn from responders to the Labour Force Survey (LFS)—a survey presenting labour market developments and employment conditions for Swedish residents. A random, stratified sample of gainfully employed LFS-participants are invited to respond to SWES. Since the 2003 SWES wave, responders are followed up every other year by SLOSH, starting in 2006. New SWES participants were added to the SLOSH cohort in 2008, 2010 (only two geographic regions) and 2014. Response rates ranged from $65 \%$ (2006) to $48 \%$ (2018).
SLOSH is a self-completed, postal and usually pen-and-paper survey with two different versions to choose from: one for those working at least $30 \%$ of fulltime (during the past three months) and one for those working less than that or those who are temporarily/permanently outside the labour market (e.g. pensioners, unemployed, students, homemakers). Each wave, participants choose
which questionnaire to fill in (and if to respond at all). Part of the items included in the questionnaires depend on the version: while working respondents answer work-related questions, those outside of work receive questions considering the situation of being outside the active/paid labour force.

Both versions of the questionnaire include items regarding health, health behaviours and social situation. Single items as well as larger, popular scales are included in SLOSH, and a few questions are based on SWES. Some of the items and scales are followed up every wave, some are only measured at single points in time or have changed over time (for a complete overview see Magnusson Hanson et al., 2018). Furthermore, data from SLOSH participants are regularly linked to a number of different national register data, allowing researchers to complement information regarding demographics, employment classification, sickness absence, prescribed and purchased drugs, hospital records and mortality.

Empirical studies included in this thesis use data from different waves of SLOSH. An overview of study-specific samples, inclusion criteria and methods are found in Table 1. All studies concerned data from participants responding to questionnaires for those in paid work (i.e., at least $30 \%$ of fulltime during the past three months). A number of different self-reported measures and partly register-based information were utilised and are specified in the following sections.

## Variables

## Work-time control

Since 2008, SLOSH includes a scale to measure participants' perceived control over their working hours (Table 2). Specifically, the influence over six factors is rated on a 5-point Likert scale from 'very little' (1) to 'very much' (5): length of a workday, starting and ending times of a work day, taking breaks during work, which days to work, taking vacation/other leaves of absence and running private errands during work. In 2008, the scale included additionally the response option 'not applicable'. The scale was translated and adapted from a Finnish version, used in the Finnish Public Sector (FPS) study (Ala-Mursula et al., 2002). In the FPS study, WTC was first measured in 1997 and originally consisted of six, then seven items: starting and ending times of a workday, taking breaks during work, handling of private matters during work, scheduling work shifts, scheduling vacation and paid days off, taking unpaid leave and length of a workday (added in 2000/2001). The Swedish version differs from the Finnish scale in two ways: two items regarding vacation and unpaid leave of absence were combined and one item regarding scheduling of work shifts was rephrased as controlling which days to work.
Table 1: Study overview of samples, methods and materials.

|  | Study I | Study II | Study III | Study IV |
| :---: | :---: | :---: | :---: | :---: |
| Title | Investigating the factorial structure and availability of work time control in a representative sample of the Swedish working population | The longitudinal relationship between control over working hours and depressive symptoms: Results from SLOSH, a populationbased cohort study | The mediating effect of worklife interference on the relationship between work-time control and depressive and musculoskeletal symptoms | Prospective effects of worktime control on overtime, worklife interference and exhaustion in female and male knowledge workers |
| Sample | 14974 SLOSH participants in 2014 | 2791 SLOSH participants from 2008, 2010, 2012 and 2014 | 26804 SLOSH participants from 2010, 2012, 2014 and 2016 | 2248 SLOSH participants working within knowledge-intensive services from 2016 and 2018 |
| Inclusion | Responding to questionnaire for those in paid work ( $\geq 30 \%$ ); no missing data on work-time control | Responding to at least two questionnaires for those in paid work ( $\geq 30 \%$ ); excluding those in self-employment | Responding to at least one questionnaire for those in paid work ( $\geq 30 \%$ ) | Classified as knowledge worker at baseline and responding to at least one questionnaire for those in paid work ( $\geq 30 \%$ ) |


| Statistical <br> Methods | Exploratory and <br> confirmatory factor <br> analysis (SEM), <br> independent samples t- <br> tests, one-way ANOVAs, <br> binomial logistic <br> regression | Latent growth curve <br> modelling and cross-lagged <br> panel modelling (SEM) | Cross-lagged panel models <br> (path analysis) | General and gender-stratified <br> sequential, multiple regression <br> and conditional process analysis |
| :--- | :--- | :--- | :--- | :--- |
|  | Gender, civil status, <br> parental status, age, <br> employer type, working <br> time, overtimed <br> (education, working <br> contract, actual working <br> hours, workplace size) | Work-time control (control <br> over daily hours and control <br> over time off) | Work-time control (control <br> over daily hours and control <br> over time off) | Work-time control (control over <br> daily hours and control over <br> time off) |
| Outcome/ | Work-time control <br> (control over daily hours <br> and control over time off) | Depressive symptoms | work-life interference <br> (mediator), depressive <br> Mediator/ <br> Moderator | complains, musculoskeletal |
| Covariates | - | Age, gender, educational <br> attainment, occupational <br> status, shift-work status, <br> weekly working hours, civil <br> and parental status | Gender, occupational status, <br> age, educational attainment, <br> shift-work status, weekly <br> working hours, civil and <br> parental status | Age, civil status, parental status, <br> interference (outcome), work-life <br> hime work, occupational skill |

In a principal component analysis, the Finnish WTC-scale was found to consist of two sub-dimensions, namely 'control over daily working hours' (items 'length of a workday' and 'starting and ending times', Cronbach's alpha 0.86) and 'control over days off' (items 'scheduling vacation and paid leave' and 'taking unpaid leave', Cronbach's alpha 0.67). Some researchers analysed Finnish data of WTC separately for each sub-dimension (Ala-Mursula et al., 2005, 2006), others used an overall score (Salo et al., 2014; Vahtera et al., 2010; Virtanen et al., 2014), while again others focused on single items (Karhula et al., 2019). Likewise, the choice of index scores varied between studies: some used mean scores (Ala-Mursula et al., 2005; Vahtera et al., 2010), others formed tertiles based on mean scores (Virtanen et al., 2014) and again others formed categories of low, intermediate and high control (Karhula et al., 2019).

Choice of index scores varies slightly between studies in this thesis. Study I describes mean and median scores and utilises a median split to differentiate between higher and lower levels of control. In Study II, data are described based on mean scores and analysed using both mean scores and latent variables (items loading onto respective latent variable). Study III and Study IV again use mean scores. Table 3 displays mean scores in control over time off and control over daily hours for SLOSH participants between 2008 and 2020.

## Work-life interference

In SLOSH, interference of work with personal life is measured by a translated version of a scale developed by Fisher et al. (2009). The purpose of this scale was to capture the work/non-work interface of any working individual and to include effects on any part of private life. Earlier scales of work-family conflict focussed merely on interference with family responsibilities-thereby ignoring a large proportion of workers like those who are unmarried, without children or other close family members as well as roles, responsibilities and interests other than family-related ones. Work and private life affect each other: demands from work can interfere with private life, demands in private life can interfere with work responsibilities. Both aspects are accounted for in Fisher et al.'s measure of interference between the domains of work and nonwork. Scale validity has been examined and confirmed (Fisher et al., 2009).

In this thesis, focus is primarily put on work interfering with personal life (in contrast to personal life interfering with work). Four items of the original subscale measuring work interference with personal life were translated and included in SLOSH questionnaires for working individuals since 2010. Items concerned statements such as "I come home from work too tired to do things I would like to do" and "My personal life suffers because of my work" (for a complete overview of items see Table 2). Respondents rate the frequency they

Table 2: Overview of relevant scales and respective items.

| Scale | Items |  |
| :---: | :---: | :---: |
| Work-time control (Ala-Mursula et al., 2002) | How much can you influence your working time regarding | length of a work day? starting and ending times of a work day? taking breaks during work? which days to work? taking vacation or other leave of absence? running private errands during work? |
| Work-life interference (Fisher et al., 2009) | How often have you felt like this during the last three months? | I come home from work too tired to do things I would like to do. My job makes it difficult to maintain the kind of personal life I would like. I often neglect my personal needs because of the demands of my work. My personal life suffers because of my work. |
| Depressive symptoms The Symptom Checklist - core depression scale (SCL-CD 6 ) <br> (Magnusson Hanson, Westerlund, et al., 2014) | During the past week, how much were you bothered by | Feeling low in energy or slowed down? <br> Feeling blue? <br> Blaming yourself for things? <br> Worrying too much about things? <br> Feeling no interest in things? <br> Feeling everything is an effort? |
| Exhaustion <br> Shirom-Melamed Burnout Questionnaire (SMBQ) <br> (Shirom \& Melamed, 2006) | To what extent have these experiences occurred for most of your day? | I feel tired. <br> I feel refreshed. <br> I feel physically drained. <br> I feel fed up. <br> I feel like my 'batteries' are 'dead'. <br> I feel burned out. I feel mentally fatigued. I have no energy for going to work in the morning. |

Table 3: Mean scores of control over time off and control over daily hours (ranging from 1 to 5) between 2008 and 2020 in SLOSH questionnaires for working individuals.

|  | $\mathbf{N}$ | Mean | Standard <br> deviation |
| ---: | :---: | :---: | :---: |
| Control over time off |  |  |  |
| 2008 | 9524 | 3.25 | 1.04 |
| 2010 | 9020 | 3.14 | 1.04 |
| 2012 | 7225 | 3.14 | 1.03 |
| 2014 | 15218 | 3.18 | 1.06 |
| 2016 | 13455 | 3.20 | 1.06 |
| 2018 | 11381 | 3.22 | 1.04 |
| 2020 | 10212 | 3.30 | 1.05 |
| Control over daily hours |  |  |  |
| 2008 | 9174 | 2.87 | 1.39 |
| 2010 | 8973 | 2.83 | 1.34 |
| 2012 | 7193 | 2.82 | 1.33 |
| 2014 | 15264 | 2.87 | 1.38 |
| 2016 | 13504 | 2.89 | 1.36 |
| 2018 | 11327 | 2.90 | 1.36 |
| 2020 | 10170 | 3.00 | 1.36 |

felt a particular way during the last three months on a 5-point scale from 'not at all' to 'almost all of the time'. Means were calculated across items in both Study III and Study IV. We found Cronbach's alphas to be 0.89 (2010), 0.89 (2012), 0.90 (2014), 0.91 (2016) and 0.92 (2018).

## Overtime hours

Since the 2016-wave of SLOSH, quantity of overtime hours is measured with one item asking "How many hours of overtime-paid and unpaid-do you usually work per week?". Participants estimate number of hours in an open response field. This format allowed for a finely grained picture, good differentiation between individuals and analysis on the ratio scale. However, a small number of participants rated number of hours unrealistically high and data were excluded for those; any number higher than 30 hours per week was rated as missing, a cut-off value chosen equally in previous research (Beckers et al., 2008). In Study IV, overtime hours were assessed both as outcome and intermediary variable for the 2016 and 2018 data collection (rated as missing of $>30$ hours of overtime per week $\mathrm{n}=10$ in 2016 and $\mathrm{n}=12$ in 2018 for the eligible sample).

## Depressive symptoms

A subscale of the Hopkins Symptom Checklist (SCL-90) was used to measure core symptoms of depression (Lipman, 1986). SCL-90 (which also exists as a 58 - and 35 -item version) measures several factors of mental complaints that can be related to clinical diagnoses: somatisation, phobic-anxiety, retarded depression, agitated depression, obsessive-compulsive phobia, interpersonal sensitivity, anger-hostility and psychoticism. The Symptom Checklist-core depression (SCL-CD ${ }_{6}$ ) scale contains six items asking how much participants have been bothered by any of the following symptoms during the last week: feeling lethargic or low in energy, feeling blue, blaming oneself for things, worrying too much about things, feeling no interest in things and feeling like everything is an effort. The perceived intensity of these symptoms is rated on a 5-point scale from 'not at all' to 'very much'. Psychometric properties as well as diagnostic cut-off values have been examined previously, utilising a sub-sample of SLOSH (Magnusson Hanson, Westerlund, et al., 2014). Sum scores are built across items, resulting in a range from 0 to 24 and with scores of 17 or more indicating clinical levels of depression. Descriptive statistics and frequencies of scores signifying major depression for working individuals participating in SLOSH between 2008 and 2020 can be inspected in Table 4.

Study II and III include depressive symptoms as outcome variable from 2008 to 2014 and 2010 to 2016, respectively. Cronbach's alphas lay between 0.89 (2016) and 0.92 (2010). Study II utilised a latent variable representation of depressive symptoms, while Study III analysed sum scores.

## Exhaustion

A sub-scale of the Shirom-Melamed Burnout Questionnaire (SMBQ; Shirom \& Melamed, 2006) is included in SLOSH questionnaires since 2012, seeking to measure emotional exhaustion and physical fatigue. The SMBQ as a whole aims at capturing the multi-dimensionality of burnout, namely physical, emotional and cognitive exhaustion. It has been developed as a conceptional alternative to the popular Maslach-Burnout Inventory (MBI; Maslach \& Jackson, 1981), yielding comparable psychometric qualities (Shirom \& Melamed, 2006). Although the SMBQ was originally aimed more at the working population, it has proven useful even in clinical settings (Stenlund et al., 2007). With some adaptations regarding included items, the scale's construct validity was confirmed in a clinical and non-clinical sample (Lundgren-Nilsson et al., 2012).

Table 4: Descriptive statistics and frequencies for health outcomes from SLOSH questionnaires for working individuals between 2008 and 2020.

|  | N | Mean | Standard deviation | \% with score $\geq 17$ <br> (major depression) |
| :---: | :---: | :---: | :---: | :---: |
| Depressive symptoms (range 0-24) |  |  |  |  |
| 2008 | 11129 | 5.61 | 5.33 | 5.0 \% |
| 2010 | 11211 | 5.16 | 5.17 | 4.7 \% |
| 2012 | 9673 | 4.50 | 4.85 | 3.5 \% |
| 2014 | 19954 | 5.00 | 4.98 | 3.9 \% |
| 2016 | 18998 | 4.86 | 5.00 | 4.0 \% |
| 2018 | 17546 | 4.66 | 4.99 | 3.7 \% |
| 2020 | 17123 | 4.71 | 4.86 | 3.4 \% |
|  | N | Mean | Standard deviation | $\begin{gathered} \% \text { with mean } \\ \text { score }<2 \\ (1=\text { almost never }) \end{gathered}$ |
| Exhaustion (range 1-7) |  |  |  |  |
| 2014 | 20131 | 2.33 | 1.28 | 49.2 \% |
| 2016 | 19147 | 2.32 | 1.32 | 50.5 \% |
| 2018 | 17591 | 2.28 | 1.32 | 52.5 \% |
| 2020 | 17346 | 2.16 | 1.25 | 56.9 \% |
|  | N | Mean | Standard deviation | \% without any complaints |
| Musculoskeletal complaints (range ' $\mathbf{1 - n o}$ - to ' $\mathbf{4} \mathbf{-}$ yes, affects my life a lot') |  |  |  |  |
| 2008 | 11133 | 1.52 | 0.95 | 74.3 \% |
| 2010 | 11201 | 1.58 | 0.96 | 70.4 \% |
| 2012 | 9652 | 1.60 | 0.98 | 69.9 \% |
| 2014 | 20032 | 1.60 | 0.99 | 69.8 \% |
| 2016 | 19084 | 1.60 | 1.00 | 70.1 \% |
| 2018 | 17543 | 1.60 | 0.99 | 70.3 \% |
| 2020 | 17142 | 1.59 | 0.99 | 70.6 \% |

In SLOSH, eight items of the SMBQ are included (see Table 2), rated on a 7-point Likert scale from 'almost never' (1) to 'almost always' (7). Items concern symptoms of emotional and physical exhaustion and in how far the respondent experiences these most of a day. In a previous study, two of the items showed low factor loadings and rendered the scale time-variant (Leineweber et al., 2021). By excluding these items ('I feel refreshed' and 'I feel physically exhausted'), scores of the factor solution and internal consistency improved. Excluding the only positively framed item regarding feeling refreshed followed even recommendations by Shirom and Melamed (Shirom \& Melamed, 2006) and general ones for measuring burnout (Qiao \& Schaufeli, 2011). The average of the remaining six items as well as the proportion with a score $<2$ (suggesting almost no symptoms of exhaustion) are presented in Table 4 for working individuals responding to SLOSH between 2014 and 2020. In Study IV, mean scores were used as indicator of exhaustion in 2018. Cronbach's alpha was 0.92 .

## Musculoskeletal complaints

In SLOSH, one measure is included to examine if participants had any longlasting or serious complaints or diagnoses during the last two years and how much these affected their lives. The complaints concern mostly physical symptoms, such as high blood pressure, diabetes, migraine. Musculoskeletal complaints are measured with one item regarding diseases of the back, joints and muscles. Participants rated how much these complaints affected their lives with the response options 'no', 'yes, but does not affect my life at all', 'yes, affects my life a little' and 'yes, affects my life a lot'. Descriptives and the proportion of those without any complaints can be found in Table 4. In Study III, musculoskeletal complaints were analysed as categories as well as mean scores (rating 'no' as 1 and 'yes, affects my life a lot' as 4).

## Demographic and work-related measures

A number of demographic and work-related variables are measured in SLOSH or can be accessed via registers and linked to participants. Study-specific information on included variables as exposure, outcome, intermediary/moderating variable and covariate can be found in Table 1. Demographic variables of interest concerned respondents' gender (male/female), age (at the end of the year of data collection), highest educational attainment (differentiating between a maximum of 9 years of school, gymnasium (high school), less than 3 years of university, exactly or more than 3 years of university and doctoral education), civil status (single/living alone versus married/cohabiting), and parental status (at least one child versus no children living at home). A number of different work-related information was included in the empirical studies of
this thesis. Regarding the employment type, variables concerned type of employer (private company, association/non-profit organization, governmental, farmer, entrepreneur with/without employees), working hours contract (fulltime, part-time with fixed working time, part-time with varying working hours, non-employed/self-employed), usual work schedule (daytime, evening, permanent night work, rotating shift work (with or without nights), rostered work (with or without nights), non-regulated/varying working hours, other), and workplace size (none versus 1 to 9 versus 10 or more). Actual weekly working hours were measured from less than 10 hours to 60 or more hours (before 2016: in seven categories; since 2016: in ten categories). Overtime was measured as weekly hours of paid and unpaid overtime (before 2016: categorical at least once a week yes/no; since 2016: numerical). Information on respondents' occupational status came from the Swedish socio-economic classification ('socioekonomisk indelning', SEI; Statistics Sweden, 1984), differentiating between manual workers (unskilled and skilled), non-manual workers (lower, medium, high, leading professionals) and self-employed workers (professionals, entrepreneurs, farmers). Occupational skill level was based on the Swedish Standard Classification of Occupations ('standard för svensk yrkesklassificering', SSYK 2012; Statistics Sweden, 2012), which in turn is based on the International Standard Classification of Occupations (ISCO-08; International Labour Office, 2012). Workers are categorised based on occupations and their job tasks and required skill/educational level (managers, professionals, technicians and associate professionals, clerical support workers, service and sales workers, skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machines operators and assemblers, elementary occupations, armed forces occupations). Hierarchical position differentiated between no leading role, supervisor but not manager, manager without subordinates and manager with subordinates.

## Statistical analysis

Studies included in this thesis apply a range of statistical methods. While Study II and III model data using structural equation modelling (SEM) across four waves, Study I and IV utilise more traditional regression modelling of one or two data collections. The following sections are ordered analysis-based, and not chronologically per study. Software used for analyses included SPSS statistics (version 22 to 27; IBM Corp., 2013), Mplus (Muthén \& Muthén, 2012) and R (R Core Team, 2017). Statistical testing and inferences were focused on model fit indexes, point estimates including confidence intervals ( $95 \% \mathrm{CI}$ ) and applicable p-values.

## Regression modelling

## Logistic regression

In Study I, binomial logistic regression models were estimated in order to test the likelihood of experiencing low WTC (i.e., below the median) considering a number of demographic/work-related factor. We used cross-sectional data from working individuals of the 2014 SLOSH wave. Variables predicting low control over daily hours/time off were step-wise reduced and model fit differences were assessed with Chi-square difference tests and Hosmer and Lemeshow tests of goodness of fit. We calculated odds ratios (OR), means and mean differences (MD) including their $95 \%$ confidence intervals (partly attained by bootstrapping based on 1000 samples).

## Linear regression

In Study IV, we used sequential, multiple regression models in R (R Core Team, 2017) to test the association of i) control over daily hours and time off and gender with subsequent overtime hours and ii) control over daily hours and time off, gender and overtime hours with subsequent work-life interference and exhaustion. Prior to analysing data, we examined underlying assumptions of multiple regression analysis; all assumptions were met apart from normality of residuals. Due to the Central Limit Theorem and the sample size being sufficiently large, the assumption of normality of residuals could be relaxed (Pek et al., 2018).

Variables were included step-wise, starting with both WTC sub-dimensions, then gender and overtime hours (the latter regarding work-life interference and exhaustion only), and finally covariates (age, civil and parental status, leading role, fulltime/part-time work, occupational skill level).

## Conditional process analysis

Conditional process analysis, a regression-based method, was implemented in Study IV using the PROCESS macro for SPSS (Hayes, 2017). First, we examined the moderating role of gender in the association of control over time off/daily hours with subsequent overtime hours. Next, moderated mediation was tested, namely whether the mediating effect of overtime on the relationship between control over time off/daily hours and subsequent work-life interference and exhaustion was moderated by gender. In other words, we assumed the process of WTC affecting work-life interference/exhaustion via overtime to be contingent on gender. Conditional process analysis integrates mediation and moderation analysis and allows to test if an indirect effect is a function of a moderating variable (Hayes \& Rockwood, 2020). In our model, we tested for first-stage moderated mediation (allowing gender not only to moderate the indirect, but also the direct effect (Hayes, 2017) with centred continuous variables and covariate-adjusted estimates; see previous section
and Table 1). Confidence intervals were based on 10000 bootstrap samples. Using interval estimates of the index of moderated mediation, it is tested whether the effect of the moderating variable (gender) on the indirect effect (WTC to overtime to work-life interference/exhaustion) is different from zero (Hayes, 2015).

## Structural equation modelling

In contrast to single-equation regression analysis, SEM can include multiple equations and model pathways between several variables. This allows to model more complex relationships, both directional and non-directional. These relationships are reflected in structural models that are underlying the observed data. Inevitably, all models are simplifying reality; SEM is an analytical approach searching for the most parsimonious model while still satisfying goodness of fit. Simply put, models in SEM are simplifications that are useful and efficient in explaining and predicting processes. Two types of variables need to be differentiated: observed and latent ones. While observed (manifest) variables mean measured values of a construct of interest, a latent variable uses several measurements as indicators for the construct, thereby controlling for measurement error (Little, 2013b). Path analysis, as used in Study III, involves only observed variables and as a result, lacks the advantage of accounting for measurement errors. In evaluations of model fit and comparisons between models, we focused on fit indexes such as the root mean square error of approximation (RMSEA) and the comparative fit index (CFI).

## Exploratory and confirmatory factor analysis

Study I investigates the factorial structure of a scale measuring WTC. In a first step, underlying factors were tested in an exploratory factor analysis (EFA). For this, we used a $90 \%$ sub-sample of the data to allow using the remaining $10 \%$ of participants for cross-validation in a confirmatory factor analysis (CFA). The CFA, the measurement model, is the link between the observed indicators of a latent variable and essentially the basis for further model evaluations and comparisons. Factor loadings and fit indexes were considered to evaluate model fit for different factor solutions.

## Latent growth curve modelling

Study II utilised latent growth curve modelling to examine if change in WTC (control over daily hours and control over time off) was related to change in depressive symptoms over time. Across four waves, individual trajectories were modelled for control over daily hours/time off and depressive symptoms. Each variable was predicted by an average latent intercept (average starting point) and latent slope (average rate of change), with a significant variance on these estimates indicating significant differences between individuals. While
depressive symptoms were used as latent variables, both WTC sub-dimensions produced identification issues and were included as observed variables.

Several models were tested subsequently, including i) random intercepts and no slopes, ii) random intercepts and fixed slopes, iii) random intercepts and random slopes, iv) random intercepts and correlated random slopes, v) correlated random intercepts and random slopes, and finally vi) correlated random intercepts and correlated random slopes. Comparing these models allowed to determine in how far intercepts and slopes of the variables were associated with each other. Since using slopes-the rate of change-means removing information regarding which variable preceded the other in time, conclusions on causality cannot be drawn. Additionally, we tested gender differences for the best-fitting model by comparing two models either constraining or freeing intercept/slope parameters.

## Cross-lagged panel models

Cross-lagged panel modelling can be used to determine the direction of an effect, ideally with a minimum of three measurement points for all relevant variables (Little, 2013c). Both Study II and III used cross-lagged panel models, but in slightly different formats.

In Study II, latent variables across four waves were used to examine the direction of effect between control over daily hours and time off and depressive symptoms, in separate analyses for each WTC sub-dimension. Models that were compared included i) autoregressive pathways across time points within the same concept only, ii) causal pathways from WTC to subsequent depressive symptoms, iii) reversed-causal pathways from depressive symptoms to subsequent WTC, and iv) reciprocal pathways in both causal and re-versed-causal directions. Comparing model fit allowed estimating which model was best-fitting and which direction of effect predominated in the relationship between WTC and depressive symptoms. Additionally, gender differences were tested for the best-fitting model by comparing two models either constraining or freeing relevant parameters.

In Study III, cross-lagged panel models were used to test the mediating role of work-life interference in the relationship between control over daily hours/time off and depressive/musculoskeletal symptoms. Exposure (control over daily hours/time off), mediator (work-life interference) and outcome variables (depressive/musculoskeletal symptoms) were all measured at four time points and analyses performed separately for each variable combination (e.g. control over time off and depressive symptoms). Analyses were performed using the maximum likelihood estimator and compared to results with the weighted least square mean and variance adjusted estimator (for categorical data) -if estimates and model decisions were largely in accordance with each other, results were preferably reported based on maximum likelihood estimation due to the advantage of handling missing data (regarding MAR) in a better way.

Across four measurement points, model fit was compared between models including and adding succinctly the following pathways to basic autoregressive pathways within variables (see Figure 2): i) cross-sectional covariances between variables, ii) causal-mediational paths (e.g. from control over time off 1 to work-life interference 2 to depressive symptoms 3), iii) reversed-mediational paths (e.g. from depressive symptoms 1 to work-life interference 2 to control over time off 3), iv) direct paths (e.g. from control over time off 1 to depressive symptoms 2 ), and $v$ ) reversed-direct paths (e.g. from depressive symptoms 1 to control over time off 2). Finally, pathways improving model fit in previous models, lags larger than one across time within variables and covariates were added stepwise to a final model. Non-significant pathways were pruned in this model. Only if causal mediational pathways remained significant in the final model, the total indirect effect was calculated as the sum of product of mediational pathways in a model including other directed pathways as covariances (Little, 2013a). Confidence intervals of the total indirect effect estimate were based on bootstrapping ( 1000 samples). As a large number of tests were performed, significance levels were set to 0.001 (Sterne \& Smith, 2001).

## Ethical considerations

Studies discussed in this thesis use panel-data of Swedish workers from SLOSH. All data collection waves as well as studies included in this thesis underwent ethical evaluation at the Regional Ethics Board in Stockholm. Data collection of SLOSH is performed by Statistics Sweden (Statistiska centralbyrån, SCB) with data being transferred to researchers in a de-identified format. Participants are informed about the purpose of SLOSH, linkage to register data, voluntariness of participation and distribution of results in the beginning of each questionnaire in each wave.

Although intrusiveness of data collection and items is limited, some considerations about ethical concerns have to be acknowledged. SLOSH includes a number of sensitive information about participants and links to national register data are possible. Anonymity of participants is a main concern at that. SCB removes connections to personal security numbers and allocates new identifier numbers. Likewise, national register data are matched to SLOSH data by identification numbers provided by SCB. That way, researchers cannot connect data to individuals. Further, data need to be safeguarded against misuse. Studies that use SLOSH data need to provide separate ethical approval in order to access subsets of data. Additionally, as SLOSH involves a large number of sensitive information about participants which could potentially mean backward identification of single individuals, data are not published and openly accessible.

Model 0:


Model 1:


Model 2:


Model 3:


Model 4:


Figure 2: Cross-lagged panel models tested and compared in Study III between WTC (control over daily hours or time off), work-life interference (WLI) and health outcomes (H; depressive or musculoskeletal symptoms); figure from Albrecht, Kecklund, et al., 2020.

Some items in the questionnaires concern sensitive or personal topics, in particular regarding mental health complaints. As a result, respondents may experience increased negative affectivity. At the same time, information on individuals' state of mental health is crucial for research with the ultimate goal of improving the situation or understanding risk of mental ill-health for those affected. And on a positive note, reflecting upon health and health behaviourrelated questions may prompt respondents to check or improve their health, behaviour or work situation.

In contrast to cross-sectional studies, some additional issues need to be considered when using longitudinal data. Responses to questionnaires are linked across waves and participants cannot be informed about the purpose of all studies that will use their data in the future, as interests and hypotheses of researchers may evolve over time. Likewise, best practices of ethical data collection may develop which cannot be fully anticipated in advance. As SLOSH undergoes ethical evaluation for each wave, new ethical requirements will be considered consequently. Additionally, participants can decide to partake for each survey separately and also refuse participation in any future data collection.

## Summary of Results

Studies included in this thesis concerned WTC and its association with different outcomes relating to health. Findings of the individual studies are briefly reviewed in the following sections.

## Study I: Investigating the factorial structure and availability of work time control in a representative sample of the Swedish working population

Study I focused on two things: i) the factorial structure of the measure for WTC and ii) the descriptive levels of control in different groups of labour sectors and demographic conditions. Cross-sectional data from the 2014-wave of SLOSH for working individuals were used with a total sample size of n=14 974 participants.

The EFA found best fit for a two-factorial model—but model fit indices were satisfactory only after removing one item from the 6-item scale. 'Control over which days to work' cross-loaded on both latent factors and loadings were fairly low. After excluding this item, the EFA resulted in good model fit for the two-factorial model $\left(\chi^{2}(1)=1.92 ; p=0.17 ;\right.$ RMSEA $\left.=0.01\right)$. The two factors could be described as 'control over daily hours' (two items: length of a work day, starting and ending times of a work day) and 'control over time off' (three items: scheduling vacation/other leave of absence, taking breaks during work, running private errands during work). This two-factorial model was then cross-validated using a CFA, which again found better model fit for the two-factor solution $\left(\chi^{2}(4)=29.51 ; \mathrm{p}<0.001 ;\right.$ RMSEA $=0.06 ; 95 \% \mathrm{CI}$ 0.04 to $0.09 ; \mathrm{CFI}=0.99$ ) compared to a one-factor model $\left(\chi^{2}(5)=1200.37\right.$; $\mathrm{p}<0.001 ;$ RMSEA $=0.39,95 \%$ CI 0.37 to $0.41 ; \mathrm{CFI}=0.96$ ). Internal consistency of the scale was confirmed with Cronbach's alpha at 0.88 for the total WTC scale, 0.93 for 'control over daily hours' and 0.77 for 'control over time off'. We then examined averages of the two sub-dimensions of WTC and group differences regarding a number of work- and demographic-related variables (selected results presented in Figure 3 and Figure 4). Control over time off was overall rated higher by workers than control over daily hours. We found the largest differences in mean scores of both control over time off and control over daily hours for gender (men $>$ women), labour sector (private $>$
public), employment (self-employed $>$ employed), working time (daytime $>$ shift/roster/night work), overtime hours (at least once a week overtime $>$ less than once a week overtime) and education (university/post-graduate $>$ primary/secondary school). Differences tended to be smaller regarding control over time off (particularly for working time schedules and to a lesser degree for working overtime and educational level).

In separate logistic regression models per sub-dimension of WTC, we tested which of the demographic and work-related variables contributed to predicting levels of control. Particularly shift work, rostered work and night work stood out as strong predictors for lower levels of control over daily hours and, to a lesser degree, control over time off. Being married/co-habiting predicted higher levels of control over daily hours and time off for men only. Likewise, working less than once a week overtime predicted higher control over time off for men, but not women.

In conclusion, we replicated that the scale measuring WTC represents two underlying sub-dimensions regarding daily working hours and time off from work. Among workers in our sample, we saw systematic differences in the availability of either aspect of WTC, which highlights that control over working hours is not equally distributed and is linked to a number of work-related and demographic factors.


Figure 3: Gender-stratified averages and 95\% confidence intervals in control over daily hours regarding working time and sector.


Figure 4: Gender-stratified averages and 95\% confidence intervals in control over time off regarding working time and sector.

# Study II: The longitudinal relationship between control over working hours and depressive symptoms: Results from SLOSH, a population-based cohort study 

In the literature, several studies found evidence of WTC predicting levels of work-life interference, yet effects on health-related outcomes are less clear (Nijp et al., 2012). This second study examined associations between either sub-dimension of WTC and subsequent depressive symptoms. We then tested the direction of such an effect, comparing causal, reversed-causal and reciprocal pathways. Data came from four waves of SLOSH from 2008 to 2014. Using latent growth curve modelling, we found best fit for models with correlated intercepts between control over daily hours and depressive symptoms (correlation coefficient $=-0.083, \mathrm{p}<0.001$ ), and with both correlated intercepts and slopes between control over time off and depressive symptoms (correlation coefficient intercept $=-0.145, \mathrm{p}<0.001$, correlation coefficient slope $=-0.217, p=0.005)$. Effects tended to be larger for control over time off compared to control over daily hours. Control over daily hours by itself appeared to be stable over time on average, as indicated by a non-significant slope mean. While higher initial levels of control over daily hours were related to lower initial depressive symptoms only (and not rate of change), increasing levels of control over time off were associated with decreasing depressive symptoms over time.

Testing cross-lagged panel models, we found best model fit for the causal models including pathways in the direction from control over daily hours to subsequent depressive symptoms and from control over time off to subsequent depressive symptoms (e.g. WTC $1 \rightarrow$ depression 2). Differences to the other models (reversed-causal and reciprocal pathways) appeared to be fairly small though, indicating that reversed processes might still be at play to a smaller degree.

In both latent growth curve and cross-lagged panel models, we tested for gender differences, but model fit did not improve when allowing coefficients to vary by gender. This could either indicate that women and men benefit equally from WTC in terms of mental health, or that the selected sample made detecting gender differences difficult due to horizontally and vertically gen-der-segregated labour sectors.


Figure 5: Estimated correlation coefficients for best fitting models between latent intercepts and slopes (indicators not displayed) of control over time off/control over daily hours and depressive symptoms in latent growth curve models ( $* * * p<0.001$, ** $p<0.01$ ).

## Study III: The mediating effect of work-life interference on the relationship between work-time control and depressive and musculoskeletal symptoms

One of the proposed mechanisms underlying effects of WTC on health assumes that more control over working hours allows workers to better align private and work life and hence, prevents or buffers against conflicts between these domains. In the third study, we tested the mediating role of work-life interference in the association between WTC and mental and physical health outcomes. Particularly, we were interested in effects of control over daily hours and time off on subsequent levels of depressive symptoms and musculoskeletal complaints. We used path analysis in cross-lagged panel models to examine mediation via work-life interference in these relationships, with SLOSH data from 2010 to 2016 (four waves).

Results on depressive symptoms showed best model fit for models including both causal and reversed causal pathways between control over daily hours, work-life interference and depressive symptoms. However, pathways from work-life interference to subsequent control over daily hours (one part of the reversed mediation chain) became non-significant in final models. Figure 6 (from Albrecht, Kecklund, et al., 2020) presents standardised parameter estimates for both final models on control over daily hours and control over time off (covariates not displayed, but included in the models). We concluded that reversed processes played a role for specifically depressive symptoms affecting work-life interference. Causal pathways from control over daily hours to subsequent work-life interference to subsequent depressive symptoms remained significant after including a number of potential confounders. The estimate for the total indirect effect was significant at -0.018 (95\% CI -0.026 to -0.010 ), meaning for a 1 -unit increase of the score for control over daily hours (range 1 to 5), a decrease in the score of depressive symptoms (range 0 to 24) of 0.018 was attributable to work-life interference.

Results were similar regarding control over time off: both causal and re-versed-causal mediation paths were retained in the final model, but pathways from work-life interference to subsequent control over time off were non-significant. Causal pathways (control over time off to work-life interference to depressive symptoms) remained significant despite adding potential confounders to the model. The total indirect effect estimate was -0.053 (95\% CI 0.065 to -0.042); for every 1 -unit increase in the control over time off score, a decrease of 0.053 on the score of depressive symptoms was attributable to work-life interference.

Regarding mediation via work-life interference on effects of control over daily hours and musculoskeletal symptoms, we found causal, reversed-causal, direct and reversed-direct pathways to play a role. Still, causal mediation path-
ways remained significant in the final model and covariate inclusion attenuated estimates only slightly (again, pathways from work-life interference to subsequent control over daily hours became non-significant). The total indirect effect was very small at $-0.003(95 \% \mathrm{CI}-0.004$ to -0.002 ). For control over time off and musculoskeletal symptoms, results were very similar, and the total indirect effect estimate regarding mediation via work-life interference was significant but very small at $-0.007(95 \%$ CI -0.008 to -0.005$)$. Standardised parameter estimates for both final models regarding control over daily hours and control over time off are displayed in Figure 7 (from Albrecht, Kecklund, et al., 2020).

In summary, while we found evidence for partial mediation via work-life interference, effects were small for depressive symptoms and very small for musculoskeletal complaints.

Figure 6: Final models with standardised estimates in Study III for the outcome depressive symptoms with covariates included in models, but not displayed (from Albrecht, Kecklund et al. 2020, supplementary material).


Figure 7: Final models with standardised estimates in Study III for the outcome musculoskeletal symptoms with covariates included in models, but not displayed (from Albrecht, Kecklund et al. 2020, supplementary material).


## Study IV: Prospective effects of work-time control on overtime, work-life interference and exhaustion in female and male knowledge workers

Some evidence exists regarding the relationship between flexible working hours and overtime work, mainly concerning differences between genders with higher levels of WTC: while women appear to use flexibility at work to buffer against work-life interference, men tend to further increase working hours, thereby exacerbating work-life interference (Hofäcker \& König, 2013; Lott \& Chung, 2016). In Study IV, we investigated if gender moderated the effects of control over daily hours/time off on work-life interference and exhaustion via overtime hours (moderated mediation). Since men and women are unequally distributed between labour sectors, we selected a more homogeneous sample, knowledge workers, to ascertain both genders having similar access to flexibility as well as the opportunity to work overtime hours. In a subsample of SLOSH data from 2016 to 2018 ( $\mathrm{n}=2248$ knowledge workers), we employed hierarchical, multiple regression modelling to estimate associations (in overall and gender-stratified samples) and conditional process analysis to test for moderation and moderated mediation.

We found men to work on average 42 more minutes of overtime per week than women, after adjusting for covariates. Higher control over daily hours was related to more subsequent overtime in overall ( 24 minutes/week more per 1-unit increase in control) and for men ( 22 minutes/week more per 1-unit increase in control) in stratified crude results, but confidence intervals for all estimates crossed zero when including covariates. Control over time off appeared to relate to a decrease in overtime in general and male samples, but again, confidence intervals crossed zero in both crude and adjusted analyses. Point estimates for both control over daily hours and time off on overtime hours were close to zero for women. However, we found no evidence for gender moderating the effects from either WTC sub-dimension to subsequent overtime hours as indicated by interaction terms (control over daily hours: $0.278,95 \%$ CI -0.760 to 0.205 ; control over time off: -0.100 , $95 \%$ CI -0.735 to 0.535 ).

Regarding work-life interference, point estimates for control over daily hours were close to zero (in overall and stratified samples), while control over time off was related to a decrease in work-life interference, particularly for women. Confidence intervals were crossing zero for the index of moderated mediation (control over daily hours: $0.015,95 \%$ CI -0.016 to 0.046 ; control over time off: $0.030,95 \%$ CI -0.014 to 0.079 ), meaning our data did not support evidence for gender moderating the mediated effect via overtime hours in the relationship between control over time off/daily hours and work-life interference. Conditional indirect effect estimates are displayed in Figure 8.

When exploring other models, we found evidence for only one model: a mediation model for control over time off and work-life interference via overtime; higher control over time off was related to lower levels of work-life interference and this effect appeared to be going, at least in part, through fewer overtime hours. Most importantly, this effect was independent of gender.

We found control over time off related to lower subsequent levels of exhaustion for both women and men (adjusted results). Overtime appeared to be unrelated to exhaustion levels, as well as control over daily hours, with point estimates close to zero. From the index of moderated mediation (control over daily hours: $0.004,95 \%$ CI -0.004 to 0.015 ; control over time off: $0.006,95 \%$ CI -0.006 to 0.022 ), we could not infer that gender moderated the mediating role of overtime in the relationship between control over daily hours/time off and exhaustion. Conditional indirect effect estimates are displayed in Figure 9. When exploring mediation-only and moderation-only models, all interaction and indirect effect estimates contained zero in their confidence intervals.

In summary, although we found some indications for traditional genderrole time allocation among a sample of knowledge workers regarding overtime hours, we could not confirm gender moderating the indirect effect of WTC on work-life interference or exhaustion via overtime hours. In particular, control over time off was beneficial for knowledge workers, relating to less work-life interference and lower levels of exhaustion.

Figure 8: Conditional indirect effect estimates and 95\% confidence interval of control over time off and control over daily hours on work-life interference for women and men (moderator) through overtime hours (mediator).


Figure 9: Conditional indirect effect estimates and 95\% confidence interval of control over time off and control over daily hours on exhaustion for women and men (moderator) through overtime hours (mediator).


## Methodological Considerations

Studies included in this thesis sought to increase our understanding of the relationship between perceived control over working hours and health by examining a large sample of working individuals in Sweden, applying longitudinal study designs and utilising sophisticated statistical methods. Notwithstanding these strengths of the research presented, findings should be interpreted in light of a number of potential methodological limitations that are discussed below.

## Confounding bias

One major focus when seeking to infer causality from observational studies is bias due to confounding. A confounder, a common cause of both exposure and outcome variables, can both make an association appear or cover a true association (likewise, a relationship may seem stronger or weaker). Identification and measurement of potentially confounding variables is crucial to prevent biased results as much as possible (Pearl et al., 1999).

A useful tool to think about and display relationships among exposure, outcome and confounding variables are directed acyclic graphs (DAGs; Tu \& Gilthorpe, 2012). By plotting directed relationships between variables based on theoretical considerations and empirical evidence, DAGs help to identify when adjustment for a confounder is needed, but also when adjustment could actually introduce bias or overcontrol results (Textor et al., 2016). Unknown and unmeasured confounding variables often still remain a challenge.

In the studies of this thesis, DAGs were continuously used to graph assumed/known pathways between variables and pinpoint sets of covariates for adjustment in analyses. Additionally, Study I gave an overview of several variables and their associations with WTC. Even though SLOSH includes a number of useful information about participants, both self-reported and registerbased, unknown confounders cannot be ruled out and may have biased results to a degree. Particularly personality traits such as locus of control could play a role in both increased needs for autonomy and agency as well as higher susceptibility for ill-health ( Ng et al., 2006). One study on job attitudes saw positive effects of flexible work-time arrangements were generally underestimated when unobserved, time-constant variables were not taken into account
(Kröll \& Nüesch, 2019). If the mechanisms and unobserved variables are similar regarding effects on health-related outcomes, findings reported in this thesis may underestimate beneficial effects of WTC.

A number of potentially confounding variables were adjusted for in Study II to IV; study-specific sets of covariates can be found in Table 1. Social position was deemed to be an important potential confounder, related both to levels of WTC and health outcomes. Different indicators of an individual's social position-education, occupational class and income-contribute independently and distinctly to health (Geyer et al., 2006). In studies in this thesis, focus is put on educational attainment and occupational class in favour of income. Education is less prone to be reversely affected by health as it usually precedes effects on health in time (Diderichsen et al., 2012) and reflects to a degree also parental social position (Geyer et al., 2006). In SLOSH, most participants have likely reached their highest educational level. In contrast, a number of participants might not have reached their full potential in terms of income-e.g. young individuals with high education but entry-level jobs. Likewise, WTC is likely more closely related to education than income-especially knowledge workers have oftentimes higher control over their working hours, but not necessarily high income (depending on working sector and hierarchical position). It has even been argued that income may lead to an underestimation of population effects regarding individual differences in health (Lynch et al., 2000). Income was therefore not included as covariate in any of the four studies in this thesis.

The relationship between occupation and WTC is less straightforward. In general, lower levels of WTC are related to lower occupational class (AlaMursula et al., 2006). This may in part reflect the higher frequency of shift working systems within manual and lower non-manual work-with levels of WTC usually being low in shift workers compared to daytime workers (Nätti et al., 2014). In Study II and III, occupational class (differentiating between manual, lower non-manual and medium-to-high non-manual workers) is included as potential confounding variable; however, occupation or industry would have likely better represented differential availability of WTC to workers. For instance, a construction worker may have regular hours with some discretion over taking breaks and time off, while a medical doctor could have fairly little influence over variable working hours and taking breaks and vacation. Occupational class may have been a fairly coarse grouping, but at the same time, educational level likely complemented this information well.

In all studies, psychosocial factors other than WTC were excluded as covariates. This decision was led by the assumption that WTC is i) overlapping to some degree with other psychosocial factors at work and ii) predicted to affect other psychosocial conditions; for instance, higher levels of WTC may facilitate dealing with high job demands, WTC may be perceived as a form of reward for expended effort, both WTC and job control provide a sense of au-
tonomy and discretion over work. Psychosocial work factors being intertwined is a common problem in this field of research and remains a balancing act between under- and overadjusting results (Tang, 2014).

## Selection bias

Bias can be introduced if selection into the data pool depends on common effects of exposure and outcome variables, hence the selected sample systematically differing from the respective population (Hernán et al., 2004). In observational studies, participants in a sample are selected (or self-select) at different stages; selective first recruitment, selective missing data across data collection, and selective loss to follow-up.

In this thesis, data came from SLOSH, which is based on SWES, which in turn in based on LFS-a random sample of Swedish residents. Although a random, representative sample creates a good basis to limit bias due to selection, only around $55 \%$ of eligible LFS respondents (those being gainfully employed at the time and responding to particular LFS waves) agreed to participate in SWES. In turn, response rates for initial SLOSH-waves lie around $55 \%$. Responders, compared to non-responders, were found to be more likely female, older, married/co-habiting, well-educated, as well as originally born in Sweden (Magnusson Hanson et al., 2018). Participants were further lost in follow-up questionnaires in SLOSH and differ to a degree from those responding several times; i.e. the proportion of those being female, better educated and originally born in Sweden, as well as being older and married/cohabiting, increased among those participating in up to six SLOSH waves (Magnusson Hanson et al., 2018). Finally, even if individuals participate in a questionnaire, data on single items might be missing, potentially due to sensitive information. Inclusion in the data pool (in complete case analysis) would then select only those providing all relevant information and hence, potentially introduce bias (Hernán et al., 2004).

While selection has naturally taken place among SLOSH participants (specifically, those continuously partaking), bias is only present if the association of exposure and outcome differs from the association in the originally eligible, representative sample of the Swedish working population. This, of course, is difficult to prove. Selection bias is challenging to eliminate in observational studies, but one can aim at both preventing and handling selection to a degree. Several measures were taken in the studies of this thesis that target minimisation of the influence of selection on results.

In Study I, we present a number of descriptive tables displaying differences between those with lower and higher levels of WTC. Additionally, logistic regression was used to test which demographic and work-related factors would predict low WTC. This information is useful in estimating which char-
acteristics are associated with the exposure variable WTC, and more specifically, which of those might be common effects of WTC and an outcome of interest.

In Studies II to IV, we utilised the full information maximum likelihood (FIML) method to address missing data and minimise selection based on complete data. Several assumptions regarding reasons for missingness need to be differentiated: missing completely at random (MCAR), missing at random (MAR) and missing not at random (MNAR). For questionnaire data, it seems unlikely that data are missing completely at random, i.e. missingness being independent of the respondents' (or non-respondents') characteristics. Instead, it is plausible that data are missing at random, i.e. missingness is independent of unobserved variables after taking observed ones into account (White et al., 2011). FIML has been found to produce less biased estimates when data include missing values compared to more traditional approaches such as listwise or pairwise deletion (Enders \& Bandalos, 2001). In Study II to IV, we utilised FIML to fill in missingness under the MAR assumption (apart from the conditional process analysis in Study IV).

Even though respondents may not be lost-to-follow-up, they may switch from actively working to being inactive (less than $30 \%$ of full-time employed). Samples used in all studies of this thesis consider exclusively those responding to questionnaires for those in active work. Selection into this group may have occurred over time, i.e. those with lower levels of WTC and worse health indicators may have been more likely to temporarily or terminally exit the active labour force, and increasingly so with each follow-up measurement. The accumulation of the healthy worker effect further hampers external validity of the results (see following section). At the same time, including health-related results from participants not actively working would have introduced uncertainty if individuals were actually exposed to levels of WTC in the time between measurement of WTC and health outcomes. As we expected effects of WTC to be more immediate (although exposure could accumulate over time), health-related data were only included for those actively working.

## Generalisability

SLOSH is based on an approximately representative sample of the Swedish working population, as described under 'Methods and Materials', but the previous section highlighted that participants underwent (self-)selection at several points. As some respondents in SLOSH can be lost-to-follow-up or switch between responding to questionnaires for those in- or outside the active labour force over time, selected waves/samples may become less representative than the original sample of the working population. Differences in the sample compared to the target population (and potentially further to other populations)
hamper external validity of results. In particular, SLOSH participants responding several times are healthier than those responding only once (Magnusson Hanson et al., 2018). Likewise, eligible individuals may be healthier already before participating for the first time as SWES is based on those Swedish residents that are gainfully employed. As already mentioned, those who are female, older, married, well-educated and born in Sweden were found to be more likely to respond to SLOSH questionnaires (Magnusson Hanson et al., 2018). Consequently, prevalence of symptoms of ill-health (i.e. depressive symptoms, musculoskeletal complaints and exhaustion in our studies) and low control over working hours could be underestimated in the empirical studies of this thesis. Although SLOSH data offer rich personal information on a nationally representative Swedish cohort, these limitations need to be kept in mind.

At the same time, as this thesis focuses on WTC-a construct relevant to those individuals that are in work-generalisation of results mainly concerns the active labour force, and not the general population at large. Of note, as the cohort of SLOSH participants is ageing, findings presented in this thesis may represent the middle-to-older aged workforce more than the younger one. There is a need for future studies to replicate findings presented in this thesis and examine whether effects and mechanisms are different for the younger working generation.

Generalisability of findings across Swedish borders depends heavily on the respective society and culture. Some countries, in particular Nordic ones, share similar characteristics with the Swedish society and labour market, and therefore, implications may be extended to a large degree. Other countries present marked differences, such as more gender-traditional division of labour, which limits generalisability. At the same time, if the underlying mechanisms explored in the empirical studies of this thesis are universal and largely independent of cultural/societal factors, findings would apply to a wide range of working individuals. In explanation, higher degrees of WTC may bolster a sense of autonomy/self-efficacy, facilitate well-timed recovery and improve the psychosocial work environment overall—regardless of type of society, occupation, hierarchical position or demographic characteristics. Effects on work-life interference on the other hand may depend more on the level of egalitarianism of the society, gender composition of the workforce, cultural norms and expectations, model of organisations and availability of child-care-and therefore be less externally valid outside of Sweden or Scandinavian countries. This is particularly relevant with regard to Study IV.

## Measurement error

When measuring a concept that is not directly observable, the measured score results from both variation of the true value and variation of systematic and/or
random error. Measurement error means the variation in the observed score that is not attributable to the underlying construct; it concerns any included variable, exposure, outcome and confounder. Self-reported data and retrospective ratings, as used in studies in this thesis, are particularly prone to include some degree of measurement error. Participants may respond more negatively in general, fail to recall the past correctly, answer in the desired direction, misunderstand questions or make random mistakes.

Ideally, measurement error would be limited in the design of the measure itself. A well-developed and validated tool to measure a concept yields less biased estimates (Muthén, 1992; VanderWeele, 2021). But particularly observational studies are always faced with measurement error; the extent as well as the direction of bias is difficult to assess. Some statistical tools make it possible to account for random and systematic measurement error. Latent variable modelling has the advantage of not assuming observed values to be measured without error, but instead as indicators for an underlying, un-measured construct. Imprecise measurements are taken into account in that way (Little et al., 2007). In Study I and II, we used latent variables for at least part of the concepts of interests, thereby limiting problems due to measurement error.

High degrees of measurement error hamper the internal consistency of a measure, meaning the concept of interest is not reliably captured by item scores. For a multi-item measure, Cronbach's alpha is traditionally used to estimate reliability. Random measurement error is argued to be less of a problem for scales using several items to measure an underlying concept (Muthén, 1992). In the studies of this thesis, we used multi-item measures for most studied concepts (alas, musculoskeletal complaints were assessed with one item only). Cronbach's alphas were found to be around 0.92 for control over daily hours and 0.75 for control over time off, 0.91 for depressive symptoms, 0.90 for work-life interference, and 0.92 for exhaustion-indicating good internal consistency.

As another indicator of precision of measures, the width of confidence intervals of point estimates can be considered. Higher random measurement errors, as well as small sample sizes, can yield wider confidence intervals which indicate higher uncertainty around the estimate. Likewise, narrow confidence intervals indicate better precision and less random error. Results from this thesis presented overall very narrow confidence intervals. For instance, in Study III, the total indirect effect of control over daily hours/time off on depressive symptoms via work-life interference was calculated; although the point estimate was very small ( $-0.018 /-0.053$ respectively), confidence intervals were very narrow around these estimates $(-0.026$ to $-0.010 /-0.065$ to -0.042$)$.

## Causality

Most of the previously discussed biases and errors contribute to the validity of causal-inferential claims and can lead to both over- or underestimation of the true effect. While the gold standard for examining the causality of a relationship is randomised controlled trials, the empirical studies in this thesis used (mostly longitudinal) observational data-as is the case in much of the literature on the psychosocial work environment. Though this type of data offers rich information about participants, causal inferences cannot be drawn with certainty. At the same time, avoiding any causal language in associational research has been challenged and criticised as masking the causal goal of observational studies (Hernán, 2018).

In Study II to IV, we used longitudinal data spanning over two to four waves. In contrast to cross-sectional data, repeated measures allow to separate exposure and outcome (as well as mediator) variables in time. In turn, we were also able to examine reversed causal pathways in Study II and III and change over time in Study II. While this is a step closer to inferences about causality, our data were still potentially subject to bias as discussed above. Associations between measured concepts thus need to be interpreted with caution and under consideration of the potentially included error and bias-and vis-à-vis other empirical evidence.

Findings from the studies in this thesis should not be used separately in trying to estimate the true effect of WTC on health and well-being; instead, results need to be considered in combination, and also in relation to the available literature on flexible working hours as a whole with different designs and statistical approaches. While Study I and IV tested associations using regres-sion-based techniques, Study II and III utilised SEM and partly latent variables; while Study I to III regarded cross-sector samples, Study IV focused on the knowledge-working sector; while Study I and part of Study IV used com-plete-case analysis, Study II, III and part of Study IV utilised FIML estimation to handle missing data. These differences between the studies are highlighted here as each design-based and statistical decision comes with certain drawbacks and advantages-triangulation of evidence allows for stronger confidence in robustness of results and causal inferences (Hammerton \& Munafò, 2021). In the section on 'Public health implications and recommendations', results from this thesis are set in context to other, in particular implementation research to draw overall conclusions and recommendations.

## Measuring control over working hours

An ongoing discussion in the literature questions whether access, use or need for flexible work-time arrangements matters most for health and well-being, and whether this should reflect subjective or objective levels. In SLOSH,

WTC is measured as the perceived access to control individuals have regarding their working hours. Ratings are thus influenced by individual factors (such as personality or mental health influencing perceived control) and employer aspects (such as culture at work regarding using flexible work-time arrangements). This way of measuring WTC comes with both perks and downsides. On the one hand, subjectively rated control can be argued to be more indicative for individual outcomes than objective availability. On the other hand, reciprocal processes and inter-individual differences impede inferences about the causal nature of effects. In contrast, measuring objective availability of WTC-for instance, anchored within contracts or rated practices by supervisors-brings the advantage of eliminating reversed processes of health affecting reported levels of WTC as well as individual influences in ratings. Some evidence points towards the likelihood of subjectively rated WTC largely reflecting the levels of control within work units: effects of individual WTC on sickness absence were mostly replicated using aggregate scores in one study (Ala-Mursula et al., 2005). This could be confirmed for female employees only, possibly due to the fact that the sample consisted to three quarters of women working within the public sector.

For some of the factors lying on the pathway between WTC and health outcomes, actual use of WTC may be more critical than perceived access. Negative effects on work-life interference should only be buffered by higher control over working hours if working hours are actually adapted according to needs. Likewise, a high need for WTC should relate more strongly to outcomes in health (in either direction commensurate to the level of control) than the mere access to WTC if need for it is low. In SLOSH, neither data on actual use nor need for control over working hours are collected. This may have resulted in an underestimation of effects on health for those individuals with low WTC, but high need for more flexible working hours, and an overestimation for those with high WTC, but no need for it. One study highlighted the significance of a negative mismatch between access and need (i.e. access being lower than need) for WTC and its unfavourable effects on work-life interference and fatigue (Nijp et al., 2015). At the same time, negative mismatches were highly prevalent, particularly among shift workers with commonly less control over working hours. Results were also indicative of the lesser importance of actual use of WTC on health: high versus low use of WTC was unrelated to levels of fatigue, while associations with work-life interference were negligibly small.

In summary, findings from other studies suggest that perceived subjective levels of WTC may reflect the most vital aspects of control over working hours for its effects on work-life interference and health. Lower levels of control likely indicate a negative mismatch between access and need for WTC. At the same time, subjective ratings may be conditional on reversed processes to a degree. Study II and III paid particular attention to reciprocal ties between

WTC and health/work-life interference with longitudinal study designs. Generally, these pathways were of lesser importance than those in the causal direction, which indicates that ratings of control are affected by ill-health only to a small degree.

As discussed in the introduction under 'Work-time control', a number of flexible work-time arrangements are examined in the literature. In contrast to some other studies, WTC, as it is measured in SLOSH, contains only factors of temporal flexibility, not spatial ones. Studies in this thesis thus make no contribution to evidence of effects from flexible location of work (e.g. flexplace, home office, telework, telecommuting) to health and well-being outcomes. Few studies examined control over working hours and place at the same time. One meta-analysis found effects of flextime on work-life interference larger compared to flexplace (Allen et al., 2013).

Another aspect not covered in our measure of WTC concerns the latency between exerting control over working hours and the actual work/time off from work. For instance, shift workers may be able to pick certain schedules, but only weeks in advance of the actual shift. This implies that WTC would only facilitate long-term alignment of work and private life and personal needs for recovery, not acute reactions to emerging needs. WTC as rated by a shift worker may reflect a slightly different concept than for a daytime office worker. The difficulty of comparing occupational groups in their ratings of psychosocial work conditions has also been discussed for a multi-dimension index of the psychosocial work environment (Clausen et al., 2019). Results discussed in this thesis (in particular Study II and III) cannot directly differentiate between controlling working hours short-notice versus well in advance, and this limitation could imply that effects of WTC on health may be overestimated regarding shift workers-if immediate control over working is indeed more favourable for health and well-being.

Of note, response alternatives of the WTC scale differed slightly in SLOSH in 2008 compared to all other waves as 'not applicable' was included. As can be observed in Table 3 under 'Work-time control', mean scores of both subdimensions of WTC are higher in 2008 than 2010, while the overall trend from 2010 to 2020 indicates increasing levels of control. This could suggest that those responding with 'not applicable' may be more likely those with very little control over working hours. Estimated slope growth factors from Study II could have been affected by this, but this influence was likely minimal considering satisfactory results in tests of longitudinal measurement invariance.

Some workers are working part-time hours involuntarily. This underemployment may be reflected in low perceived WTC, but actually concerns flexibility in contracts more than individual control over working hours (Joyce et al., 2010). Among Swedish part-time workers, about $15 \%$ of women (decreasing trend over the previous years) and $18 \%$ of men reported to be underemployed in 2016 (Svenskt Näringsliv, 2017). Although this share is fairly small,
involuntary part-timers may report low levels of WTC more often and information on this was unavailable for the waves of SLOSH included in the studies of this thesis.

## Discussion

Flexible working hours continue to rise across the working population (Eurofound, 2012c; Plantenga \& Remery, 2010; Riedmann, 2010). While evidence supports beneficial effects of work-time control on work-life balance (or in other words, appears to buffer to an extent against work-life interference), less is known about implications for health-related outcomes as well as mediating and moderating factors (Nijp et al., 2012). The overall aim of the work described in this thesis was to expand knowledge on WTC and effects on health. Four studies have produced a number of findings that are discussed in the following sections. Finally, conclusions are considered that can be drawn from the findings as well as public health implications and recommendations.

## Summary of findings and theoretical implications

## Dimensionality of work-time control

Previous studies measured control over working hours in different ways, both in terms of number of items and dimensionality of the construct (Nijp et al., 2012). Findings from Study I highlight that the scale used to measure WTC in our dataset reflects two aspects of control that concern duration and distribution of working hours (Knauth, 1998); or put differently, time at work and time off work. Our results thereby replicated previous findings (Ala-Mursula et al., 2005) of a two-dimensional structure underlying the construct of WTC, namely 'control over daily hours' and 'control over time off'.

In the literature, different types of flexible work-time arrangements are dis-cussed-for instance, flexitime (varying and deciding starting and ending times of work), self-scheduling rosters (using software to pick or vote on shift schedules in advance), home-office, compressed work weeks, variable work time with time accounts and part-time work, to name a few. Yet, empirical studies often concern aggregates of flexible work-time conditions to summarise overall effects (Chen \& Fulmer, 2018). While our scale does not cover all available flexible work-time arrangements, it differentiates between two aspects of perceived temporal control over working hours that can coincide, but
neither are they the same, nor necessarily concomitant. Some forms of control over working hours may not be feasible for certain occupations/organisations, others not useful or needed by some groups of workers. One study found workers to most frequently report high needs regarding aspects of control over time off (particularly scheduling vacation) compared to control over daily hours (Nijp et al., 2015). Furthermore, the two dimensions may be differentially related to outcomes regarding health and well-being. Indeed, some evidence found that control over time off was associated more strongly and consistently with depressive symptoms than control over daily hours in a crosssectional sample using a very similar scale to measure WTC (Takahashi et al., 2011).

## Distribution of work-time control

Study I further explored descriptive differences in reported levels of control over daily hours and time off by a number of work-related and demographic factors. Some groups were seen to perceive lower levels of both control over daily hours and time off, in particular those who were female, employed in the public sector or working any type of shift or night work. Likewise, we found those working shift hours (as common in healthcare, but also within manufacturing, transportation and service sectors) to have the highest odds of reporting low control over daily hours and, to a slightly lesser degree, control over time off. A Dutch study showed that particularly shift workers reported a mismatch between access to and need for WTC-meaning they perceived a greater need for different aspects of WTC than they had access to-which was associated with greater work-life interference and fatigue, as well as lower job motivation (Nijp et al., 2015). This fits well into theories of Person-Environment Fit (Barnett et al., 1999; Caplan, 1987): WTC may be particularly beneficial for those perceiving high needs to utilise control over working hours. A fairly restrictive work format such as shift work may leave a larger number of workers not fitting well with their work situation. Under this premise, our results emphasise that shift workers in particular may benefit from interventions to increase availability of WTC.

Not only were work-related aspects associated with levels of WTC, but also demographic variables, especially gender. Being female was likely interrelated with some work-related factors: the Swedish labour market remains fairly gender-segregated (Sverke et al., 2017). The majority of public healthcare workers (often working shift schedules) are female (Cerdas et al., 2019). Likewise, women are more likely to hold sub-ordinate positions that come with lower levels of control over work (Fagan \& Brendan, 2002). Gendersegregation, both vertically and horizontally, may explain our results in terms of lower perceived WTC; i.e. female-dominated sectors and lower hierarchical
positions are characterised by occupational factors that are related to less em-ployee-based flexibility. However, some other factors might also play a role in low ratings of control among women.

Locus of control has long been discussed as a psychological trait describing in how far one perceives having control over one's life (Rotter \& Mulry, 1965). Early on, evidence of gender differences in the frequency of external versus internal locus of control was quite ambiguous (Sherman et al., 1997). Recent studies point towards women more often perceiving control as external (attributing causes for events in life outside one's control) than men (Churchill et al., 2020), which is in line with research on robust gender differences in basic personality traits (Schmitt et al., 2017). One's locus of control is likely also affecting perceptions of WTC to a degree: with an internal locus of control, an individual might believe to have greater discretion over working hours, in particular on a theoretical level (i.e. concerning access to, and not actual use of WTC). If women have in general a more external locus of control, this could contribute to them more often perceiving the level of control lower than men. This is not to argue that men and women have in fact equal access to flexible work-time arrangements. But locus of control may both affect rating and perception as well as effectiveness and usefulness of WTC.

Apart from women, those who were single/living alone and without children also reported lower control over daily hours and time off. These factors may reflect lower career progression to an extent. However, age differences in ratings of WTC were comparably small and age groups failed to contribute to predicting levels of WTC. Individuals with family and child-care responsibilities may perhaps i) perceive higher need for adapting working hours, ii) self-select into jobs allowing for greater control, iii) perceive their levels of WTC to be higher because of increased usage and/or iv) actually have more access because they have a legal right to request flexible work-time arrangements (see 'A brief history of work time and flexibility').

Interestingly, higher levels of WTC were related to working overtime hours at least once a week, and more so for men and regarding control over daily hours. This association is likely affected by a number of factors. Higher seniority may more often come with the benefit of higher discretion over working hours. Occupations allowing for overtime hours might also be those that offer higher WTC (for instance within knowledge-intensive work). At the same time, these findings might suggest that to some extent, higher levels of WTC could potentially contribute to increasing total number of working hours, possibly due to increased organisational commitment and in particular for men (Hofäcker \& König, 2013; Leslie et al., 2012).

Results from Study I highlight that WTC is neither unidimensional, nor equally distributed (or perceived) across workers. The groups with the lowest perceived control may be those in occupations where WTC is less feasible (in particular shift work), but also those who would potentially have the greatest benefits from increased levels of control.

## Effects of control over daily hours versus time off on depressive symptoms

Following calls for more longitudinal studies on effects of WTC on outcomes of health (Nijp et al., 2012), the aim of Study II was to examine if either of the two sub-dimensions was related to depressive symptoms in a longitudinal design and which direction this effect would predominantly follow (causal, re-versed-causal or reciprocal). We found participants reporting higher levels of control over time off at baseline being more likely to also perceive lower intensity of depressive symptoms at that time. Participants with increasing control over time off over time were more likely to report decreasing levels of depressive symptoms. In contrast, change in control over daily hours appeared unrelated to change in depressive symptoms, and only higher control over daily hours at baseline was associated with lower intensity of depressive symptoms at baseline. All of the relationships were driven more in the causal direction whereas reversed-causal or reciprocal ones played a smaller role.

Longitudinal studies comparing sub-dimensions of WTC are scarce. We found control over daily hours and time off to differ in the strength of association with depressive symptoms. On average, control over daily hours changed less over time than control over time off, which would explain why this (non-significant) change was unrelated to depressive symptoms. But effects were also consistently smaller for control over daily hours on depressive symptoms, pointing towards a lesser significance of control over daily hours than control over time off for health-related outcomes. These findings are in line with an earlier, cross-sectional study on daytime and shift workers showing stronger and more consistent effects on several health-related outcomes (recovery, sleep and depressive symptoms) for control over time off than for control over daily hours (Takahashi et al., 2011). Another cross-sectional study on manufacturing workers found beneficial effects on work-life balance only for high control over time off paired with low variability of work hours, but not for high control over daily hours (Kubo et al., 2013). These findings highlight that control over time off may prove more useful for workers to reconcile work and non-work responsibilities and facilitate recovery. Taking breaks when needed and scheduling leave and vacation aids in recovering both inside and outside of work, thereby maintaining good mental health, which is in line with predictions from the Effort-Recovery Model (Geurts \& Sonnentag, 2006; Meijman \& Mulder, 1998). Although running private errands during working hours could potentially introduce home-to-work interference, it may also prevent conflicts if private matters can only or have to be handled during certain time windows. In contrast, control over daily hours might play a relatively smaller role in supporting well-being and counteracting work-life conflicts. Based on their findings, Geurts and colleagues (2009) argue that control over time off is directly associated with less work-life interference, whereas control over daily hours plays a more moderating role: they
found negative effects of long contractual work hours on work-life interference were mitigated by higher levels of control over daily hours.

Overall and not surprisingly, effects on depressive symptoms were comparably small for both sub-dimensions of WTC in our study. Although difficult to compare, other factors of the psychosocial work environment showed similarly sized effects (Magnusson Hanson, Chungkham, et al., 2014). Psychosocial work conditions arguably play an important role in individuals' health; however, neither are they the only causing factors for mental health problems, nor does one single factor drive the whole of effects on health. Instead, the psychosocial work environment consists of a multitude of conditions-some of them very closely related or even depending on each other-which act together in impacting workers' health, for better or worse.

Conclusions that can be drawn from Study II imply that WTC plays a small part in supporting mental health, in particular regarding depressive symptoms. Findings were more consistent for control over time off, indicating a relatively higher importance of this dimension of WTC. Considering the far-ranging perceived level of either WTC sub-dimension (as examined in Study I), these results are promising: there is good potential for workers with currently low WTC to benefit from interventions or contractual/policy changes aiming at increasing individual control in terms of mental health.

## Work-life interference as a mechanism between work-time control and health

Among the first research to investigate the underlying mechanisms of WTC affecting health and well-being, the third study in this thesis examined the mediating role of work-life interference in the relationship between control over daily hours/time off and depressive symptoms and musculoskeletal disorders. We found evidence for partial mediation via work-life interference, albeit estimates being small for depressive symptoms and very small for musculoskeletal complaints. Higher levels of both control over daily hours and time off were related to less subsequent work-life interference, which in turn benefitted outcomes of mental and physical health. These causal pathways were mostly stronger than other directions.

Regarding the differential effects in size between depressive and musculoskeletal symptoms, we assumed that both work-life interference and WTC are stronger related to mental than physical health. While we concluded that the effect from WTC on depressive symptoms was mediated by work-life interference, results were less clear regarding musculoskeletal symptoms. As displayed in Figure 1, physical health could suffer from low levels of WTC via several mechanisms that concern both psychological and physiological strain. While work-life interference (causing psychological strain) has been related
to musculoskeletal disorders (Hämmig et al., 2011), this pathway may be relatively less important for effects of WTC on physical health. Instead, recov-ery-related and biomechanical-load mechanisms may explain more of the effect. Particularly control over time off could aid in interrupting and recovering from long stretches of physical strain as well as facilitate managing chronic complaints that may have already emerged. One study highlights that flexible working hours could be particularly beneficial for older workers with chronic physical disorders to lower work limitations (i.e. limited performance at work due to chronic health conditions) regarding productivity, ability, functioning and early labour exits (Vanajan et al., 2020) - in light of increasing retirement ages, this topic should receive more attention.

Another aspect sheds some light on differences in effect sizes between depressive and musculoskeletal symptoms: the way the constructs were measured in our sample. While depressive symptoms concerned intensity of symptoms during the last week, musculoskeletal disorders regarded the presence of long-lasting/serious complaints or disorders of the back, joints or muscles during the last two years. This apparent difference highlights that while depressive symptoms were captured fairly momentarily and allowed for detecting a wide range of intensities and even clinical levels of symptoms (Magnusson Hanson, Westerlund, et al., 2014), musculoskeletal complaints required chronic, serious symptoms across a long time span. As a result, this measure could only capture those individuals with already quite severe symptoms in which case the influence of WTC was most likely smaller in helping to reduce complaints or buffer against further deterioration. But while severity of disorders may not observably change much, the previously mentioned study underscores that these individuals could still benefit from increased control-by lowering the likelihood of work limitations (Vanajan et al., 2020). This is further supported by findings on Finnish public sector workers: especially those who were older benefitted from increased levels of control over daily hours (as well as time off) in terms of a decreased risk of long-term sickness absence due to musculoskeletal disorders (Albrecht, Leineweber, et al., 2020).

We found that direct and reversed processes (in contrast to causal mediational paths via work-life interference) still played a role-particularly regarding musculoskeletal complaints. Not surprisingly, depressive symptoms worsened perceived work-life interference; this finding is in line with a number of previous research (e.g. Nohe et al., 2015). Levels of work-life interference, on the other hand, were less prone to affect ratings of WTC. In contrast, musculoskeletal complaints were associated with lower subsequent ratings of both control over time off and daily hours. Reversed effects from health/wellbeing to job stressors, or 'strain-to-stressor' effects, have long been a rather understudied topic (de Lange et al., 2003; Zapf et al., 1996). Yet, the idea of feedback loops is not new at all and goes back to Bandura's social cognitive theory (Bandura, 1977); environment, individual and an individual's behaviour all interplay and affect each other. Bidirectional relationships between
psychosocial work factors and health outcomes are therefore not surprising. For instance, a systematic review concluded that there was moderately strong support for job demands being affected by worker well-being, albeit no evidence for reversed effects regarding job control or support (Tang, 2014).

Proposed underlying mechanisms for these effects concern either changes in the environment or changes in perception (Tang, 2014). Healthy workers may be upward-selected into jobs with a better psychosocial work environment, while strained individuals are more likely to move down to less favourable job characteristics (environmental change). Likewise, healthy individuals might evaluate their existing job and job resources as better over time, while strained workers perceive job characteristics as worse due to decreased coping ability or increased negative affectivity (Beck, 2002). These mechanisms predict that unhealthy individuals drift down to or perceive a more negative work environment, but there is a case to be made that these workers could also improve their situation: by switching into new jobs with fewer job stressors or modifying their existing jobs to better fit their needs and capabilities (Garst et al., 2000; Rudolph et al., 2017). At the same time, healthy and well-performing individuals might be promoted into jobs with higher responsibilities, demands and workload, thereby changing into a less favourable work environment or even exceeding their capabilities (Schaap, 2019). This interplay of mechanisms and competing effects highlights that the direction of reversed processes-enhancing or decreasing unfavourable psychosocial job condi-tions-is not easily predicted. In our results, musculoskeletal complaints were related to, on average, lower subsequent control over daily hours and time off (as well as greater work-life interference). As the sample included participants that changed jobs over the study period (but not those exiting the labour market), these effects could reflect both changes in perception and job environment. With onset of musculoskeletal diseases, workload may be perceived as more burdensome and restrictions in when and how work is performed may become more problematic. At the same time, if chronic complaints limit work, this could induce job changes that offer less favourable resources. In both cases, workers who might actually benefit from greater WTC perceive/have lower control over working hours which in turn contributes to increased strain via different processes.

Just as in Study II, we found effects of control over daily hours and control over time off differ in size in the third study: estimates, models and conclusions regarding control over time off presented consistently higher associations with both work-life interference and health outcomes, in contrast to control over daily hours. These results further support findings from Study II, in particular as we observed this gradient for both depressive symptoms and musculoskeletal complaints. General implications are discussed in the previous section in relation to Study II, but the third study indicates that other mediating pathways than via work-life interference might play a larger role in regards to effects from control over daily hours to health-which is in line
with previously discussed findings showing direct associations with work-life interference for control over time off only (Geurts et al., 2009). This is surprising to a degree: one of the proposed underlying mechanisms predicts WTC to offer better time regulation which in turn buffers against work-life conflicts (Nijp et al., 2012). Control over daily hours should be particularly useful in that regard, by adapting daily hours and duration of work to better align with private life. Either individuals in fact do not use control over daily hours much to reconcile private and work life (i.e. any positive effects go via different routes such as improved recovery), or control over daily hours comes with negative side effects or unintended repercussions that counteract beneficial effects.

As differences between sub-dimensions of WTC are rarely examined, only few studies offer more insights on this. Contrary to the notion of control over daily hours benefitting recovery or preventing fatigue, one study using SLOSH data found control over time off, but not control over daily hours, to be inversely related to sleep disturbances (Tucker et al., 2016)-sleep quality in turn could be expected to affect recovery (Meijman \& Mulder, 1998). A large cross-sectional study representative for U.S. adults failed to find an association between control over daily hours and daily fatigue (Kim et al., 2020). Moreover, more control over daily hours was related to an increase in worklife interference, while taking time off during work appeared to buffer against work-life interference (as well as job stress and daily fatigue). On the other hand, a cross-sectional, Japanese study on manufacturing workers found both sub-dimensions of WTC to be related to recovery from fatigue (higher control was related to better recovery; Kubo et al., 2013). This finding underscores that beneficial effects of control over daily hours on well-being may depend more on work-related factors and differ between groups of workers-making investigations of underlying processes difficult.

Overall and in combination with our own research, control over daily hours appears to present more complicated associations with health, but also weaker or no beneficial effects at all. Other mediational pathways than via work-life interference may play a role; at the current state of knowledge, improved recovery from fatigue is unlikely to explain much the effect from control over daily hours on health outcomes. Most importantly, higher control over daily hours might come with negative consequences for some individuals, whereas control over time off presents beneficial effects more consistently regarding a range of health and well-being outcomes. To conclude, this third study presented support for beneficial effects from WTC-in particular control over time off-on depressive symptoms and, to a smaller degree, musculoskeletal complaints and found changes in work-life interference to explain part of these relationships.

## On differential effects by gender

In the fourth study, we were particularly interested in the role of gender in effects of WTC on work-life interference and exhaustion. In a sample of workers within knowledge-intensive services, we found no evidence for gen-der-dependent effects of control over time off or daily hours on work-life interference or exhaustion via overtime hours; men with higher levels of control were not more likely than their female counterparts to perceive greater worklife interference/exhaustion due to increased working hours. At the same time, results showed men worked more overtime hours on average and appeared to be more likely to increase overtime with higher levels of control over daily hours (albeit zero-crossing confidence intervals when accounting for other variables), but not with higher control over time off.

These findings stand in contrast to previous research. Those indicated that higher levels of WTC lead to increased working hours among men, but not in women, such that men experienced more work-life interference while women perceived less (Chung \& van der Lippe, 2018; Hofäcker \& König, 2013; Lott \& Chung, 2016). Studied samples however included a broad spectrum of occupational sectors-which can introduce bias due to gender-segregated labour sectors with different availability of flexible work-time arrangements as well as opportunity to work overtime (Härenstam \& Nyberg, 2021; Sverke et al., 2017). Interwoven relationships and processes between individual and group characteristics and occupational influences impact outcomes in work-life balance and health (Richter et al., 2021). Mixing female- and male-dominated working sectors in studies makes entangling effects of different working conditions typically faced by one sector and genuine differences by gender difficult. Horizontal and vertical gender segregation of occupational sectorswhich has persisted over time and across borders (Fagan \& Brendan, 2002)is arguably one of the most important factors that need to be considered (Härenstam et al., 2006; Sverke et al., 2017). Different labour sectors feature particular work conditions and schedules that are more or less resourceful and more or less beneficial for health and well-being (Fagan \& Brendan, 2002; Nyberg et al., 2021). Differences in outcomes of, for instance, flexibility may have less to do with gender per se and more with working conditions that are characteristic of female- or male-dominated occupations. And yet, not all gendered health outcomes can be traced back to gender segregation in the labour sectors either: in Sweden, sickness absence rates were found to be higher for women than men in almost all considered occupational sectors, both maleand female-dominated ones (Hägglund \& Johansson, 2015).

To surmount these shortcomings, we focused on a sample of knowledge workers-a relatively homogenous occupational group with approximately equal gender representation-and, as noted above, were unable to confirm the proposed gender-dependent mediating role of overtime between WTC and
work-life interference/exhaustion. Other evidence already suggested that gender differences in outcomes related to flexibility are smaller as working arrangements are more similar for women and men. One study on German panel data found men with flexitime or highly autonomous working schedules worked more overtime hours than women; but when only full-time working individuals were considered, these differential effects disappeared (Lott \& Chung, 2016). The processes and conditions when WTC is associated with overtime hours are perhaps more similar for genders than analyses on general samples can illuminate. This notion is also tentatively supported by a crossEuropean study that found only small differences between genders in predictors of voluntary and involuntary excessive working hours (Oinas \& Anttila, 2021).

In light of these results, differences between genders in outcomes of flexible work-time arrangements are likely to be neither entirely dependent, nor entirely independent of gender (or the socially constructed characteristics thereof). Our own findings highlight the complexity of this relationship: despite studying an occupational group with women and men equally represented, we still found men working more overtime hours in general, as well as increasing overtime with higher control over daily hours to a degree (albeit zero-crossing confidence intervals). This may either reflect genuine gender differences or indicate that even in a relatively homogenous occupational sample, women and men still experience different working conditions as well as responsibilities outside of work.

Even in Sweden-a country considered to be relatively egalitarian-gendered roles and time allocation persist (Nyman et al., 2018). Despite a strong identity of being gender-equal (Lane \& Jordansson, 2020), women are still performing the majority of household labour and childcare (Evertsson \& Nermo, 2007; Leineweber et al., 2018). This may in part be related to women working more often part-time hours of paid work than men (Arbetsmiljöverket, 2014; Eurofound, 2012b). The gender division of domestic/family tasks is greater in the working-class sector than in the middle class (Gupta et al., 2015; Warren, 2003). Gender-equality policy in Sweden unfortunately has not solved this problem, but rather masks the fact that men are and can remain less involved in household labour, at least in middle and upper socioeconomic classes: in 2007, the Swedish government introduced a tax scheme to subsidise costs for domestic services which incentivises outsourcing of housework (Lane \& Jordansson, 2020). In addition to the acclaimed high availability of childcare to parents in Sweden, this context allows women to join the labour market, but fails to fully change cultural gender norms and to promote equally shared paid and unpaid labour (Hochschild, 1997). Gender equality was problematised in the working life, not in domestic activities; in other words, labour force participation of women was a problem that needed a solution, whereas equally shared household and childcare responsibilities between partners were not in focus.

Our findings reflect that in higher hierarchical positions, both women and men work more overtime hours, compared to those not holding a leading position. Still, this group was not more likely to perceive more work-life interference or exhaustion. A higher hierarchical position was even related to lower work-life interference and exhaustion for women, while we found only nulleffects in men. A strong predictor for fewer overtime hours among men was working part-time. These two groups-women in leading positions and parttime working men within knowledge work - could be fruitful to study further in order to increase our understanding of how gender equality in paid and unpaid labour can be promoted and achieved. Of note, future research would benefit from using a broader definition of gender instead of binary, heteronormative categorisation.

Why did we find differences between women and men in overtime hours, and to a degree how control over daily hours relates to overtime, but no evidence for a gender-conditional mechanism via overtime between WTC and work-life interference/exhaustion? If men are indeed more likely to use control over daily hours to increase working hours (and our findings are ambiguous in that regard)-especially those in leading positions-this might happen in a context that buffers against greater work-life interference and higher exhaustion. Individuals who use this aspect of control for more work may have set their lives up in a way that allows them to do so without perceiving direct conflicts with responsibilities outside of work or lack of time to recover; perhaps with the support from a partner as well as outsourcing part of domestic labour and childcare, as discussed previously. Such circumstances may be more common among men than women in Sweden and within the knowledge work sector.

Overall, we observed consistently favourable effects of control over time off on work-life interference and exhaustion, and even overtime, for both genders. These findings are entirely in line with Study II and III, again underscoring that enhancing workers' control over taking breaks, time off and days off from work is related to a number of positive outcomes and is unlikely to come with negative side effects such as excessive working or increased loss of boundary control. At the same time, control over daily hours should not be seen as insignificant or unfavourable. Instead, it appears that the way control over daily hours is used by an individual determines in how far it relates to positive or negative consequences. Depending on the individual, working culture and norms at a company, determining starting and ending times as well as duration of work can promote a better or worse balance between private and work life and more or fewer opportunities for recovery.

## Public health implications and recommendations

With the Work-Life Balance Directive (EU/2019/1158), flexible work-time arrangements will be more available, particularly for parents of young children and all carers. The challenges to reconcile work and family responsibilities have been recognized, with flexible work-time arrangements emerging as a potential tool aiding in satisfying (as much as possible) needs from both domains. Unquestionably, many will benefit from this, but implementations of flexible work would likely be more successful and with less unwanted consequences under certain guidelines. Moreover, this thesis highlights that not only can work-life interference be mitigated with higher control over working hours, but also (and partly in turn) ill-health. And not only would working parents benefit, but any working individual. The ILO called for a degree of flexibility in working hours for any worker-already more than a decade ago (International Labour Office, 2007). In striving for "decent working time" for everyone, any personal needs and preferences of workers should be acknowledged and considered. In a Swedish sample of working individuals in $2019 / 2020$, it was estimated that $31 \%$ among the men and $37 \%$ among women had generally no influence over their working hours-emphasizing the potential to improve the work environment for more than a third of the active labour force in Sweden by addressing temporal flexibility for workers (Arbetsmiljöverket, 2020). At the same time, any implementation of flexible work-time arrangements needs to be cognisant of potential risks for individuals and prevent/mitigate repercussions such as unhealthy work schedules, excessive working hours and lower boundary control.

Empirical studies included in this thesis are based on observational data; in combination with other research and in particular intervention studies regarding flexible working hours some conclusions can be drawn and recommendations for policy stakeholders and employers formulated. For that, we need to differentiate between baseline levels of available flexible work-time arrangements: workers with low levels of individual control over work hours and those with medium/high control or high feasibility of WTC. While the former often concern those working shift schedules/public sector workers, the latter are more often found within the private sector, in particular knowledge or expert work.

Introducing higher control over working hours to shift working sectors means usage of self-rostering systems that allows employees to in advance select/wish for a certain shift schedule for a period of time. The level of WTC concerns more long-term planning than reacting to immediate needs. At the same time, selecting shifts could give higher flexibility over when to work during the day (including the night) and week, in contrast to regular daytime work. Several Danish intervention studies focusing on shift workers reported favourable outcomes with the implementation of self-rostering on need for recovery, somatic symptoms, mental distress and sleep (Garde et al., 2012),
social support and, to a degree, job demands (Hansen et al., 2015), work-life balance and work-family facilitation (Albertsen et al., 2014). However, all of these studies underscored that positive effects appeared to depend on the employer's reason for (and execution of) implementing self-rostering: optimising staffing levels and saving resources was related to less consistent or no positive outcomes as well as employee resistance (Albertsen et al., 2014). Shift workers have been found to be particularly vulnerable to lower levels of WTC in terms of mental and physical health (Nabe-Nielsen et al., 2011), and this group was found to report the lowest levels of WTC in Study I in this thesis. Self-rostering software is nowadays readily available and although the implementation may come at a certain cost for employers, the benefits should far outweigh expenditures-both on the employee's and employer's side. Given the weight of evidence, self-rostering can improve work-life balance and health, among other positive effects, and should be one of the pillars in designing healthy(ier) workplaces for shift workers. At the same time, findings presented in this thesis underscored the favourable effects of in particular control over taking breaks and time off from work. Health-care staff working under stressful working conditions during the COVID-19 pandemic themselves proposed that increased time off from work (Almeida, 2021) and flexibility over time off from work (Hlubocky et al., 2021) would be helpful in coping with work stress. Implementing this aspect of WTC may be harder to achieve in shift systems, but would likely prove useful and beneficial for workers in preventing build-up of strain.

Among daytime workers and in particular knowledge workers, flexible working hours are usually easily implemented (in particular in occupations using ICTs). In a natural experiment of corporations implementing an initiative to focus on results only, instead of temporal presence at work (i.e. introducing very high levels of WTC), beneficial effects were observed on a range of outcomes: reduced work-home spillover, better health behaviour, lower emotional exhaustion and psychological distress and better sleep quality and energy (Moen, Kelly, Tranby, et al., 2011) as well as reduced turnover (Moen, Kelly, \& Hill, 2011). Another workplace intervention study enhancing individual schedule control (as well as promoting family-supportive supervision) increased employees’ sleep duration (Olson et al., 2015) and found mothers, but not fathers, increasing time spent with their daughters, but not sons (Davis et al., 2015). In the same intervention program, even exosystem effects were observed: the emotional well-being and sleep quality and latency of employees' children (aged 9-17 years) improved (Lawson et al., 2016; McHale et al., 2015). Beneficial effects were also observed on employees' cortisol awakening response (indicative of healthy recovery and absence of chronic stress), but only during non-workdays (Almeida et al., 2018). In a large, Dutch intervention study focusing on both temporal and spatial flexibility (but also saving company resources), researchers found no increase in levels (or use) of WTC,
only regarding location of work (Nijp et al., 2016). Likewise, no effect was observed on work-life interference, fatigue or stress.

In combination with findings included in this thesis, implementations of higher and very high levels of WTC are generally related to positive, or at least not negative, outcomes such as work-life balance, sleep, health and health behaviour and can even concern extraindividual beneficial effects. However, a company's goal for introducing higher flexibility needs to mainly focus on and monitor employee well-being. Individuals at risk for excessive working should be guided to maintain healthy boundaries between work and private life.

In summary, three keys for a successful implementation of higher control over working hours in any setting need to be highlighted. First, employers need the right attitude and focus towards implementing higher individual control. Not only do the formal, temporal restrictions of work need to change, but also company culture. Implementing flexible working hours for the sake of saving resources and optimising staffing levels comes with a number of negative side effects for employees that can significantly hamper beneficial effects from higher control over working hours. Companies should particularly target increasing control over taking breaks, time/days off and vacation/leave. Second, expectations in outcomes based on higher flexibility need to be realistic. WTC is not a panacea for work-life conflict, nor does it completely eliminate strain from demanding work environments and their effects on health. Other work and psychosocial factors need to be considered and adapted/optimised. Flexible working hours offer some degree of buffer for workers in challenging times and situations, but if for instance workload or job demands are simply too high, more control over working hours cannot relieve these conditions. Third, individuals need to be guided in healthy ways of utilising high levels of control over working hours and maintain/obtain an awareness of boundaries between private and work life. This goes hand in hand with a positive company culture supporting individual recovery and time for leisure in favour of excessive working hours.

Finally, making flexible work-time arrangements more available to work-ers-be it in the form of policies, collective agreements or interventions at the enterprise-level (or even the individual level by becoming self-employed)cannot be discussed without mentioning the elephant in the room: quantity of working hours. During the last century, we experienced surprisingly few changes in the standard of working hours. Though a decreasing trend in weekly working hours can be observed particularly in economically well-off countries, excessive working hours are still common for a substantial share of workers, while others are employed for fewer hours than they would prefer (Messenger, 2011). The number of working hours and flexibility over when, where and how the work is performed tie into each other. Temporal and spatial flexibility alone are unlikely to be successful in alleviating chronically stressful work or life conditions due to too many (or too few) hours of work. One
study from the UK found indications for exactly that: flextime and flexplace were unrelated to allostatic load, whereas reduced working hours were associated with a lower chronic stress response (Chandola et al., 2019). With the challenges brought forward by the Fourth Industrial Revolution, among them robotization and automation of work, dual-earner couples and blurring of boundaries between the domains of work and life, a reduction in weekly working hours could go hand in hand with increased employee-based flexibility. Calls of this nature have already been discussed by the ILO (Messenger, 2018) and will likely receive increasing attention in the future. Studies included in the present thesis examined effects of temporal control over working hours on workers' health and focused on this aspect in giving recommendations for implementations and public health policies.

## Future outlook

The work discussed in this thesis concerned data spanning from 2008 to 2018. Availability of flexible working hours has since then drastically increased due to the COVID-19 pandemic (Forbes et al., 2020), fast-tracking a trend that was already underway. Although the primary focus was on transferral to working from home, affected workers likely also perceived an increase in WTC to a degree, as was shown in a recent retrospective study (Ervasti et al., 2021). And yet, this surge has concerned high-paid, highly educated, white-collar workers more than those in less favourable working conditions who are unable to work from home (low 'teleworkability' of work) or offered less discretion over timing of working hours (Ervasti et al., 2021; Kniffin et al., 2021; Sostero et al., 2020). In part, this change will be temporary. More likely though, higher flexibility over working hours is here to stay and will not return entirely to baseline levels (Forbes et al., 2020; Kniffin et al., 2021). This can be an opportunity to improve the work environment and compatibility with personal and family needs in the future-and challenge societies' and employers' perceptions of the standard of working hours and the 'ideal worker' (Thomason \& Williams, 2020). The effects of the large-scale implementation of more flexible ways of working in time and space for several occupational groups are and will be investigated. Three areas of research need particular attention in the future.

Diverging levels of flexible work-time arrangements between occupational groups may lead to increasing disparities in well-being and health. Those working in blue-collar, low-paid occupations as well as essential workers have received fewer expansions in flexibility over working hours during the pandemic in contrast to workers in more favourable socioeconomic and workrelated conditions (Sostero et al., 2020). This may also be reflected in increasing gender inequalities in access to flexible work. In light of the higher incidence rate among those in lower socioeconomic positions (Mishra et al., 2021;

Strang et al., 2020) vis-à-vis the multitude of sequelae of a COVID-19 infection (Al-Aly et al., 2021), disparities in health could markedly increase in the future. To mitigate work limitations due to chronic conditions of ill-health, a particular focus needs to be put on vulnerable groups and how to improve their work environment-including increasing access to flexible work-time arrangements.

At the same time, there are indications that accelerated increases in flexible working hours during the pandemic were beneficial for those who had previously low access, but high potential for flexibility (Sostero et al., 2020). Regarding gender inequalities in paid and unpaid work, flexibility over working hours might have contributed to slightly decreasing the gap between working mothers and fathers (Chung et al., 2021). Research should monitor and compare control over working hours between occupations, socioeconomic positions and genders pre- and post-pandemic as well as the implications for health and well-being outcomes.

Another fruitful area of future research concerns the ideal and, most likely, individually tailored area and level of control over working hours. Individual differences in personality in particular have received little attention in flexible work research. For instance, research on locus of control could give vital insights into who benefits most from increased flexibility. At the same time, knowledge about at-risk groups and characteristics for negative consequences of complete time sovereignty in working hours needs to be expanded.

Finally, within those groups of workers who received higher degrees of temporal and spatial flexibility over working hours, not only should the shortand long-term beneficial effects and unwanted negative consequences be studied, but also repercussions from taking this control away again, as soon as public health orders allow for more standard ways of working. Some might benefit from going back to clearer boundaries between work and private life, but many individuals will have adapted to working more flexibly in time and space and developed new routines during the pandemic. Drawing on Hobfoll's COR model (Hobfoll, 1989, 2001), the loss of a resource, such as time for family, leisure, and sleep, can result in significant distress for an individual, in contrast to the mere lack of a resource. Employers enforcing a 'going-back-to-normal' way of work may put workers at particular risk to become unsatisfied, stressed and unwell.

## Final remarks

Time, including working hours, is a socially constructed concept. In the past and the present, societies experienced rapid changes in what determines the status quo of working time. Many of these developments undeniably brought improvements for workers in security, health and quality of life, whereas some transformations challenged us in our evolutionary setup. The quest to find the
gold standard of working hours and what constitutes a healthy life may be well guided by looking back and bringing forward changes than standing still and holding onto cultural artefacts. This thesis presented findings that support the notion that higher autonomy over timing and time off from work is beneficial for workers' health. From an evolutionary perspective, this should not come as a surprise. Humans are equipped more for autonomous working time than fixed hours without discretion; for exerting energy and recovering extensively, for following daily rhythms and taking breaks and reacting to upcoming needs, for connecting with people and being without input from the outside world at times. This extends of course beyond the working life and warrants the question where else individuals could use more autonomy over their time.

## Sammanfattning

Flexibla arbetstider anses skapa sätt att förena arbetsliv och privatliv samt underlätta återhämtning. Även om tidsmässig flexibilitet generellt sett stärker balansen mellan arbete och privatliv, är dess effekter på hälsa mindre utforskade. Tidsmässig flexibilitet innebär att arbetstagare har en högre kontroll över den egna arbetstiden. Denna avhandling syftar till att undersöka om och hur upplevd kontroll över arbetstiden gynnar arbetstagares hälsa. I fyra empiriska studier baserad på en omfattande svensk kohortstudie undersöks sambandet mellan arbetstidskontroll och påföljande mental och fysisk hälsa. Därutöver analyseras i studierna underliggande mekanismer och modererande faktorer.

Studie I utvärderade faktorstrukturen hos ett verktyg för att mäta arbetstidskontroll. Studien fann två underliggande dimensioner: kontroll över dagliga arbetstimmar (längd, samt start- och sluttider för en arbetsdag) och kontroll över arbetsfri tid (ta pauser eller ledigt, betald och obetald). Kontrollnivåer per deldimension beskrevs av demografiska och arbetsrelaterade faktorer för ett stort urval svenska arbetare. I synnerhet rapporterade skiftarbetare, anställda i offentlig sektor och kvinnliga arbetstagare låga nivåer av arbetstidskontroll.

Studie II undersökte effekterna av kontroll över dagliga arbetstimmar och ledighet på depressiva symtom. Ökad kontroll över ledighet var relaterad till minskande depressiva symtom över tid, däremot var endast initial nivå av kontroll över dagliga timmar associerad med lägre nivåer av depressiva symtom. För båda underliggande dimensioner av arbetstidskontroll var orsaksriktningen för denna effekt huvudsakligen från upplevd kontroll till efterföljande depressiva symtom; omvända processer var av mindre betydelse.

Studie III fokuserade på interferens mellan arbete och privatliv som ett steg i orsakskedjan mellan arbetstidskontroll och depressiva symtom respektive muskuloskeletala besvär. För båda dimensionerna av arbetstidskontroll gick en del av effekten på depressiva symtom genom interferens mellan arbetsliv och privatliv. Omvända processer var endast relevanta för depressiva symtom och interferens mellan arbetsliv och privatliv. Kontroll över ledighet visade sig mildra interferens mellan arbetsliv och privatliv och efterföljande depressiva symtom mer än kontroll över dagliga timmar, om än med generellt små effekter. När det gäller muskuloskeletala besvär var effekterna ännu mindre och arbetslivets interferens med privatliv verkade vara mindre viktig.

Studie IV bedömde könsskillnader i arbetstidskontrollens inverkan på interferens mellan arbetsliv och privatliv samt utmattning när det gäller övertidstimmars roll som mellanliggande faktor. I ett urval av kunskapsarbetare var högre kontroll över arbetsfri tid associerad med lägre efterföljande interferens och utmattning i arbetslivet, medan kontroll över dagliga arbetstimmar inte var relaterad till båda resultaten. Även om män i genomsnitt arbetade fler övertidstimmar än kvinnor, fanns inga belägg för att män med hög kontroll över arbetsfri tid/dagliga arbetstimmar skulle uppleva mer interferens mellan arbetsliv och privatliv eller utmattning på grund av ökad övertid jämfört med kvinnor.

Denna avhandling visar att högre nivåer av arbetstidskontroll var fördelaktiga för en rad hälsoresultat, vilket delvis förklarades av färre konflikter mellan arbetsliv och privatliv. Även om dessa effekter i allmänhet var små, var kontroll, särskilt över arbetsfri tid, konsekvent förknippad med bättre hälsa och färre interferenser mellan arbetsliv och privatliv. Med tanke på att nivån på arbetstagarnas tidsmässiga flexibilitet varierar kraftigt beroende på arbetsrelaterade och demografiska faktorer, är det i folkhälsans intresse att förbättra tillgången till flexibla arbetstidsarrangemang. Arbetstidskontroll, med särskilt fokus på anställdas förmåga att ta ledigt från jobbet, kan förbättra det dagliga gränssnittet mellan arbete och privatliv och stödja ett hållbart arbetsliv.

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