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Telework in Academia –  
Opportunities and challenges for well-being  
at work

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*“I was taught that the way of progress  
was neither swift nor easy.”*

*Marie Curie*

*To my husband Tobias, for your unconditional love and support*

*To my cats Bäjbisen and Klujten, for all your purrs and cuddles*

*To myself, for not giving up*



## Abstract

**Background:** Telework reshapes the conventional work practice by providing the flexibility to perform work at new places and times. Telework can increase individual autonomy to control and organize work, but can also place higher demands on the ability to separate work-nonwork in time and space, physically and mentally. Leaders' abilities to manifest trusting relationship with staff, and support them seems important during telework. Academic staff are frequent teleworkers, but little is known about how it may impact on their well-being. The overall aim of this thesis was to investigate how academic teaching and research staff practice telework and how telework affects their well-being at work. Another aim was to investigate the experiences of academic managers leading teleworkers in academia.

**Methods:** Study I was a cross-sectional survey and examined the association between the amount and frequency of telework and perceived health aspects. Study II was conducted with assessments of psychophysiological activity, postures and movements, and with daily self-ratings on stress, fatigue, and recuperation, to compare exposures during telework and work at the conventional workplace. Study III and study IV had qualitative study design and were based on semi-structured interviews using an inductive phenomenographic approach.

**Results:** Academics who teleworked several times per week or more reported more work-related stress related to indistinct organization and conflicts, and individual demands and commitment, compared to academics who teleworked less. The psychophysiological activity indicated more relaxation before and after workhours during teleworking days. Academics had overall sedentary behaviors regardless of work location, alternated more between sitting and standing during working hours during telework than at the ordinary workplace. The academics' experiences of telework were related to work tasks, coping strategies, workgroup relationships, and policies/regulations, which were mostly interrelated. Collectively, the process of change of managers' conditions and experiences of leading teleworkers before, during and after the pandemic were related to digital and social interaction, work performance, the work environment in, and regulations of, telework.

**Conclusions:** The use of different research designs and methods showed that telework in academia could impact biological, psychological, social and professional aspects of academics' well-being. The perspective of academic managers showed that the organizational context could impact on the conditions for providing academics with support in telework. We argue future studies to adopt different research designs and methods when studying well-being in telework, and especially consider the professional and organizational context in telework.

**Keywords:** telework, academia, psychophysiological activity, physical behaviors, stress, well-being, leadership, phenomenography

# Sammanfattning

**Bakgrund:** Distansarbete förändrar det konventionella sättet att arbeta genom att ge flexibilitet att utföra arbete på nya platser och tider. Detta kan öka autonomi att styra och organisera arbetet, men det kan också medföra högre krav på förmågan att separera arbetet i tid och rum, fysiskt och mentalt, från livet i övrigt. Chefers förmåga att upprätthålla en förtroendefull relation med, och stödja sin personal, verkar vara särskilt viktigt vid distansarbete. Distansarbete är vanligt bland akademianställda, men det saknas kunskap om hur det kan påverka deras välbefinnande i arbetet. Det övergripande syftet med denna avhandling var att undersöka hur undervisande och forskande personal inom högre utbildning distansarbetar och hur det kan påverka deras välbefinnande i arbetet. Ett annat syfte var att undersöka akademianställda chefers erfarenheter av och förutsättningar för att leda distansarbetare i akademien.

**Metod:** Studie I var en tvärsnittsundersökning av sambandet mellan mängd och frekvens av distansarbete och skattade hälsoaspekter. Studie II bestod av mätningar av psykofysiologisk aktivitet, kroppsställningar och rörelser, och av dagliga självskattningar av stress, trötthet och återhämtning vid distansarbete jämfört med arbete på ordinarie arbetsplats. Studie III och studie IV hade kvalitativ studiedesign och baserades på semistrukturerade intervjuer med en induktiv fenomenografisk ansats.

**Resultat:** Akademianställda som distansarbetade flera gånger per vecka eller mer rapporterade mer arbetsrelaterad stress relaterad till otydlig organisation och konflikter, och individuella krav och engagemang i arbetet, jämfört med de som distansarbetade mer sällan. De psykofysiologiska mätningarna tydde på mer avslappning före och efter arbetstid under distansarbetsdagar. Akademianställda var generellt stillasittande oavsett plats för arbete, men växlade mer mellan att sitta och stå under arbetstid vid distansarbete jämfört med ordinarie arbetsplats. Akademianställdas upplevelser av distansarbete relaterade till arbetsuppgifter, copingstrategier, arbetsrelationer och policyer/regler. Chefers förutsättningar och erfarenheter av att leda distansarbetare före, under och efter pandemin relaterade till digital och social interaktion, arbetsprestationer, arbetsmiljön i och reglering av distansarbete.

**Slutsatser:** Studierna med olika forskningsdesign och metoder i denna avhandling visade att distansarbete i akademien kan inverka på biologiska, psykologiska, sociala och professionella aspekter av akademianställdas välbefinnande i arbetet. Akademianställda chefers erfarenheter var att den organisatoriska kontexten kunde påverka deras förutsättningar att ge akademianställda stöd vid distansarbete. Vi rekommenderar att framtida studier använder sig av olika forskningsdesign och metoder för att studera välbefinnande vid distansarbete, och särskilt beaktar den professionella och organisatoriska kontextens betydelse för välbefinnande vid distansarbete.

**Nyckelord:** distansarbete, akademianställda, psykofysiologisk reaktivitet, fysiska beteenden, stress, välbefinnande, ledarskap, fenomenografi

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## List of Papers

This thesis is based on the following papers, which are referred to in the text by Roman numerals.

### Paper I

Heiden, M., Widar, L., Wiitavaara, B., & Boman, E. (2021). Telework in academia: Associations with health and well-being among staff. *High. Educ.*, 81:707–722. <https://doi.org/10.1007/s10734-020-00569-4>

### Paper II

Widar, L., Wiitavaara, B., Boman, E., & Heiden, M. (2021). Psychophysiological reactivity, postures and movements among academic staff: a comparison between teleworking days and office days. *Int. J. Environ. Res. Public Health* 18: 9537. <https://doi.org/10.3390/ijerph18189537>

### Paper III

Widar, L., Heiden, M., Boman, E., & Wiitavaara, B. (2022). How is telework experienced in academia? *Sustainability*, 14, 5745. <https://doi.org/10.3390/su14105745>

### Paper IV

Widar, L., Boman, E., Heiden, M., & Wiitavaara, B. (*Manuscript*). Academic managers' conditions for, and experiences of, leading teleworkers in academia before and during the Covid-19 pandemic.

Reprints were made with permission from the respective publishers.

## Author contributions

**Paper I:** The study was designed by Marina Heiden (MH), Birgitta Wiitavaara (BW), and Eva Boman (EB). The questionnaire was developed by MH, BW, and EB. Data were collected and analyzed by MH and Linda Widar (LW). MH and LW drafted the manuscript, which was critically reviewed, revised, and approved by all authors.

**Paper II:** The study was designed by LW, BW, EB and MH. Data were collected by LW and analyzed by LW with the assistance of MH. LW wrote the original draft of the manuscript, which was critically reviewed, revised, and approved by all authors. Data processing was performed by Per Gandal and Kent Dimberg.

**Paper III:** The study was designed by LW, BW, EB, and MH. Data were collected by LW and analyzed by LW with assistance of BW. LW wrote the original draft of the manuscript, which was critically reviewed, revised, and approved by all authors.

**Paper IV:** The study was designed by LW, BW, EB, and MH. Data were collected by LW and analyzed by LW with assistance of BW.

## Abbreviations

ICT	Information and communication technology
LMX	Leader-member-exchange model
ANOVA	Univariate analysis of variance
MANOVA	Multivariate analysis of variance
VAS	Visual analogue scale
bpm	Beats per minute
HRV	Heart rate variability
RRI	Beat-to-beat intervals
ms	Milliseconds
ms <sup>2</sup>	Milliseconds squared
SDNN	The standard deviation of beat-to-beat intervals
rMSSD	The root mean squared successive differences of beat-to-beat intervals
LF	Low frequency
HF	High frequency
CODA	Compositional data
OHS	Organizational health and safety management



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# Background

## Telework development and definitions

The telework concept was established by Jack Nilles (1,2) in the 1970s with the purpose of reducing work commuting, which was associated with economic waste and air pollution. As a part of the concept, knowledge and information workers were encouraged to work from home or from satellite offices provided by the organization, using telecommunications (e.g., telephones and faxes) to stay in touch with their conventional workplace (1,3). In the 1980s and 90s, technological developments contributed to an increasing digitalization in working life, i.e., the conversion of analogue work routines and processes to digitally based correlates. For many professions, especially knowledge and information workers, work became heavily computerized and thus possible to perform outside the conventional workplace. The following decade included a rapid dispersion of the internet in society, in parallel with an escalating development and virtualization of information and communication technologies. With this development, access to and sharing of information and communication technology (ICT) underwent time-space compression, i.e., became independent of geographical borders and time zones. Hence, virtual access to and use of ICTs extended the reach of work and made it less dependent on physical premises and work-time structures. Ultimately, these decades of digitalization and technological development caused the telework concept to evolve into the flexible and omnipresent work arrangement it is currently understood as (3–6).

When comparing the spread and adoption of telework across Europe, the largest growth can be recognized in the northern European countries (6). The Scandinavian countries have the highest proportion of teleworkers in Europe. In Sweden, in 2018, an estimated 40 percent of the working population reported teleworking (defined as working from home) at least once during a 12-month period (7). This makes Sweden one of the European countries with the highest prevalence of teleworkers (6,7).

The most common motives for organizations to offer telework are to attract and recruit competence, to decrease real estate costs, and to increase employees' well-being and organizational performance. Generally, organizations are more likely to offer telework if they expect benefits from this. Telework is mainly offered in large organizations with flat hierarchical structures, and in knowledge and information sectors (8–10), including professions with work tasks that involve “acquir[ing], creat[ing] and apply[ing] knowledge for the purposes of their work” (8) (p.51, 2019). Knowledge and information professions are recognized as the most frequent teleworkers, which has been explained by their autonomous, computer-based tasks (6,9,11). In addition, telework seems to be practiced more by individuals with higher education and

higher organizational status and/or positions (7,12,13). There are studies suggesting that women generally practice telework more than men (14–16); however, there are also studies contradicting such associations (17–19). The choice of telework has been related to both individual and organizational factors (8,11). A large share of studies have identified private activities such as family duties and household chores as the most influential factors in the choice of telework (16,17,19–23). Contrarily, in other studies, family obligations have not been proven to be an instrumental reason for teleworking (9,11).

The evolution of the telework concept in research is sometimes categorized into “three generations” (2–4). The first generation of research mainly conceptualized telework as working from locations provided by the employer or in an employee’s home (i.e., *telecommuting*), while the second generation included work performed beyond these locations (i.e., *teleworking*), and the third generation added work performed in virtual contexts (3). Within the frame of the original concept, researchers have coined various terms for telework (e.g., telecommuting, remote work, e-work, digital work, virtual work, nomadic work, hybrid work) attached to different definitions, which are used interchangeably across studies and countries (2–4,13,24). Consequently, current research lacks a common term and an unambiguous definition of the telework concept.

The conceptualizations of telework differ mainly in the classification and combination of the spatial and temporal dimensions of telework, and the role of ICT. The spatial aspect refers to the possibility to choose the physical location of work and is generally classified into work from home and work performed at places beyond the conventional workplace (e.g., hotels, trains, cafés, libraries, satellite offices). The temporal aspect considers the worktime latitude, e.g., the flexibility to independently arrange working hours, work schedule, and the ways in which work is performed. Because the spatial and temporal flexibility implies geographical and interactional distance between the teleworker and the conventional workplace, ICT is generally viewed as the mediator for telework (2–4,6,8,10). In most studies, telework is defined as work performed in employees’ home to some extent, within regular working hours. This despite ICT being a natural part of working life today and creating an array of portable electronic devices expanding the access to work in both time and space. Reviews of telework research conclude that few studies include telework performed beyond the workplace and the home or outside regular working hours (e.g., during evenings, weekends, vacations). Further, many studies lack a definition of telework (2–4,6,8,10).

For the purpose of this thesis, telework has been defined in accordance with the definition of telecommuting by Allen et al. (10), that is: “...a work practice that involves members of an organization substituting a portion of their typical working hours (ranging from a few hours per week to nearly full-time) to work away from a central workplace-typically principally from home- using technology to interact with others as needed to conduct work tasks.” (p.44, 2015).



## **The opportunities and challenges of telework**

The conventional work practice constitutes a social system with predefined formal regulations and objectives that are determined by an employer and rooted in a physical context. Hence, the conventional work practice provides workers with an organizational, social, and physical framework that guides the execution of the professional role, activities, responsibilities, and work relationships. This construct allows employees to separate their professional role and responsibilities from those in private life (6,25–27).

The introduction of telework reshapes the conventional work practice in two major ways. First, telework provides the flexibility to perform work at new places and times that are not traditionally associated with, or designed for, work. Second, telework changes the formal power balance at work by shifting control over where, when, and how work tasks are performed from the employer to the individual employee. One major effect of telework could thus be an increase of individual autonomy, i.e., the opportunity to control and organize work. An increase of autonomy comes with greater responsibilities of self-regulation, that is independently and effectively allocating resources in time and space in accordance with work obligations. Telework may also place demands on an individual's ability to separate work from private life in time and space, physically as well as mentally (6,8,22,28,29). Thus, telework changes the conditions for work practice, which might ultimately create new conditions for, e.g., well-being and performance at work.

The integration and separation of work and nonwork and activities are focal aspects of telework research. The level at which work and nonwork domains are “mutually (in)compatible” could be important for the outcomes of telework as regards well-being at work (8,30). Telework could increase individuals' autonomy to organize work in time and space and provide the opportunity to adapt work-related demands (e.g., workload, time pressure, work relationships) to nonwork responsibilities (e.g., family and leisure activities) and vice versa. Congruent alignment of work-nonwork, i.e., work-life balance, could free up time which may be invested into activities supporting family needs, rest, and recovery (8,24,28,31,32). The integration of work into private spheres (e.g., the home environment) may however weaken work-life boundaries and cause difficulties of separating work from nonwork. Incongruence of work-nonwork in time and space during telework could cause work-life intrusion, i.e., private and professional responsibilities may restrict and intrude upon one another and end up in conflict (26,32,33). This has been associated with teleworkers engaging in rumination and worrying about work and having problems mentally detaching from work after working hours. Such difficulties are seen to obstruct teleworkers' abilities to rest and recuperate after work (22,34,35).

A lack of work-life boundaries may also cause spillover effects such as overtime work. Teleworkers may engage in work extension, i.e., supplemental, unpaid work beyond regular working hours (e.g., evenings, weekends, vacations), and work intensification, i.e., working harder with greater effort, during longer, continuous working hours. Studies that have identified such behaviors

show how they can lead to teleworkers exceeding their regular worktime with up to a full extra workday per week. Supplemental work is often found in studies showing productivity increases during telework (17,18,33,36–38) and has been argued to be a possible barrier to mental and physical recovery (36,39).

Teleworkers' mental transition between work and nonwork roles may create psychological and cognitive strain, which might cause them stress. In addition, the locations where telework takes place may entail demands opposing those related to work. It has been suggested that insufficient resources (e.g., time, instructions, feedback, recognition) to meet the demands of work and nonwork might cause role ambiguity resulting in stress and exhaustion (22,27,40). A review on stress among teleworkers showed that the majority of stressors when teleworking from home were caused by interruptions from family members. In comparison, sources of stress during telework from places beyond employees' workplace and homes were mostly "job-related," caused by, e.g., poor work relationships and high workload (35). This notwithstanding, the impact of telework on employee stress appears to be inconsistent. For example, a comparison of self-assessed stress levels between workplace days and teleworking showed lower stress during telework (41), while a review on stress during telework showed inverse effects, and a longitudinal study on stress-related biomarkers indicated no impact of telework (defined as working from home) on employees' stress responses (42).

Telework may entail restricted communication with supervisors and coworkers and reduce insight into and influence over work processes. These effects have been positively related to teleworkers experiencing social and professional isolation, and are seen to possibly impair organizational identification, work motivation, and loyalty (43,44). A sociotechnical system approach suggests that the match, or mismatch, between organizational, individual, and technical demands could determine the direction that telework imposes on these outcomes. For example, insufficient managerial and technical support to teleworkers' work-related needs (e.g., work obligations, communication) might reduce work performance and weaken work relationships (45). Regular face-to-face interaction and digital connectivity is often suggested to attenuate the negative impact of telework on work relationships by supporting teleworkers' availability and social presence at the workplace (46,47). However, it is also seen that teleworkers may suffer guilt and fear of missing out when physically absent from the workplace and, therefore, extend their availability and digital connectivity beyond regular working hours (8,9,48). The expansion of digital communication has been found to significantly increase teleworkers' stress levels by causing work-life intrusion and constant social interruptions (9,10,35). Hence, telework may cause a connectivity paradox, i.e., creating a need of being digitally connected and available, to remain visible to coworkers and managers when teleworking, while also requiring the ability to disconnect, to maintain work-life boundaries (49,50). The general conclusion of studies investigating the social aspects of telework options is that there are more factors impacting the outcomes of work relationships than those of physical distance. For example, some studies suggest that the level of task independence

and how well employees know one another may affect how work relationships are perceived during telework (10,51).

The extent to which individuals' need for work autonomy is satisfied during telework has been seen to impact the ability to achieve work-life balance and prevent stress. As seen in studies, high levels of temporal latitude (e.g., schedule flexibility) could support teleworkers' autonomy to effectively allocate their job resources (e.g., time) in a way that may prevent, e.g., work-life conflict, stress, and exhaustion (10,52).

How the extent of teleworking affects well-being is a recurring question without a given answer. Researchers reviewing the effect of telework on job satisfaction suggest that the relationship between the extent of telework and job satisfaction is curvilinear, meaning that low levels of teleworking have a positive impact on job satisfaction, but this impact plateaus at higher levels (defined somewhere around two days per week) (10,51,53). However, even low telework frequency (from home) has been associated with negative effects such as decreased work performance, poor relationship quality with coworkers, and increased work-life conflict (54). Conversely, some studies show that a high extent of teleworking can enhance the quality of employees' relationships with managers and improve work-life balance (36). There are also studies suggesting that any level of teleworking may reduce individuals' work performance and lead to work-life conflict (55).

All things considered, the impact of telework is shown to be bidirectional. The same factors that are associated with opportunities for health and well-being during telework have also been defined as challenges. Thus, telework is full of paradoxes and several researchers conclude that the resources of spatial and temporal flexibility and work autonomy alone are not sufficient to achieve the benefits expected of telework. There are other aspects affecting the outcomes of health and well-being, beyond those commonly investigated within this research area.

## **Telework in academia**

According to statistics reported by the European Commission's science services, approximately 40 percent of the teleworkers in EU are found in knowledge- and information-intensive occupations such as teaching and science (6,7). Despite this high share of teleworkers, little attention has been directed towards the opportunities and challenges of telework at academic institutions.

Like what has been seen for other occupations, academics could benefit from telework, which could facilitate their work-nonwork adaption by giving them spatial and temporal flexibility to align their professional and individual needs and preferences. A study comparing outcomes of telework and conventional workplace work found that teleworking academics were more productive, happier, and experience lower levels of fatigue and stress than non-teleworking peers (56). The flexibility provided by telework has been suggested to alter academics' work-related demands and resources by protecting their working time, performance, stamina, and work-life balance (55–59). For example, telework from places free from work-related disruptions could allow

better concentration (55,59). This, in turn, has been associated with academics being more productive, dedicated, and satisfied with their work, while also experiencing less frustration and exhaustion when working (55,59).

Criticism has been directed towards the introduction of telework options in academic institutions. Some researchers argue that telework decentralizes the academic work practice by increasing academics' individual responsibility for organizational performance and quality in teaching and research. According to such argumentation, the flexibility provided by telework encourages academics to adapt their private life in a way that meets their work obligations (60,61). In a literature review listing potential benefits and drawbacks with telework in academic institutions, telework was associated with work-life interference caused by work extension and intensification. Teleworking was also found to restrict academics' time for leisure and rest, and cause stress, partly because of increased availability through ICT (59). Some findings have shown higher stress levels among academics with long working hours while teleworking (55,61). Additionally, it has been found that academics describing a culture of working long hours are less satisfied when teleworking, which might be related to an increased intrusion of work into private life (58).

Telework options may influence the communication flow and performance quality in academic institutions. In a study telework reduced the number of events that united faculty members, resulting in lost peer-learning opportunities and a sense of social isolation. This was especially recognized among adjuncts, who reported organizational detachment because of their own teleworking, as well as that of coworkers (62). Evaluations of telework options in academic institutions have concluded that the academics with the most professional experience (e.g., (associate) professors) are best suited for telework options. This was based on these academics' high experience in teaching, which was seen to ensure their teaching quality when teleworking (61,62).

Challenges with virtual interaction have been identified as a risk for academics experiencing social and professional isolation during telework (59,62–64). Virtual interaction may be an obstacle for social cues which can create feelings of uncertainty and hostility, with the risk of undermining trust between teleworking coworkers, which in turn could create feelings of social isolation. Such feelings have been shown to have a negative impact on academics' perceived personal growth and health (62,65).

### ***The academic work context***

Digitalization has increased the access to and the reach of information in society and changed the conditions for when and where education can be offered. This development has placed the higher education system on a globalized arena and increased academic institutions' national and international competition for resources such as students, funding, and faculty staff (66–69). Consequently, academic institutions have developed towards a market-oriented management, which has changed the working conditions for teachers and researchers within higher education. The work context of academic institutions today is described as characterized by increasing demands on transparency, availability, and

achieving the organizational productivity and quality goals in teaching and research. Reports on the situation within higher education demonstrate that academic institutions may lack sufficient resources (e.g., research funding and faculty staff) to handle these increasing demands (67,69–71).

Researchers argue that the demands and workload prevailing in academic institutions today have changed academics' need for autonomy in their work. It is claimed that academics' work autonomy does not necessarily correspond to their actual influence over their work situation (66,72). Studies on academic institutions' work environments show that academics may feel overscheduled, i.e., not having enough time to fulfill their work obligations during regular working hours. These experiences have been associated with behaviors such as work extension during weekends and nights, with less time for relaxation, causing stress, sedentary behaviors and reduced well-being. Additionally, work extension for research purposes has been considered a typical work pattern for academics (73). For example, a study showed that about 40 percent of academics worked more than 50 hours per week (74). In relation to this, somatic symptoms such as sleep disturbance and musculoskeletal pain have been identified, together with exhaustion and burnout (75–77).

Academic position has been linked to perceived stress levels (61,68,75,78). Generally, the highest levels were recognized among lecturers and associate professors (68,76). Perceived stress levels were also strongly correlated to the number of working hours, where more working hours meant higher stress levels. Factors that have been identified as significantly impact stress levels are the number of hours spent in research, peer recognition, personal and professional development, freedom and independence in the job, and job security (62,67,68,71,76). However, a satisfied need for freedom and independence at work had the largest impact on academics' stress levels (67,73).

## **Telework and leadership**

Leadership is considered an important mediating factor for the impact of telework on health and well-being outcomes. Beneficial effects are generally coupled to managers providing teleworkers with support – both formal (e.g., financial, technical, instructional) and social (e.g., recognition, feedback, trust, encouragement). Another central aspect for positive outcomes is the relationship quality between teleworkers and their managers (10,79,80).

Previous findings suggest that leadership that is relationship-oriented and includes trust-building efforts can improve organizational performance among teleworkers. Scholars have connected these leadership aspects to the transformational leadership theory (81) and the leader-member-exchange (LMX) theory (82). Hence, leaders who engage in considering, motivational, and intellectually stimulating behaviors with the purpose of manifesting employee trust, loyalty, and respect, and who have a high-quality relational exchange with employees, are seen to impact teleworkers' well-being positively (83–86). A high-quality exchange/relationship is generally defined by leaders having the ability to provide their employees with the necessary work-related resources and sup-

port (e.g., influence over work, information, career advancement, schedule latitude, economic rewards) in exchange for, e.g., employees' dedication, loyalty, and work performance (82,85,86).

A report published by the Institution of Occupational Safety and Health suggested that behaviors related to transformational leadership and LMX theory (e.g., trust and contingent reward) could promote the fulfillment of work-related health and safety standards in organizations offering telework. Further, research shows that a high-quality relationship with managers, and managers' trust, can positively influence well-being and job satisfaction among teleworkers (85). It has also been found that frequent teleworkers who receive extra support from their managers perceive higher work commitment and are more productive than those who do not receive the same support (10). Additionally, support from managers has also appeared to reduce teleworkers' psychological strain (45,87). Other studies have shown that transformational leadership behaviors can mitigate the negative impact of telework on relationship quality through physical and psychological distance (83,85).

Managers' abilities to achieve a culture of high-quality relationships and trust has thus been found to alter negative impacts of telework, leading to favorable outcomes. However, the physical distance inherent to telework may cause psychological distance between managers and their employees, which may challenge managers' cultivation of work relationships and trust (83,88–90).

Telework is argued to disrupt the traditional organizational structures and norms of leadership practice. A review on leadership in virtual and telework settings showed that these contexts could undermine the influence of leadership on work groups' performance, organizational identity, and relationship proximity (91). Additionally, the findings indicated risks of telework depriving managers of their hierarchical and decisional authority. Consequently, managers may experience insufficient control over, and insight into, employees' work processes, as well as in their social and professional needs during telework (90,91). Research indicates that, rather than engaging in behaviors associated with favorable outcomes, managers leading teleworkers may compensate for their lack of control and insight by restricting telework options. Some researchers have referred to this effect as managers becoming "gatekeepers to telework." Controlling leadership behaviors, and lack of consideration for employee needs, have been associated with reduced work engagement, job satisfaction, and well-being, and with social isolation, stress, and lowered retention intentions among teleworkers. For example, when managers' communication was insufficient, and they did not acknowledge and help the solving of work-nonwork conflicts, teleworkers' felt neglected and their work engagement decreased (90,92).

### ***Leadership in academia***

Leadership in academic institutions is described as complex in nature. It entails the responsibility over a wide range of faculty members with differing functions, professions, academic fields, and nationalities, expected to develop new

knowledge while also endeavoring to achieve common goals set by the organization, stakeholders, and politicians (65,72). It also involves strategic planning and alignment of organizational resources (e.g., economy, personnel) in accordance with the development of teaching and research. Moreover, academic leadership must consider the complexity and autonomy defined by academia's professional culture and hierarchies. Expectations on and conceptualization of leadership in academic institutions seem to vary with its structural and social diversity. It has been ascertained that this complex interplay complicates generalized solutions and increases the need for adaptable leaders (65,72). A review on leadership in academic institutions showed that the academic leadership requires multiple abilities to meet all the different expectations of the organization, stakeholders, and academic professions (72). Additionally, it is argued that the exercise of academic leadership may be challenged by the autonomous and collegial culture of academic institutions, where everyone is leading themselves, more or less. Scholars have concluded that, because of academia's complex construct, it requires more adaptive and distributed leadership approaches than other sectors (65,66,72,93).

Academic leadership thus requires a contextual awareness relative to different responsibilities, functions, and professions involved in academic work. Studies investigating academic managers' experience of leadership have found that they suffer difficulties in defining their role and function. It is also seen that they often feel undervalued (72,93,94).

The democratization of information access and power relationships created by digitalization and globalization has been claimed to increase the complexity of academic leadership. The constant changes require academic institutions to become more "ecological/organic," meaning that they must have the ability to constantly develop with surrounding changes. Academic leaders have become less of control agents and are instead expected to become facilitators of constant change. The enabling of work beyond the conventional workplace has also highlighted the importance of academic leaders' ability to maintain sustainable work relationships and facilitate work performance. As recognized in other sectors, the quality of collegial and managerial relationships has been identified as a predictor of work commitment, successful cooperation, and positive attitudes and behaviors. Leaders' abilities to manifest trusting relationships among faculty staff seems to become even more important with the introduction of flexible work arrangements (65,72,93,94).

## **Homebound work and the COVID-19 pandemic**

In March 2020, the outbreak of the COVID-19 pandemic forced authorities all over the world to request their citizens to stay at home, to limit the risk of contracting and spreading the disease. Organizations in various sectors had to redirect their work processes to digital and homebound work solutions, which workers were forced to adapt to (95). In Europe, this situation saw the number of workers practicing work beyond the conventional workplace increase from 9 percent (in 2019) to about 40 percent (7). Consequently, homebound work

became an international norm for a large number of organizations and occupational groups (7,95).

Differences were seen between countries, organizations, professions, and workers' conditions for switching to, and dealing with, the homebound work situation. Many organizations lacked adequate plans and experience for having their employees working from home, and there could be inequalities in employees' possibilities of adjusting to this situation (7).

The conditions for the homebound work practiced during the COVID-19 pandemic differed from traditional telework in that it was mandatory and limited to employees' home. The homebound work conditions for spatial flexibility and autonomy were thus different to the conditions characterizing traditional telework. Hence, workers generally neither had the option to choose, nor the possibility to alternate, their place of work during the pandemic (7,96,97). Some scholars suggested that the characteristics of this mandatory homebound situation could exacerbate previously recognized challenges during traditional telework (97,98). However, research into this situation partly showed that the level and experience of individual autonomy during homebound work could differ depending on employees' skill level and the standardization of their work tasks. For example, employees with tasks requiring basic knowledge and training (i.e., medium-skilled workers) could experience higher work autonomy than employees with low- or high-skilled tasks. Additionally, the employees with highly standardized work (i.e., low- and/or medium-skilled workers) could perceive less impact of the increases in supervision and control which followed the transition to homebound work in some organizations (99). Like traditional telework, homebound work could improve temporal flexibility by providing the possibility to independently tailor working hours and breaks to personal preferences and, naturally, homebound work saved time by reducing the need for commuting (96,100,101). In some cases, the control over work schedules was seen to facilitate the performance of complex tasks, while time savings were sometimes invested in physical activity (100) or extra hours of sleep in the morning (102). Such behaviors could benefit well-being by the reduction of stress during workdays (100,102). However, changed working behaviors during homebound work were also associated with restricted time for work and leisure, with negative consequences such as poor sleep quality and depression (103,104).

In general, the outcomes and impacts of the pandemic's homebound work on occupational well-being and work performance resembled those seen in traditional telework (96,101). Among the challenges suggested to have the most negative impact, loneliness, work-nonwork interference, and ineffective communication were identified. These challenges were associated with, e.g., stress, anxiety, overtime work, and poor sleep quality (105).

Unclear physical and psychological boundaries between work and non-work were an evident problem in the homebound work situation – sometimes even described as the primary problem (100). Challenges to work and non-work boundaries were mostly attributed to the lack of a dedicated home office, the presence of family members, and the lack of a pre-determined work schedule. Such factors could cause distraction, complicate work performance, make



it harder for individuals to manage and limit their working time, and lead to stress (100,101). This was especially common among parents and, above all, among women having children home-schooled during the pandemic (100,101,106). On the other hand, the homebound work environment was sometimes seen to provide better conditions for privacy, concentration, and comfort compared with the conventional workplace. In such cases, homebound work seemed to significantly facilitate the completion of complex work tasks, especially among individuals disliking their conventional workplace (100).

As working from home was mandatory, the physical working conditions of each employee's home became important. Individuals lacking a designated workstation in their home could be forced to work in their kitchen and/or bedroom under inappropriate ergonomic conditions, which could lead to, e.g., musculoskeletal problems (100,101). A review on the physical and mental health effects of the pandemic's homebound work revealed increases in back pain together with decreases in general physical activity as well as in specific sport exercising (101). Similar findings were recognized in other studies reporting worsened low back and neck pain among homebound workers (107) and increases in sedentary behaviors (108). These effects were paired with consequences such as weight gain and decreased job satisfaction (107,108).

Another difference between the pandemic's homebound work and telework was the role of ICTs. ICTs became a more central feature in the pandemic situation, as digital tools had to replace the interaction and work routines normally performed in the conventional workplace. Digital interaction tools such as Zoom<sup>®</sup> and Teams<sup>®</sup> became the primary place for employers, managers, and employees to meet and interact, resulting in them spending a considerable amount of their working hours in digital environments, using various digital tools (98,101). Consequently, new ICT systems and tools were implemented to meet the increased digital needs of the homebound work situation. This placed higher demands on employees' digital competencies. Common challenges that appeared in this situation was cognitive overload, i.e., mental weariness, and technostress from the extensive use of digital tools and interaction. This was seen to affect well-being and work performance negatively by leading to fatigue and stress (98,101).

Individuals' abilities to handle the transition and adjustment to the homebound work situation were linked to similar factors as those found during traditional telework. Social support from managers and colleagues was seen to mitigate problems related to reduced work performance, such as procrastination, stress, and low job satisfaction. It was also found that social support from managers could reduce emotional exhaustion and compensate for employees' lack of self-discipline when working from home (104,105).

There are studies showing that organizations' supervision could change during the pandemic, becoming more bureaucratic and standardized in nature. In some cases, managers were seen to practice intrusive leadership styles, which were associated with negative effects for employees' well-being, such as depression and anxiety (101). One study concluded that managers seemed to have a harder time adjusting to the homebound work situation than their employees (104).

The pandemic's homebound work situation was also seen to affect academic institutions. Above all, switching teaching activities to digital settings seemed challenging. Teachers were found to suffer from technostress, anxiety, and fatigue because of the increased use of technical equipment and digital interactions (101). There were studies showing that academic staff got sick from working, were emotionally exhausted, more negative, tired, and had less energy for leisure during this homebound work situation (101,109). However, a study conducted at Swedish academic institutions found that academics seemed more interested in their work, though they tended to extend their working hours (110).

Academics' work-nonwork balance was another aspect that seemed to face negative challenges (101,111). Female academics sharing their experiences of being working mothers in this situation described the homebound work situation contributing to an increased load of domestic chores, which restricted their work performance and impacted negatively on their mental well-being (111).

Differences in the ways of handling and perceiving the homebound work situation were seen between different academic positions. Junior academics (e.g., adjuncts, doctoral students) seemed to handle the transition to homebound work worse, and suffer more from the social and professional isolation that could come with it, than their senior colleagues (e.g., professors) (109).

Further, differences were also recognized between academic managers and their staff. For example, managers could have a harder time adjusting to the homebound work situation than the academic staff. Conversely, other findings suggested that managers perceived less stress and fatigue than, e.g., teachers and scientists. In a comparison of the perceived effectiveness of management and cooperation during the homebound work situation, managers rated their achievements more positively than professors and teachers. This also applied to rating of the regularity of managers' communication, information sharing, awareness, and problem-solving (109).

## **Assessments of work-related health and well-being during telework**

Literature reviews show that commonly studied outcomes of telework are job satisfaction, autonomy, general health aspects, well-being, stress, exhaustion, social support, social isolation, organizational commitment, trust, control, work relationships, and leadership support. The populations being studied mainly fall within the knowledge branches of telecommunications, finance, IT, engineering, and government departments (3,6,8,10,26,28,79,112). Studies have also been conducted within logistics, health care services, higher education, and property and construction sectors, and there are studies that have not defined their samples. The countries represented are mainly the USA, Australia, Germany, the United Kingdom, the Netherlands, and other European countries (6,13).

Reviews on telework and health outcomes conclude this research to be homogenous in terms of study designs, but heterogenous considering outcome measures, samples, and telework definitions. Most of the research consists of

quantitative studies with cross-sectional designs conducted with validated surveys and scales at a single timepoint. The cross-sectional data provide insights into the relational effects of telework, but lack a directional insight into studied relationships and may therefore fail to capture the effects of change and longer-lasting exposure. Several different instruments have been used to measure telework and health outcomes, which has affected the uniformity of research (3,6,8,10,26,28,79,112).

Other recognized study designs are quasi-experimental, mixed-methods, longitudinal, and qualitative. There is a limited number of longitudinal studies (113). Among those performed, some have employed qualitative case study designs based on semi-structured interviews and/or observations (41), while others have used combinations of survey data, diaries, and objective assessments (e.g., of stress biomarkers) (42). Regarding the quasi-experimental studies, these have entailed telework interventions where employees have been divided into groups of teleworkers and non-teleworkers, and outcomes have been compared and evaluated with mixed-method approaches such as with surveys and/or interviews. In such studies, telework options are mostly temporary and include individuals without previous experience of telework (41). Outcomes that have been studied with this design are, e.g., job performance, satisfaction, work relationships, and the choice of telework. Generally, outcomes are tested with within-subject and between-subject analyses, and factors used for comparison are usually gender and age (6,8,10,26,28,38).

Because most studies are conducted using surveys, the outcomes of telework are generally based on self-ratings. Such data are sensitive to recall bias, as they are highly dependent on the reliability of individuals' answers. A few studies have used objective measures of blood pressure, urine, and saliva to assess biomarkers of stress (42,102,114,115). Objective measures are considered to complement subjective measures, as they can provide more reliable and robust data (116–118).

Various approaches are used in the qualitative studies but most are conducted with semi-structured interviews, either individually or in focus groups. These studies have, for example, investigated social aspects of telework and work-related well-being, often guided by theoretical frameworks (52,119–121). Qualitative data are argued to be important for identifying and understanding the underlying impact of telework on health outcomes (8,10). Attitudes and perceptions of telework have also been studied using virtual ethnography approaches. In such cases, data have been collected from public online forums and organizations' intranets (50).

Disparate findings in previous research have been related to e.g. differences in research designs, a large variety of instruments not tested against samples, heterogeneous samples, and inconsistency in telework definitions. Most studies refer to telework as work from home and therefore do not include work from places outside individuals' workplace and home. There are also differences in the amount and frequency of the telework being studied, and several studies lack definition (2,8,10). The problem with the lack of a common definition also applies to the outcomes being studied, such as work-life balance/conflict (2,6,8,10,26,28,79,112).

Taken together, the differences in telework research make it difficult to draw any conclusions on the impact of telework on work-related health outcomes. Overall, there is a limited number of studies looking into health aspects of telework and thus, this research field only covers a limited number of aspects that are considered important for individuals' health and well-being at work. Scholars argue that studies should adopt a more holistic research approach (8,10), where contextual information – such as personal, organizational, work, physical, and social characteristics – should be emphasized.

## Theoretical framework

Early research into health and well-being was characterized by reductionistic and dualistic views, where the biological and psychological components of the human body were treated as separate areas, and where objective assessments of health/well-being were considered superior to subjective equivalents (122–124). Through the biopsychosocial model, Engel proposed a holistic approach to health/well-being where subjective and objective aspects were combined and treated as equally important. According to the biopsychosocial model, health/well-being, or the absence thereof, is the result of the interaction between biological (genetic, biochemical), psychological (behavioral), and social (cultural, socioeconomically) aspects. Hence, Engel suggested that to understand the presence and absence of health, health should be considered the synergy between the body, the mind, and their surrounding context (122).

Research into well-being at work is often narrowed down to study single dimensions of well-being (e.g., affective well-being) and often lacks consideration for the context of work. Scholars have successively adopted and suggested broader and more context-specific study approaches to expand the understanding of work-related well-being (125–127). van Horn and colleagues (127) constructed what they refer to as a multidimensional model of occupational well-being that considers five different dimensions of well-being at work: affective (e.g., emotions, emotional strain, job satisfaction, organizational commitment), social (e.g., the function and quality of social relationships), professional (e.g., autonomy, aspiration, competence), cognitive (e.g., the ability to concentrate and accommodate new information), and psychosomatic (e.g., individual health complaints). According to van Horn et al. (127), the different dimensions of occupational well-being covary and have an individual as well as a collective impact on occupational well-being.

In line with the multi-aspect approaches to well-being defined by the biopsychosocial model (122) and the five-dimensional model of occupational well-being of van Horn et al. (127), the studies in this thesis have been designed to cover different aspects of well-being in the context of telework. For this purpose, different research methods have been used to investigate the impact of telework on objectively measured psychophysiological and physical aspects of well-being, as well as subjective experiences of, and conditions for, well-being during telework. This has been studied among academic teaching and research staff, and among academics with middle management positions. The findings provide knowledge on, e.g., the impact of telework frequency on perceived well-being aspects (Paper I); stress and recovery reactivity during telework compared with during work performed at a conventional workplace (Paper II); how telework is perceived and experienced among academic staff (Paper III); and how the conditions for and exercise of leadership during telework is experienced by academic managers (Paper IV).

## Rationale for the thesis

The progressing technical development and digitalization have made work more flexible in nature. Working from places and times beyond the conventional workplace, i.e., teleworking, has become increasingly common, not least among teaching and science professions. The work situation in academic institutions is strained due to, e.g., increasing competition for students and research funding, and transition to distance education, which has placed higher demands on academics' competencies, availability, and quality and quantity of work performance. Academics seem to handle this work situation by intensifying and expanding their worktime outside their regular working hours, as well as beyond their workplace. Teleworking could provide academics with the freedom to align the time and place of work to their professional and private responsibilities, which may possibly facilitate their work performance and benefit their well-being. However, telework also entails greater demands on academics' abilities to manage and restrict their work. Failing this, telework may contribute to boundless work restricting academics' possibilities to, e.g., recover and perform well. The success of telework seems highly dependent on academics receiving sufficient organizational resources, such as practical and social support, trust, and recognition from their managers. Academic managers' opportunities for providing the resources needed to support staff members' well-being and performance during telework seem limited. It has been shown that academic managers may struggle with their visibility and ability to show recognition and trust in their staff when teleworking. The COVID-19 pandemic's homebound work situation made the challenges with telework options in academic institutions more evident, though the extent of such options was believed to increase. To create a healthy work environment during telework in academic institutions, more knowledge on the opportunities and challenges of telework is needed.

## Overall and specific aims

The overall aim of this thesis was to investigate how academic teaching and research staff practice telework and how telework affects their well-being at work. Another aim was to investigate the experiences of academic managers leading teleworkers in academia.

**Paper I:** The aim of Study I was to determine if the frequency and amount of telework was associated with perceived health, stress, recuperation, work-life balance, and intrinsic work motivation among academic teaching and research staff.

**Paper II:** The aim of Study II was to determine if psychophysiological activity, postures, and movements differed during telework and work performed at the conventional workplace.

**Paper III:** The aim of Study III was to investigate academics' experiences and perceptions of telework within the academic context.

**Paper IV:** The aim of Study IV was to investigate academic managers' conditions for, and experiences of, leading teleworkers in academia before and during the COVID-19 pandemic.

## Overview of included studies

### Overview study designs

Within the scope of this thesis, the consequences of teleworking for well-being are examined in four studies in the academic context. The first study (Paper I) was based on cross-sectional survey data and examined the association between the amount and frequency of telework and perceived health aspects. The second study (Paper II) was conducted with 24-hour assessments of psychophysiological reactivity, postures, and movements, and with daily self-ratings on stress, fatigue, and recuperation, to compare exposures during telework and work at a conventional workplace. The third (Paper III) and fourth studies (Paper IV) had qualitative study designs and were based on semi-structured interviews using an inductive phenomenographic approach. Study III investigated the experiences and perceptions of telework in academia, and study IV investigated the conditions for, and experiences of, leading teleworkers in academia before and during the COVID-19 pandemic. An overview of the studies is given in Table 1.

**Table 1.** Overview of study designs and samples

Paper	Sample	Focus	Data collection	Analysis
<b>I</b>	Academic teaching and research staff $n = 392$ (♀ 204 and ♂ 188), from six different universities	Telework amount and frequency and perceived health, work-related stress, recuperation, intrinsic work motivation, and work-life balance	74-question web-based survey	MANOVA, and regression models were used to determine the association between perceived health aspects and telework
<b>II</b>	Academic teaching and research staff $n = 23$ , (♀ 12 and ♂ 11) from five different universities	Psychophysiological reactivity, postures, movements, and perceived stress, fatigue, and recuperation	Heart rate recordings, saliva samples, accelerometry measures, VAS scales, and diaries	Repeated measures ANOVA and paired sampled t-tests were used to determine the difference in studied factors between telework and work performed at a conventional workplace



<b>III</b>	Academic teaching and research staff $n = 26$ (♀ 19 and ♂ 7), from six different universities	Experiences and perceptions of telework in academia	Semi-structured interviews	An inductive phenomenographic research approach was used to investigate similarities and differences in experiences
<b>IV</b>	Academic middle managers $n = 16$ (♀ 8 and ♂ 8), from nine different universities	Experiences and conditions for leading teleworkers in academia before and during the COVID-19 pandemic		

## Overview study samples

The study samples in this thesis includes a total of 457 academic staff members from 16 urban and rural Swedish universities and colleges within various pedagogic and scientific fields located in different parts of Sweden. Study samples were recruited separately for each study. Papers I–III included academic teaching and research staff employed as junior lecturers, senior lecturers, and professors engaged in teaching and/or research during  $\geq 50$  percent of their working time. The sample in study IV included academics who were employed as middle managers and leading teleworking teaching and research staff.

## Paper I

### Data collection

For study I, academics’ amount and frequency of telework, and their perceived health, were assessed in a web-based survey through the SUNET Survey© software (Artologik Survey & Report). The survey comprised 74 questions including items on telework and 11 scales with items on perceived health aspects. It also included demographic data such as age, gender, family situation, form and extent of employment, work content, and working time.

To examine how often academics worked outside their conventional workplace, telework frequency was assessed using four possible options: “never,” “less than 1 time per month,” “several times per month,” “several times per week,” and “always.” Telework was also assessed using the amount of telework, i.e., the average number of hours the academics spent teleworking per week in the preceding month.

To assess work-related health aspects, the study includes health-related factors commonly recognized as affected by teleworking.

- *Perceived health*, General Health Questionnaire (12 items) (128)
- *Work-related stress*, Work Stress Questionnaire (21 items) (129)
- *Recuperation*, Validated items for recuperation (8 items) (130)

- *Intrinsic work motivation*, Basic Psychological Need Satisfaction at Work Scale (21 items) (131)
- *Work-life balance*, Copenhagen Psychosocial Questionnaire (4 items) (132)

The items on *perceived general health* assessed work-related health aspects such as the ability to cope with work, feelings of strain, levels of anxiety or depression, and perceived confidence at work. *Work-related stress* considered how academics perceived their influence at work, time interference between work and leisure, work demands and commitment, indistinct organization and conflicts, such as unclarity of organizational goals and work assignments, and the presence, involvement in, and management of conflicts at work. *Recuperation* assessed how tired, rested, or recuperated academics felt during their workdays. *Work-life balance* estimated perceived work-to-family conflicts, i.e., the intrusion of work in family/private activities, and vice versa. *Intrinsic work motivation* was an assessment of academics' perceived autonomy, such as the sense of freedom and choice at work, perceived competence in the form of skill fulfillment, appreciation at work, and relatedness, such as the establishment of social work relationships. Items were formulated as statements and academics gave their answers on Likert scales.

### **Sampling**

Twenty-four universities were selected for recruitment based on organizational size, geographic location, and proportion of teaching and research. An email request to distribute the survey was then sent to the universities', human resource departments, of which six agreed to this request. The accepting human resource departments then forwarded an email invitation, containing study information and a weblink that gave access to the survey, to eligible participants. Reminders to answer the survey were sent approximately two weeks after the first invitation. The survey yielded 392 responses with a 14 percent response rate relative to the number of eligible participants employed at the responding universities. The survey data were collected between May 2017 and March 2018.

### **Analyses**

For the scales on health, work-related stress, recuperation, intrinsic work motivation, and work-life balance, the Likert method (133) was used to calculate the index of each scale's total score. Each scale's internal consistency was tested in terms of Cronbach's alpha. For the item on telework frequency, the end categories "never" and "always" were merged with their adjacent categories due to few responses.

The data were analyzed using multivariate and univariate analysis of variance with the scales on health, work-related stress, recuperation, intrinsic work motivation, and work-life balance as dependent variables, and the frequency of telework as the independent variable. Model assumptions in multivariate and univariate analyses of variance were checked using Box's M test, Levene's

test, and standard graphical procedures. For the amount of telework, regression models were fitted for each of the dependent variables with amount of telework as the independent variable. All analyses were performed with and without adjustment for age, gender, marital status, children, form of employment, commuting time, and job content. The statistical analyses were conducted using SPSS Statistics 22.0 for Windows (IBM Corp., Armonk, NY, USA), and  $p < 0.05$  was considered significant in all tests.

### **Findings**

Academics who were teleworking several times per week or more reported more work-related stress related to indistinct organization and conflicts, and individual demands and commitment, compared with academics who teleworked less than one time per month. The most frequent teleworkers also showed a tendency for more fatigue than those teleworking less frequently.

The analyses did not show any association between telework frequency and academics' perceived autonomy, work demands, work-to-family conflict, or the establishment of social work relationships. For the amount of telework, the analyses showed no significant effects on perceived health aspects from academics' number of hours of telework per week.

Regarding predictors, the results did not change when adjusted for age, gender, marital status, children, form of employment, commuting time, or previous job content. Female academics perceived more stress and fatigue than their male colleagues, but also perceived better relatedness in their work. As regards job content, performing a high proportion of research tasks at the workplace was associated with less work-life balance. The presence of children when teleworking from home was associated with more stress related to indistinct organization and conflicts and less satisfied need for competence at work.

## **Paper II**

### **Data collection**

Data on psychophysiological reactivity, postures, movements, and perceived stress, fatigue, and recuperation during teleworking days and workplace days were collected using heart rate recordings, saliva samples, physical activity assessments, self-ratings, and diaries. In addition, participants' gender, age, height, and weight was documented.

The participants' psychophysiological reactivity was determined by heart rate and heart rate variability (HRV) assessments, and cortisol concentration in saliva. Heart rate and HRV were sampled with 24-hour assessments using a Firstbeat Bodyguard 2 device (Firstbeat Technologies Ltd., Jyväskylä, Finland), which was attached to the participant's chest area using two electrodes.

For salivary sampling, a self-administrated Salivette active sampling technique (134) was used to assess daily changes in salivary cortisol concentration (cortisol/ml saliva) by sampling saliva six times a day during one day of workplace work and one day of teleworking. The sampling technique consisted of having the participant chew on a cotton swab for 30 seconds to obtain saliva,

then placing the cotton swab in a standard centrifugation tube and freezing it at -18 °C. Participants were asked to refrain from consuming alcoholic beverages or nicotine, and performing strenuous physical exercise one hour prior to salivary samplings, to avoid increasing cortisol secretion.

Postures and movements were assessed using 24-hour AX3 accelerometry samples of acceleration frequency. Two AX3 devices were attached to the upper arm and mid-thigh on the same side of the participant's body. To synchronize the AX3 arm and thigh devices (135), the participants were instructed to perform reference movements at the start and end of the measurement period, as well as once a day (see Paper II for details).

Perceived stress, fatigue, and recuperation were assessed using self-ratings on visual analogue scales (VAS) ranging from 0 to 10. Participants estimated how stressed and tired they felt before and after each workday, where low ratings indicated no/low stress/fatigue and higher ratings indicated feeling more/completely stressed/fatigue. In the mornings before leaving for work, participants estimated how recuperated they felt, where low ratings indicated feeling no/low recuperation, and higher ratings indicated feeling more/completely recuperated.

To distinguish teleworking days from days at the conventional workplace, each participant was given a diary where they documented their daily work location, working hours, work tasks, and leisure activities. The diary was also used for documenting daily VAS ratings described above, reference movements, detachment/reattachment of measurement devices, location and time of salivary sampling, consumption of alcoholic beverages or nicotine, and performance of strenuous physical exercise.

### **Sampling**

During the recruitment to Study II, eligible participants were identified through the web-based survey collected in Study I, through which participants who were interested in future studies could leave their contact information. Based on this information, an email invitation was sent to 111 academics. The inclusion criterion was that staff teleworked regularly to some extent and were teleworking  $\geq 1$  day during the week of data collection. Academics who had retired and those with chronic heart conditions were excluded, leaving 108 academics eligible for inclusion. Reminders were sent two, four, and six weeks after the first invitation. The final sample included 23 academics from five different universities. Sessions for data collection startup were booked individually with each participant, and during these sessions, the data collection materials were introduced and measuring devices were applied on the participants' The accelerometers were attached distal on the participants deltoid muscle bracket and on mid quadriceps in accordance with customary procedures. The measurement period lasted for one work week, comprising both days of telework and work at the conventional workplace. It started on a Monday morning before working hours and ended on a Friday night when the participant went to bed and disconnected the measuring equipment themselves. Data were collected between August 2018 and June 2019.

## **Analyses**

Heart rate recordings and accelerometry data were tidied up and processed using customized MATLAB Software algorithms in Spike version 9 for Windows (Cambridge Electronic Ltd., Cambridge, UK).

Heart rate recordings were transformed into variables of heart beats per minute (bpm), and into variables of HRV reflecting the oscillations in, and intervals between, consecutive heart beats (RRI). The HRV variables were transformed into variables in time domain (ms) and frequency domain ( $\text{ms}^2$ ). The HRV in time domains was calculated as the standard deviation of RRI (SDNN) and the root mean square of the successive differences of RRI (rMSSD). HRV in frequency domains was calculated as the mean of low frequency (LF) (0.04–0.15 Hz) and high frequency (HF) (0.15–0.40 Hz) of HRV power during the recorded sessions. The SDNN variable was used for indicating overall HRV, rMSSD and HF for indicating parasympathetic reactivity, and LF for indicating sympathetic reactivity. Psychophysiological activity was determined by the increase/decrease in bpm and HRV values (136).

The saliva samples were processed to remove particles that may affect the results, in accordance with customary procedures (134). Psychophysiological reactivity was determined by comparing the participants' values of cortisol concentration to standardized reference values for age, gender, and time of day (137). Cortisol concentrations beyond reference values indicated an increase in sympathetic response.

The accelerometry assessments of postures and movements were used to calculate median arm angle, number of transitions between sitting/lying and standing, and average time spent in sedentary behaviors (sitting, lying) and other behaviors (e.g., standing, walking, running). Postures referred to the nature of physical behaviors and were indicated by variables of sitting/lying, standing, moving (e.g., walking, running), and arm inclination. Movements referred to the intensity and frequency of physical behaviors based on the number of transitions between sitting/lying and standing, and the durations of arm inclination. In order to enable use of standard statistical methods, a compositional data analysis was performed to obtain relative information between sedentary behaviors and other behaviors.

Based on the diary entries, heart rate recordings, accelerometry assessments, and saliva samples were categorized by work location (i.e., telework and conventional workplace work) and time of day. Heart rate recordings and accelerometry assessments were partitioned into leisure time before working hours (i.e., the time from awakening until the workday begins), work during regular working hours (i.e., 8:00 AM to 5:00 PM, excluding commuting time), and leisure time after working hours (i.e., the time from the end of the workday to going to sleep, excluding overtime work). For saliva samples, values were divided into six timepoints (7:00, 9:00 AM; 12 noon; 3:00, 6:00, 10:00 PM).

Repeated-measures analysis of variance (ANOVA) were performed with workplace and time variables as within-subject effect, with and without adjustment for commuting time, children living at home, and gender. For VAS, paired sample t-tests were used to compare differences between work locations

in self-ratings of stress and fatigue before and after working hours, and ratings of recuperation before working hours.

The statistical analyses were conducted using SPSS Statistics 22.0 for Windows (IBM Corp., Armonk, NY, USA). In all tests,  $p < 0.05$  was considered significant, and the Huynh-Feldt correction was used when the assumption of sphericity was not met.

### ***Findings***

The repeated-measure ANOVA showed a significant interaction effect of workplace and time on the academics' psychophysiological activity by HRV indices. That is, significant more parasympathetic activity before and after workhours were shown during teleworking days, while for regular workhours, there were more parasympathetic activity during office days. Overall, academics had more variation in their psychophysiological reactivity during conventional workplace days.

There was a significant effect of time on cortisol concentration, with a natural decrease in ng cortisol/ml saliva during the day, where the highest concentration is seen in the morning and the lowest at the end of the day. However, when comparing academics' cortisol concentration at times of the day between workplaces, no interaction effect was found.

Academics were generally sedentary regardless of work location, but alternated more between sitting and standing postures during working hours when teleworking than when working at the conventional workplace. The analyses showed no difference in postures between telework and work at the conventional workplace. Regarding arm inclination, findings revealed a similar pattern over workdays with a successive elevation during the day, followed by a decrease after working hours.

The magnitude of interaction effects did not change when adjusted for gender, commuting time, and children living at home.

## **Paper III and Paper IV**

### ***Data collection***

The interviews conducted in Study III and Study IV were based on semi-structured interview guides, and the interview materials were analyzed using an inductive phenomenographic approach. The phenomenographic approach relies on a second-order perspective, where the aim is to describe how individuals experience a certain phenomenon relative to a specific context. In studies with a first-order perspective, the purpose is instead to describe different aspects of the world. The analysis results in a set of conceptions, i.e., categories of descriptions that illustrate the qualitative differences, similarities, and nuances in individuals' experiences (138).

In Study III, the interview guide contained 15 open-ended questions considering academics' telework practice, reasons for teleworking, their work environment, and the possibilities and challenges when teleworking and when working at the conventional workplace.

The interview guide for Study IV comprised two themes and contained 13 open-ended questions. The first theme considered experiences before the COVID-19 pandemic and included questions on opportunities, challenges, conditions, and support for leadership when leading teleworkers. The second theme considered experiences during the COVID-19 pandemic and included questions on the conditions, strategies, changes, and future implications for leadership when leading teleworkers.

Both interview guides contained background questions on the participants' private and professional context.

### **Sampling**

In study III, the recruitment was based on the contact information retrieved from study I. To achieve a varied selection, 100 participants purposively selected based on their age, gender, profession, and geographic location, and then invited by email to participate in the study. The inclusion criterion was that academics had telework experience, i.e., had been teleworking regularly to some extent and had done so for at least one year. Invitation to participate in the study was sent to presumptive participants and email reminders were sent two and four weeks after the first invitation. The final sample included 26 academics from six universities. Interviews were performed during online meeting sessions through a digital meeting tool (e.g., Zoom<sup>®</sup>) and documented using audio recordings. During the interviews, which lasted 13–42 minutes, participants were asked questions from the study interview guide. The data material was considered saturated when new interviews yielded no new answers, and no new information had emerged from the last five interviews. The data collection lasted between April 2019 and March 2020 (before COVID-19 restrictions).

In Study IV, academics employed as first-line/middle managers were recruited both through information requested from universities' human resource departments, and through personnel information displayed on university websites. A total of 97 managers were selected for recruitment based on their age, gender, profession, and geographic location. An email invitation to the study was sent to first-line/middle managers who had lead academics teleworking for at least one year prior to March 2020 (when the pandemic began) were included. Five managers were excluded as they lead only faculty staff not working in teaching and research. Reminders to answer the invitation were sent two and four weeks after the first invitation. The final sample included sixteen academic first-line/middle managers from nine different universities. Data were documented through audio recordings during individual interview sessions using an online meeting tool (e.g., Zoom<sup>®</sup>). The participants were asked questions from the study interview guide and the interviews lasted 41–67 minutes. The data collection started in August 2020 and was finished in September 2021, as the interview material was considered to have reached sufficient saturation.

## **Analyses**

The analyses in study III and IV was performed in accordance with Marton and Pong's description on phenomenography (139). Interview transcripts were read several times in order for the researchers to become familiar with the material. For each interview, the most content-rich meaning units capturing aspects of the study aims were highlighted and compiled. In study IV, to capture the process of change in managers experiences related to the pandemic, meaning units were divided during this step into the period they referred to, that is, before, under or after the COVID-19 pandemic. The meaning units were then condensed until only the main constituent parts of their contents remained. Based on their similarities, the condensed text units were grouped into preliminary categories, and then compared and revised to clarify the contents of each category. The final categories were labeled and contrasted to distinguish their unique characters as well as the similarities and differences between them.

### ***Findings Paper III***

For Study III, seven qualitatively different experiences and perceptions of telework in academia emerged from the phenomenographic analysis. The categories were related to work tasks, coping strategies, workgroup relationships, and policies/regulations, which were mostly interrelated and occurred in the outcome space of societal, organizational, workgroup, and individual aspects.

Based on the categories, academics' choice of telework was influenced by academic practices, work culture, and personal experiences, and was seen to challenge as well as benefit their work. Telework in academia was mostly self-regulated, with unclear preconditions and a lack of formal regulations. Telework could change the circumstances for certain work tasks, while the combination of work characteristics and telework could provide academics with freedom, flexibility, and control, and increase their concentration and efficiency. The possibility to adapt personal and work-related needs when teleworking could promote a balance between work and private life, but could also contribute to boundless work. Telework could mean both opportunities for and challenges to formal and informal communication and could support and change the dynamics of workgroup relationships. Working at the conventional workplace could be practical, but was not considered socially motivated. Telework could provide both better and worse conditions for physical and mental health and well-being. In academia, teleworking when ill was considered culturally accepted and forced by a high workload, but also considered to pose risks for well-being. The choice of telework was sometimes influenced by individual economic and environmental concerns.

### ***Findings Paper IV***

For Study IV, the phenomenographic analysis resulted in five categories respectively for the periods before and during the COVID-19 pandemic, and three categories for the period after the pandemic. Collectively, the process of change of managers' conditions and experiences of leading teleworkers before, under and after the pandemic were represented by categories related to



digital and social interaction, work performance, the work environment in telework, and regulations of telework.

The findings showed that, before the COVID-19 pandemic, the (digital) interaction in telework was considered to create poorer as well as better conditions for communication between managers and employees. Managers explained how telework could be mismanaged by unavailability and/or absence from meetings and the workplace. This could result in negative consequences, which could be noticeable through complaints and discontent in the workgroup and among students. Managers could therefore need to follow up telework. Telework was perceived as changing the norm of presence at the conventional workplace, which could affect managers' insight into the academic staffs' work situation and require a change in leadership. Guidelines were lacking or had varying contents and could differ between universities, departments, and personnel groups. Attitudes toward, and the functioning of, guidelines and policies could also vary. Guidelines for, and regulation of, telework could be based on the needs of management and managers, and follow-up of telework was a matter of managers' trust, support, or control. The work environment management for telework was neglected and based on the conventional workplace environment. Because managers' lacked resources and had limited insight into academics' work environment, the work environment management was de-pended on academic staff taking responsibility, and on the commitment of support functions.

During the COVID-19 pandemic, the homebound work and forced digitalization changed the work conditions and required mobilization of organizational resources and changes in work methods, which brought both challenges and positive effects for work performance and introduction of new employees. Telework experience, digital competence, and good relationships in the workgroup mitigated the consequences of the pandemics' digital transition. The homebound work was described to create advantages for the organization and managers, but challenges for the academic staff. Academic staffs' interest in their work, trust, and solidarity in the workgroup facilitated the switch to homebound work. However, the switch was also described to negatively affect the motivation and interaction in the workgroup. The limited interaction and transparency in the homebound work required a change in leadership. Digital interaction facilitated control over availability and changed managers' distribution of work tasks, but it also meant limited opportunity for inter-action with the academic staff. Lack of interaction during the homebound work contributed to reduced job satisfaction, poorer conditions for support, and weaker social relationships in the workgroup. The homebound work required strategies to maintain the work group's social relationships, however, the managers' strategies for maintaining the work relations and interactions did not always work. During the pandemic, with homebound work being necessary, the availability of employees varied and the need for follow-up could increase. The discussion on whether guidelines should be used or not was brought to the fore and was considered either necessary or redundant as they could have both positive and negative consequences. The homebound work environment created new challenges and required new strategies, but resources and support for managers

were lacking. Managers perceived that the homebound work posed challenges for academic staffs' health and well-being, but also created opportunities. It was considered difficult for managers to gain insight into and understand and manage the academics' needs during the homebound work. Follow-up of staff well-being was often delegated but could also be individual's own responsibility. The work environment for managers deteriorated during the pandemic and the support in regard to managers' work environments varied. Managers could experience remote leadership to lead to a loss of control, increased workload, and lack of support.

After the COVID-19 pandemic, managers expected the future to entail increased digitalization, requiring a development of academic organizations' technology, premises, and digital competence among academic staff. More digital ways of working may lead to increased opportunities in the future and may possibly change the academic work culture and norms. The future work environment management did not seem to be planned in relation to telework, rather, managers described returning to the old habits described before the pandemic. Some academic staff were expected to prefer working at the conventional workplace after the pandemic, while others would probably prefer teleworking. For managers, some had no ambition or expectation of a changed way of working after the pandemic and the strategy was to return to the conventional workplace. For other managers, there were a positive attitude towards increased telework, because it had positive effects on managers' work environments. There was no unified vision of the future governance and management of telework. Managers may need to bridge the gap between the management's visions of telework and the lack of sufficient organizational resources and conditions. To continue offering telework and digital meetings could be an opportunity as well as a threat for the academic work conditions. Managers' views on the need for control and regulation of academic staffs' telework differed.

## **Ethical considerations**

The studies included in this thesis have adhered to Swedish legislation on research involving human subjects (140) and have been approved by the Regional Ethical Review Board in Uppsala (Reg. no. 2016/494; 2018/399; 2020-06012). In the studies, participants were informed that participation was voluntary and that they could terminate their participation at any time without explanation. They were also informed that the collected data would be anonymized, with their names being coded, in order to ensure confidentiality. The participants received this information, together with information on study aims and procedures, prior to data collection. During the individual data collection sessions underlying Papers II–IV, this information was repeated verbally. In all studies, participants had to give their written and/or verbal consent before data collection could begin. The collected data were processed only by the authorized researchers and data analysts involved in this research project and are stored where no unauthorized persons can access them.

## Discussion

The overall aim with this thesis was to investigate how academic teaching and research staff practice telework and how telework affects their well-being at work. The aim was also to investigate the conditions for, and experiences of, academic managers leading teleworkers in academia.

The studies included in this thesis were designed to cover different aspects of well-being. The purpose of the first study was to determine if academics' telework frequency was associated with perceived health, stress, recuperation, work-life balance, and intrinsic work motivation. The second study aimed to determine if academics' psychophysiological reactivity, postures and movements differed during telework and work at the conventional workplace. The aim of the third study was to investigate academics' experiences and perceptions of telework. Lastly, the fourth study's aim was to investigate academic middle managers' conditions for, and experiences of, leading teleworkers in academia before, during and after the COVID-19 pandemic.

### **Telework and conditions for recovery**

Individuals' prerequisites for recovery at work is ascertained as central for occupational well-being (141–143). Insufficient recovery can cause somatic as well as psychological complaints, which may be expressed as e.g. behavioral and/or physiological changes (122). Psychosomatic (e.g. stress) and physical (e.g. musculoskeletal pain) health complaints are often derived from unfavorable work settings and destructive working patterns (127,144). A central aspect in the research on telework and well-being is the individuals' ability to successfully create temporal and spatial boundaries between work-nonwork and detach physically and mentally after work days (8,10,31).

The findings in this thesis showed that the academics' psychophysiological activity and physical behaviors could change in telework and differ from the conventional workplace. It was also found that the academics ability to restrict working hours and recover during telework could be challenged and impacted by professional and culture aspects.

### ***Biological and physical aspects***

It has been suggested that individuals' adaption to surrounding change may affect their biological response and studies of physiological reactivity have been argued to contribute to the explanation of workplace stressors (143). Measures of HRV indices could be used to examine individuals' recovery response to different situations in e.g. work. High overall HRV has been associated with lower morbidity, less stress, and better well-being, whilst low overall HRV has been related to the opposite effects (136,145).

The findings in this thesis showed a significant difference in academics' HRV indices between teleworking days and office days (Paper II). According to these findings, the HRV indices indicated more parasympathetic activity on days of telework, which could be interpreted as academics being more relaxed

on these days. The HRV indices of parasympathetic activity were lowest on office days before work, which could be interpreted as academics being most stressed on these days and at this time of the day. Nevertheless, even if HRV indices could indicate sympathetic activity (e.g. stress response) HRV measures primarily reflects parasympathetic activity and therefore, these measures should be interpreted with caution when determine individual stress (136). However, the findings shown in study II were confirmed by the academics' diary ratings (conducted together with HRV measures) that showed less stress and fatigue on teleworking days, and more recovery in the morning after days of telework.

As physiological stress does not always cause physiological arousal it is suggested to combine heart rate variability measures with measures of other psychophysiological biomarkers as cortisol secretion. Cortisol secretion is referred to as the primary stress response mediator, and high levels of cortisol indicates a high stress response by the central nervous system. Constant high cortisol levels or very high cortisol levels in response to stressors could be predictors of work-related illnesses (117,146). However, we found no differences in academics' cortisol values between days of teleworking and work performed at their conventional office (Paper II).

The differences in academics' HRV indices and cortisol values may be due to the biomarkers different response time, i.e. during the central nervous system's stress adaption one of the first responses is the rise in heart rate and contraction while the cortisol secretion takes longer time (117,146). Thus, it may be that a longer measuring period would show different results for cortisol values in telework than those recognized in our measures. Future studies should therefore preferably conduct longer continuous measurements to capture the change of longer lasting exposure.

When gender was considered in the analyses, we found that women perceived more stress during workdays in general (Paper I), and had lower parasympathetic activity during telework compared to men (Paper II). In previous studies on work related stress it has been suggested that women's work stress might be related to responsibilities outside work because, women generally devote more time to e.g. domestic chores as taking care of children and household work (147). Similar relationship between gender and stress has been found in studies on telework (58,148). In study II, children were not found to contribute to the differences in HRV indices between women and men in telework, and we do not know whether the children were present in the case that academics teleworked (Paper II).

There might be other possible explanations for the gender differences recognized in our findings. For example, research has shown that academics' with a high share of teaching may be more stressed than those with a larger share of research (71,149) and female academics are generally engaged in more teaching activities than their male colleagues (71,150). However, we found that a large proportion of research was associated with more stress among both women and men (Paper I). We also saw that women were typically assigned with the workplace's common administrative tasks, often referred to as "the

academic household work” (Paper III), and such tasks have also been associated with increased stress levels among women in academic institutions (61,71). Thus, it might be the additional load of informal work tasks that contributed to the differences in stress seen between women and men in study II.

Different physical behaviors and work conditions have been suggested to impact individuals’ health and well-being at work (10,35). For example, work related stress has been associated with sedentary behaviors, and physical activity have been suggested to build resources to buffer negative effects of stress and promote recovery. Prolonged stress together with lack of recovery and physical activity may result in serious health impairments such as cardiovascular disease, fatigue, incomplete recovery and mental health issues (136,143,151). The physical activity measurements performed in this thesis showed that academics had an overall sedentary behavior regardless of their work location (Paper II), which could be considered typical for professions with computer bound work (152,153). Telework was sometimes perceived as hindering physical exercise when this was mostly performed at e.g. the office’s gym facilities, during joint exercises with colleagues (Paper III) or because of the restrictions during the pandemic’s homebound work (Paper IV). Similar to what has been found in previous studies (57,101,154), our findings also showed that telework could benefit physical behaviors. Study II showed that the academics alternated more between sitting and standing during workhours in telework compared to office work. Some of the academics described that the absence of commuting, and increased worktime control, could facilitate physical breaks and exercise when teleworking (Paper III).

The physical and ergonomic conditions in telework has yet received little attention but available findings indicate that the ergonomic suitability of the workstation when teleworking can affect musculoskeletal symptoms (10,101). As we measured and compared arm inclinations during office days and teleworking in study II, the inclinations in arm angles seemed acceptable in terms of ergonomics (155). In study III we found that insufficient ergonomic conditions during telework could give the academics pain and discomfort (Paper III). This was also acknowledged in study IV during the COVID-19 pandemic’s homebound work, and was described to require the organization to provide practical support (e.g. desk equipment, chairs) to staffs’ home workspace. The managers in study IV also described using several other strategies to encourage staffs’ physical alternation and activity during workdays such as information, education and digital activities for such purposes. Previous findings have shown that academics could request such strategies to improve their physical conditions in work in general (73) and it may be reasonable to assume that such needs could increase during telework.

Some academics described that they use the option of telework to rest from periods with high workload, and as a strategy to successively recover mentally and return to work after long term sick-leave caused by burnout. The teleworking environment was also sometimes described to facilitate the handling of physical injuries and pain because of the possibility to alternate the workspace when e.g. working from home (Paper III). There is a previous example where telework has been used as a rehabilitation strategy for individuals with spinal

cord injuries to return-to-work (156). Considering this, telework may be a possible future strategy for employers to facilitate their employees' recovery and return-to-work after physical as well as mental health issues and sick leave.

### ***Professional and cultural aspects***

The academics in present studies repeatedly emphasized their difficulties to restrict their working hours, partly because of reasons recognized in previous research e.g. sleeping in, insufficient structures for working hours and breaks, and increased accessibility through ICTs (30,32,35). However, in contrast to most previous findings, the reasons the academics presented in present study for experiencing such difficulties were mostly related to their professional demands and culture.

Studies on work conditions in academic institutions often portray a long hours culture meaning that academics extend their working hours and puts more effort into their work performance (i.e. intensifies) to meet their organizational demands (66,149). We concluded that the academics in our findings generally worked more than was required for their position, which challenged their ability to restrict their working hours during telework (Paper I-IV).

Passion for the job and the sense of duty were examples on reasons for the academics extending and intensifying their working hours (Paper III). Passion for the job has been highlighted as an important factor for academics' intrinsic work motivation and performance (61,67) but have also been seen to trigger the extension and intensification of work (61). As this was previously recognized, we included items for perceived intrinsic work motivation, as we investigated the academics' amount and frequency of telework, but we found no association (Paper I).

It has been suggested that the tendencies towards work extension and intensification may be highly qualified workers' autonomous decision to gain professional recognition (157). The results in study I, which showed increased stress due to individual demands and commitment to work among the most frequent telecommuters, may indicate this. Another interpretation that has been suggested is that the behavior may be a consequence of an experience of effort-reward imbalance, i.e. staff may feel obligated to increase their work effort when teleworking to deserve the option (158,159). We did not recognize such tendencies in the present findings, which may be explained by other previous finding showing that staff did not feel compelled to earn the option of telework when this was perceived as an employer strategy to retain and recruit staff (158). In the present findings, both the academic staff and managers described telework as an important resource for their academic institutions to recruit and keep staff (Paper III; IV).

Studies on telework in academic institutions have shown that academics often extend their working hours because of time pressure and increases in workload (61,73). We found that the academics' extension of workhours was highly driven by quantitative demands in teaching and research and thus, the academics' difficulties with restricting their working hours could also be traced to their strenuous work situation (Paper III; IV). Previous studies on academic institutions have shown that, if academics' resources do not correspond with

their increasing work demands, this may be a risk for work extension, stress and burnout (61,71,73). The relationship between insufficient job resources, high demands and negative health complaints is well established (160) and have often been investigated in studies on telework and well-being aspects (8). Among present findings, it was described that the boundless behaviors recognized during telework could lead to stress and sleep problems, which sometimes had culminated into burnout and long term sick-leave (Paper III).

The academics' ability to restrict their working hours during telework was also complicated by the so called "academic freedom", which referred to the autonomy and flexibility to independently regulate work, often considered as entailed by the profession (161). Accordingly, the academics' ability to successfully regulate the spatial and temporal aspects of their work when teleworking may be considered an expectation built into their profession. The academic profession's autonomy is often discussed as a doubled edged sword that on the one hand could facilitate academics' control over their work performance, but on the other hand may increase the individual responsibility to successfully manage and organize work (65,66,72). We found that, when adding telework to the academic freedom, the opportunities and challenges of autonomy might be exaggerated. Especially, the present findings showed that the academics could be more or less left by themselves with the responsibilities over their work performance and work conditions when teleworking, because the autonomy entailed by telework made work even more individual and self-managed (Paper III; IV). Hence, we found that high expectations on self-management could contribute to some academics having difficulties to find durable structures for their working hours during telework, which could result in work intensification, lack of breaks and extended working hours (Paper III; IV).

A previous study showed that, an inadequate leadership that forced academics to handle a high self-managed workload could be a risk for sickness-presenteeism among academics (162). It has also been shown in both academic work settings and among other occupations that, when absent from work, staff may feel compelled to catch up on the missed worktime due to lack of substitutes and therefore engage in work activities outside conventional workhours (58,158). We found that the combination of the academics' autonomous work and high workload, sharp deadlines, and lack of organizational resources (e.g. personnel) could contribute to telework becoming a natural alternative to sick leave among both staff and managers (Paper III; IV). The academics generally considered this alternative as a necessary and beneficial option to cope with their workload and lack of substitutes (Paper III; IV) however, it was also perceived as a risk for their health (Paper III). It has sometimes been suggested that the changes of today's academic institutions, e.g. more bureaucratic structures and increased demands on performance, may lead to academics' autonomy no longer corresponding with their actual influence over their work (66,163). Hence, academics may feel compelled to use other strategies to gain control over their work-related needs as working outside regular workhours (66,163). In our interviews with the managers, some of them described that they could suggest telework becoming a compulsory replacement to sickness-presenteeism at the workplace as a part of the employee agreement (Paper IV).

The extension of working hours shifting into evenings, weekends and vacations seemed to be a natural feature of the academic work that, in some sense, could be facilitated by the option of telework. Telework could also be considered a resource for academics to handle their high workload when organizational demands are high and available resources are low. Hence, according to our findings, the professional culture seems to play a pivotal role for academics' ability to restrict their working hours when teleworking (Paper III; IV).

Strategies for working hours and breaks, previous telework experience, self-discipline, mental flexibility, and previous experiences of boundless telework, were described as facilitating academics' ability to successfully draw boundaries for work when teleworking (Paper III). In contrast to what is often recognized in studies on telework (10,83,164), the academics in the present studies did not express any need for managerial support for this matter. This may possibly be a consequence of the academic professions' self-regulated nature (61,73,165).

### **Telework, work performance and work relations**

Previous studies on telework have shown that the behaviors of extension and intensification may be initiated by telework enabling secluded work time which may allow more effective work (58,158). Academic staff repeatedly referred to telework as a necessity for their work performance and well-being. The main reason for such experiences was that telework provided conditions for uninterrupted worktime and concentration for e.g. complex tasks in research and teaching (Paper III; IV). Because of this, telework was generally considered a given option for the academic staff, as well as for the managers, when working with tasks requiring deep concentration (Paper III; IV).

There are studies showing that work tasks in higher education, as in working life in general, is getting more complex due to the expansive digitalization (6,62,150). Academics' need for focus and concentration to perform their complex work tasks is a well-known fact that seems difficult for academic institutions to fulfill (66,71,73,148,163). The academics in the present studies could perceive telework as forced if the office environment did not provide conditions for uninterrupted work and concentration (Paper III). Office premises being shared/open/transparent and/or noisy were examples that the academics perceived as unpleasant conditions that could complicate work performance and decrease effectivity. Physical environment conditions such as shared spaces and space limitations have previously been identified as sources of discomfort which showed high correlation with burnout symptoms in academic institutions (77). According to our interviews, the academics' need for telework was expected to decrease if the experienced hinders for concentration in the office's environment were considered and corrected by the organization (Paper III). After the COVID-19 pandemic, many organizations reported plans on transforming their physical premises into more open-workspace solutions (166,167), and similar plans were also recognized among the academic managers in study IV. Our findings displayed that the managers were concerned



about such changes because of expected consequences, as academic staff increasing their teleworking (Paper IV). Considering the findings in study III, the managers' concern might be justified.

Challenges for work performance and interaction have recurrently been brought up for discussion in relation to telework and to distance education. It has been said that the distance between coworkers, teachers and students in telework/distance education could complicate collaboration, collegial learning and problem solving (62,168). These aspects were brought up in the present findings as well, i.e. work performance could be experienced as more difficult during telework for different reasons (Paper III; IV). High absence from the office during telework could be perceived as hindering accessibility to the academics for their managers, coworkers and students, which could have consequences for the work performance, especially in teaching activities highly dependent on collaborative tasks (Paper III; IV). Communication difficulties were another aspect of this problem, e.g. when primarily using text-based and digital communication it could be harder to interpret and understand the meaning of conversations due to the lack of body language and facial expressions (Paper IV). As found in previous studies (46,169), this could create barriers in communication between coworkers by leading to misinterpretations that could result in conflicts in the workgroup, as well as between teachers and students (Paper IV). Additionally, according to the managers, some staff could lack respect for their coworkers and students needs for communication by making themselves unavailable while teleworking (Paper IV). However, as experienced by the academic staff, it could also be hard for the academics to meet the workgroups and students' high expectations on accessibility, availability and work performance during telework (Paper III).

Previous studies show that job satisfaction among employees working at the office may be affected by the frequency of their colleagues teleworking (170,171). As found in this thesis, stress related to indistinct organization and conflicts was associated with the academics having a high telework frequency (Paper I). Accordingly, the behaviors recognized during telework were often described as leading to dissatisfaction and mistrust in the workgroup, which could be directed toward teleworkers in general. In such cases, telework could either be avoided, or teleworkers could avoid the office (Paper III; IV). However, it did not seem to be the telework frequency per se that led to dissatisfaction among coworkers at the office, rather it seemed to be the lack of accessibility and interaction that could follow a high frequency. The extent of face-to-face interaction during telework has been found important for coworker relations and a satisfied need for such interaction may prevent negative consequences for work relations (46), this was also partly seen in our findings (Paper III).

When working at the office, academics described difficulties in social interaction as threatening the cohesion of the workgroup, which could lead to teleworking colleagues being perceived as invisible. Teleworking could thus create feelings of professional and social exclusion from the workgroup, which could be followed by the loss of a sense of work identity and work motivation among teleworkers (Paper III; IV). The risk of isolation in telework is well

known and has been related to loss of work motivation and sometimes to career stagnation, mental health issues, organizational alienation and retention (62,172). Problems of isolation seemed partly reinforced by the pandemic's homebound work according to findings in other studies (105,110) as well as shown in our findings. The managers in study IV explained that the pandemic's homebound work brought higher demands on the use of social meeting strategies, and a shared responsibility between managers and staff to maintain accessibility and regular communication (Paper IV). Previous studies have indicated that academic staff teleworking may need constant communication, digitally as well as face-to-face, with their managers in order to maintain their work performance (62,67). We found, however, that the managers seldom used such active strategies for interaction and communication during normal teleworking conditions (Paper IV).

The academics with a high share of research (e.g. professors) were often perceived as more absent and less accessible than other academic staff when teleworking. Previous studies have suggested that senior academics may be less frequent in their communication with coworkers when teleworking because of their long experience of teaching and research facilitating a high independence (62,78). Other possible explanations found in this thesis might be the findings showing a high share of research being associated with stress (Paper I), and the findings showing that the office premises may lack adequate conditions for performing tasks requiring deep concentration. Additionally, we found that research activities could facilitate the choice of telework (Paper III; IV). Hence, it may be that insufficient conditions to perform research tasks in the office, combined with research tasks facilitating the choice of telework, might contribute to groups of academics with a high share of becoming more absent when teleworking.

## **Regulations and leadership in telework**

The leadership practiced in telework is repeatedly described as relying on the "psychological contract" between managers and employees. This is often described as managers leading by trusting relationships rather than by managerial constraints. The quality of leader-employee relations is therefore central in the literature on leadership in telework, as it has been found important for managers supporting their employees job satisfaction and well-being in telework (80,85,173). The managers in study IV generally described their leadership as rooted in their presence and social relations at the workplace. In this manner, they also perceived the quality of social work relations (at the workplace) as the core of a well-functioning telework (Paper IV). However, the academic staff seemed to value their professional relations with coworkers rather than their relationship with managers (Paper III). Previous studies have shown that having trusting collegial relationships could be of greater importance for academics' work performance and well-being than relationships with managers (165). Nevertheless, studies on remote/digitally based leadership in academic institutions is mostly framed by theories focusing the quality of leader-em-

ployee relations (165,174). Considering our findings (Paper III; IV), and suggestions proposed by other researchers, it may be motivated to apply and develop other theoretical structures, than those mostly used, when studying leadership in academic institutions (65,72) and in telework (91). For instance, several studies on leadership in telework suggest managers to adopt performance oriented rather than relational strategies when leading teleworkers (92,175,176). This might be considered problematic in academic institutions where studies repeatedly emphasize the problem of increased performance focus leading to stress and lower performance quality in teaching in research (60,67,71,73,177,178). However, our findings showed that the academics profoundly expressed a need for formal support to achieve their work demands when teleworking. Hence, it might be difficult for managers to distinguish the character of their staffs' need for well-being during telework because of the strenuous work situation in academic institutions.

The question of whether telework should be regulated or not has been a wandering torch during the decades of telework research (2). The COVID-19 pandemic brought more attention to this question (157), however, there are few studies evaluating the success of such initiatives. This thesis showed conflicting opinions about the regulation of telework among the academic staff and managers. For instance, as previously described, telework was generally considered as entailed by the academic freedom (Paper III; IV) however, the managers generally expressed a need for regulating telework. This need was partly explained by the managers' perceived limited insight in staffs' work situation during telework (Paper IV). Telework options have been shown to challenge organizations' hierarchical structures by increasing employees' influence while limiting managers' influence over work performance (13,25,172). As such, managers may experience a loss of control that could make them hesitant to allow telework and/or contribute to their need for regulating this option (90,92). Even if academic managers generally are used to leading self-regulated staff (94,174) our findings indicated that the managers had an increased need to regulate telework options after the pandemic situation (Paper IV). Studies performed on the work situation during the pandemic showed that this situation might have been particularly difficult for middle managers who directed the organizations' operational chore. Particularly, many organizations discovered limitations in their occupational health and safety management for the work conditions in telework (157,173). Hence, managers may therefore see the opportunity to regulate telework options as facilitating their insight in, and control over, employees' work situation and environment during telework (85,173). Critics of work-nonwork policies in academic institutions have described the presence of such strategies as the extension of organizational power (60). This partly reflects the experiences found among the academic staff in present findings. For example, the managers in study IV thought that regulating actions, as increased follow-ups and policies for telework, could signal their consideration for staff while the academic staff could interpret such initiatives as managers' need for control, and mistrust (Paper III; IV).

Even if telework policies generally were rare in our findings, we found that work tasks, gender and educational field could determine the academic staffs'

possibility to telework. Examples showed that women could be hindered from teleworking because of their high amount of teaching and informal administrative tasks dependent on office presence. Educational fields with a high amount of practical teaching activities could also have less possibility to telework, and the same applied for teaching activities in general. Unequal conditions for telework related to teaching activities among academic staff have partly been recognized previously (62,73). This may be important to consider if regulating telework as such inequalities may affect academics' well-being and work performance in telework (62,73).

The academic managers' need for telework policies might have been due to their lack of organizational support. They perceived the support from their management as insufficient relative the demands posed by leading teleworkers. This restricted the managers' possibility to fulfill their staffs' needs and e.g. help them solving problems and improve their conditions during telework. These limitations were especially evident during the COVID-19 pandemic when academic staffs' need for support for work performance and well-being was described to increase (Paper IV). Previous research mainly focuses on employees need for organizational and practical support during telework, but rarely considers such needs among managers (8,10,85), which may be problematic considering what was found in our studies. Hence, in the absence of other functional options, telework regulations might be considered as the only concrete solution for managers to handle the complex challenges posed by telework.

Studies on organizational health and safety (OHS) management in telework have shown several difficulties for managers to enforce OHS standards. Among other things, lack of available organizational resources for OHS in telework have been identified (85,179). We found that the academic managers generally lacked resources as remote leadership training, customized technologies and premises for hybrid work solutions, and practical guidance as OHS directives from their management, to fulfill their work environmental responsibilities in telework. The absence of such resources could contribute to stress among managers and may also challenge staffs' conditions for well-being in telework (85,179). As recognized in our findings, the OHS management for telework often seemed to emanate from the conventional office premises (Paper IV) despite the recognized differences between these two work settings (31,85,173). It might be reasonable to assume that OHS management developed for conventional work settings may have limited effect on the problems recognized in telework. In study IV, the managers described several practical (e.g. providing desk equipment, digital tools and support), social (e.g. informal and walk-and-talk meetings) and health related (e.g. information and encouragement for increased physical activity) strategies used to improve the OHS conditions during the COVID-19 pandemic's homebound work, which normally was not performed during telework. This show that academic institutions may have resources to improve academic staffs work conditions when needed during telework.

## **A multidimensional approach to well-being**

The impact of telework has been described as bidirectional and therefore it has been suggested to adopt broad study approaches to differentiate its complex impact on occupational well-being (8,10,13,154,164). Guided by multidimensional frameworks to individual health (122) and occupational well-being (127), we investigated different aspects of individuals biological, social, psychological and professional conditions in telework. Similar to what has been proposed by van Horn's multidimensional model of occupational well-being (127), we discovered that telework highly impacted the academics professional and social well-being. The professional culture seemed to be of great importance for the academics' ability to maintain a healthy work-nonwork balance in telework. We found that the academics' strained work situation and lack of available resources could force the academics to expand and intensify their workhours to cope with their demands. In this situation, telework could facilitate the academics' professional well-being by providing autonomy to cope with this situation and fulfill achievements in work (127). Telework was also seen to mitigate the academics' cognitive weariness by providing them with the option of social seclusion and uninterrupted worktime (127). This option was considered beneficial for psychological as well as physical recovery. However, as recognized in previous research on well-being in telework (8,10,31), and in academic institutions (61,66), we found that the autonomy entailed by telework not necessarily was beneficial for the academics' job control. High as well as low levels of autonomy, and temporal and spatial flexibility, may challenge as well as benefit individuals' well-being in telework (10,25). Hence, when the increased autonomy was used for expanding working hours, telework could have a negative impact on the academics' affective well-being (127) by decreasing the job motivation, lead to stress and result in psychosomatic symptoms as exhaustion followed by sick-leave. Thus, this situation created a sort of job-demand-resource-paradox, i.e. telework became a resource for the academics to cope with job demands while at the same time also becoming a job demand (15). By this, telework could also be considered a risk for the academics' affective well-being by depleting their psychological resources and challenge their cognitive ability to perform their complex work tasks (127). When the academics' teleworking did not respond to coworkers' professional needs, it could lead to dissatisfaction and hostility among colleagues, thus, impact negatively on the academics' social well-being (127).

Previous research has highlighted the importance of organizational conditions as managerial formal and informal support in telework (8,10,85), our findings indicated that organizational support may not have the same function among academics as seen in other occupational groups. We therefore suggest future studies to pay more attention the professional and cultural aspects when studying conditions for well-being in telework.

## **Methodological discussion**

The studies included in the thesis were of different designs and methods, and included samples of academic teaching and research staff, and academic managers. In the following section, the strengths and limitations of the research designs, sample selections, methods and the definition of telework used for this thesis are discussed.

### ***Designs***

The use of both quantitative and qualitative research designs may be considered an overall strength of this thesis as it has been suggested in previous research to adopt different research approaches when studying telework (8,10,168). These study designs may complement each other by providing the opportunity to investigate and compare relationships of factors, while also give an in-depth insight in the studied phenomenon (180,181). There are, however, different strengths and limitations of quantitative and qualitative research that varies with different study designs.

Study I had a cross-sectional design which allowed the collection and comparison of several different variables. The survey used for this matter provided an overview of important factors related to well-being in telework. Cross-sectional data are, however, limited to a single time point which prevents capturing changes over time and determining the direction of cause-and-effect relationships. Another weakness is that it only provides information on the specific questions being asked and no explanation/deepening of the answers. It may also be that the time point in which the data are collected is not representative for the phenomenon being investigated (182).

Study II had a repeated measurement design where HRV indices, cortisol values, physical behaviors and VAS-ratings were collected continuously for five consecutive working days. The strength of this design is that it provides multiple measures of the same variables which gives the opportunity to capture and compare changes in the data over time. Because the same subjects act as their own comparison, this design may allow smaller study samples (183).

Study III and IV had an inductive qualitative design, which was used for investigating the experiences and conceptions of telework. The strength of the qualitative design is that it can provide rich information on how the studied phenomenon is perceived by the individual. An inductive approach allows new knowledge to emerge freely from the qualitative data without the guidance of pre-defined theories. This approach may therefore provide new and enriched insights into aspects entailed by the studied phenomenon and illustrate how these are defined and valued by the individual. However, because experiences are individual and situated in a certain context it is difficult to generalize qualitative findings to other or wider groups than the one being studied and those similar (138,184).

## **Samples**

This thesis is based on a relatively homogenous sample of teaching and research staff and academic middle managers from different educational and scientific fields, in undergraduate and advanced education, in urban and rural universities located in different parts of Sweden. Overall, the distribution of gender, age, years of employment were found to be relatively even in all the study samples. The use of homogenous samples could be an advantage as it may improve the generalizability of findings to the target population (185,186). This may be seen as a strength given that previous studies using heterogeneous samples have been criticized as partly contributing to the scattered results seen in research on telework (8).

In study I, only academic staff working in the universities agreeing to distribute the survey were available for recruitment, which may have affected the representativeness of the target population (185,186). It was found that 3,8% of the participants never teleworked. A limitation for this study was the low response rate (14%). Considering the high workload generally recognized in the academic population (71,73), the low response rate may be due to such conditions. However, as the composition of the study sample was compared to the population it showed relatively good representativeness.

As the study I sample was used as the sampling frame for the recruitments in study II and III, this may also have impacted the representativeness of those samples. However, in study II-IV eligible participants were strategically selected based on specific sociodemographic factors to get maximum variation, which improved the samples representativeness. There was a low representation of professors in the samples of study II-III and therefore, the findings from those studies may be less representative for that academic position.

## **Measurements and statistical analyses**

The data collections for this thesis were conducted using a combination of subjective and objective methods that have been seen to capture important outcomes of occupational well-being. The subjective measures reflected perceptions of health and psychological and social aspects of well-being in telework, while the objective measures reflected the biological responses to telework.

The survey used for study I contained a combination of established instruments on well-being in working life. A strength of the survey may be that the instruments included were strategically combined to cover important aspects of health, intrinsic work motivation, work-life balance, stress and recuperation that have been recognized for affecting individual well-being in telework (2,8,10). The included instruments were multi-item scales, which is beneficial for capturing a broader range of experiences of the studied factors, compared to single items where responses are narrowed down to more generic options (187). We added items to assess the academics' frequency and amount of telework, which could be considered a strength as it has been recommended for researchers to clearly distinguish between frequency and extent of telework in study samples [1]. The included instruments had an overall satisfactory internal consistency with the exception for the competence scale of BPNS-W (131)

and the influence at work scale of the WSQ (129) which was found to be low (BPNS-W 0.84; WSQ 0.62). This indicated poor relatedness between items, which impacted negatively on the reliability of those answers. No problems with collinearity were found in the model assumption multivariate and univariate analysis of variance (tolerance, 0.65–0.94; variance inflation factor, 1.06–1.54).

Biomarkers of autonomic nervous system (ANS) activity are routinely used for detecting psychological stress, and the risk of related mental or physical diseases within as well outside working life (42,116). The use of biomarkers could capture the activation of ANS through stress hormones (e.g. cortisol) production and increasing the rate and force of heart contractions (146,188). As physiological stress does not always cause physiological arousal, and because the response time differs, it is suggested to combine measures of HRV indices and cortisol when studying e.g. stress and recovery in working life (136,189). The used combination of these measures could thus be considered an advantage of this thesis, because it may have allowed more reliable predictions of stress and recovery than of a single measure. However, we did not include a stabilization period of resting HRV indices (e.g. in sleep) for reference, which is a weakness as this have been recommended for assuring reliable interpretation of HRV data (190).

It is recommended to collect biomarkers over several days to account for the natural variation in autonomic regulation and diurnal cortisol secretion caused by internal (e.g. food intake, medications) and external (e.g. exercise) factors (136,189). For example, cortisol secretion follows a specific circadian pattern with peak levels shortly after awakening, followed by continuously decreasing levels during the rest of the day. These factors were accounted for in study II in several ways. Firstly, psychophysiological measures were collected continuously over several days, which may be considered a strength of this study. Cortisol samples were, however, only collected during two separate days which may be considered to short time to capture changes in cortisol secretion (146). Hence, this makes it difficult to draw conclusions from the cortisol values obtained in study II. Secondly, when using objective measures in uncontrolled settings, it is important to account for the possible confounders that may impact the physiological response (136,189). This was considered in the recruitment in study II were participants suffering from heart conditions, and consuming beta-blocking medications, were excluded. It was also accounted for in the diaries where participants documented their consumption of caffeine and alcoholic beverages, nicotine and practice of vigor physical exercise (191). The diaries also contained the daily VAS-ratings on stress, fatigue and recovery, which were used as complement to psychophysiological measures. The combination of subjective and objective stress measures, together with information on confounding factors, may strengthen the reliability of our findings as such information may have facilitated the interpretation of the measurement results.

The diaries notes enabled the categorization of the HRV, cortisol and accelerometer variables into location (i.e. office or telework) and time (i.e. before, during and after work), which were used as the within-subject variables



in the MANOVA. As the participants acts as their own comparison in the within-subject analyses, this may have compensated for the small sample size [34]. Before the analyses, the HRV and accelerometer data were cleaned from errors to strengthen the quality. Some HRV measures were excluded due to low quality, leaving  $n=20$  for the analyses. The analyses were performed with the mean of each variable in each time period, which may have compensated to some extent for any remaining quality deficiencies.

We used accelerometers in study II to detect different physical behaviors in days of work at the conventional office and in telework. Accelerometer measures have been shown to provide reliable data and allow the separation of physical behaviors into e.g. postures and types of movement (135,192). The detection of physical behaviors along workdays is considered important as different behaviors is seen to have different physiological impact on individual stress and recovery response (135,152,193). Outcomes of physical activity are found to be highly dependent on whether it is performed at work or during leisure and therefore, it is also suggested to differentiate behavior in different times of the day (152,194). This was accounted for in study II as participants documented their work and leisure, and the activities performed during this time, in the diaries. The use of diaries to detect location and time for work, and activities performed at the different locations, is a strength of this study.

An acknowledged challenge for objective measurements in uncontrolled settings is the accuracy of the use of measuring devices. In study II, all measuring devices were applied according to customary procedures (192) by one of the researchers, but the maintenance of correct use was left to the participants. Participants were provided with written instructions on the use of all measuring devices, and saliva sampling equipment, and were instructed to document any deficiencies that may have occurred. To ensure that the accelerometers were regularly synchronized, participants performed daily reference movements in accordance with general recommendations (135,192). This may have facilitated a correct use of the different devices, and made it possible to control for such factors in the analysis.

The accelerometer measurements were analyzed using CODA [30]. The use of CODA provides the opportunity to analyze different physical behaviors relative to the total composition of physical behaviors in e.g. a day [30,35]. This may be a strength of study II considering previous acknowledged differences in physical behaviors during days [30,35]. A limitation with CODA analyses is that it cannot handle null values [30] and therefore, some values ( $n=2$ ) were excluded from the analyses in study II.

The sample sizes in study I and II were generally small, which reduces the statistical power (195). We did not test for co-variability between psychophysiological and physical activity measures, which is a weakness as these factors are highly inter-related [29,30]. Thus, we cannot determine whether the changes in psychophysiological measures may be due to physical activity.

### ***Qualitative method and analyses***

The interviews held in study III-IV were based on semi structured interview guides. In both studies, interview guides were divided into different overarching themes that were coupled with a set of questions corresponding with the themes. The use of open-ended questions may prevent from steering the informants' answers in a certain direction while follow-up questions can prevent the loss of direction. Hence, the use of semi-structured interviews may facilitate elaborated answers that stays to the subject. An important aspect of interviews is to check the comprehensibility of included questions to secure that they are interpreted as intended (191). For this purpose, interview guides were tested in pilot interviews with individuals belonging to the population. Interviews were held digitally, which may have impacted the interview quality because such settings may hinder the interpretation of mimics and body language (170). In the case of study III, the quality of online interviews was tested in pilot interviews, which were performed both digitally and in face-to-face meetings, and then these different settings were compared and evaluated. There were no considerably quality differences between these settings, and the digital setting was seen to provide an open and relaxed atmosphere. In study IV, the option of pilot testing face-to-face-interviews was not possible due to the COVID-19 pandemic.

An important aspect in qualitative analysis is the researchers' pre-understanding of the phenomenon. Everyone has an inner frame of reference through which the surrounding world is interpreted and understood. For research in general, but for qualitative research in particular, this inner frame, consisting of prejudices and pre-understanding, is of great importance for the analysis quality. This because the pre-understanding consciously and unconsciously guides the researcher's interpretation of the phenomenon. Thus, it is not possible to interpret a phenomenon without presumption, however, if not handled correctly it can mislead the researcher. The acknowledgement of pre-understanding is therefore crucial when performing a qualitative analysis because otherwise it is not possible to consider the impact of it (196,197). In the case of this thesis, all the researchers involved belonged to the target population and had different academic positions and telework experiences, and were employed in a Swedish university. The prior knowledge could have been an advantage as it may allowed a deeper understanding and interpretation of the interview material. To prevent the authors' pre-understanding from resulting in misleading interpretations, the phenomenographic analysis process was conducted both through individual interpretation, and through dialogue between the researchers. The analyses were thus partly a process of discussion, which have been suggested as a strategy to handle the trustworthiness of qualitative data. This strategy may enlighten and enrich the understanding of the studied phenomenon and provide different perspectives of it (196,197). Except this strategy, the trustworthiness in study III and IV was considered by providing thorough descriptions of the analytical processes and by presenting the findings with quotes. However, there are other aspects that may have affected the trustworthiness. For example, there is always the risk of desirability bias, i.e.

that the informants show a better, adjusted side of themselves, which may not necessarily correspond to the reality. This risk may be particularly evident when e.g. evaluating one's own behaviors and action. Such bias could be reduced by using member checking i.e. letting the informants take part and comment on the findings before they are finalized (198). This was however not done in present studies, and may therefore be considered a disadvantage.

### ***Defining telework***

The lack of consistency in the telework terminology constitutes a problem for the interpretation, comparison and compilation of research findings. The importance of defining the spatial and temporal construct of the telework being studied is therefore considered crucial for the quality of studies on telework. For this reason, we clearly defined the time and place of telework in all studies and used the definition provided by Allen et al. (10) for telecommuting (that rather corresponds with how Nilles originally defined the term telework (1,2) that is “work practice that involves members of an organization substituting a portion of their typical work hours (ranging from a few hours per week to nearly full-time) to work away from a central workplace typically principally from home—using technology to interact with others as needed to conduct work tasks.” This definition allows work being practiced from other places than the individuals' home, which may be considered suitable for the academic profession's disperse work activities including international and national business travels, conferences, collaborations and data collections (66,67,73). It also clearly defines which hours should be considered telework and, thus, which hours that should be considered overtime work. Considering the problem of extended work hours in the academic population (61,71,73), this distinction of work-nonwork hours may have been important in our studies. ICTs were primarily treated as the enabler of interaction between the teleworker and the conventional workplace, and generally receive modest attention in study I-III. However, as have been recognized in working life in general (7), and in our findings (Paper IV), the use of digital tools and interaction in digital settings became more central during the pandemic's homebound work. Consequently, during the pandemic years, the way researchers and practitioners referred to and defined telework was seen to successively change.

The term “hybrid work” seems to have become more established (especially among practitioners) and replaced terms as e.g. telework. According to how it has been referred to among practitioners, the concept of hybrid work seems to include an equal share, and the integration, of work at the conventional workplace, work at different physical locations outside the workplace, and work/interaction in digital settings. Scholars have argued for a greater consideration towards changes in the digital and technical development in working life when conceptualizing telework as those changes are the main enablers for the telework concept (2). Hence, if researchers adopt the pandemics' transformed version of the telework concept, this might give the opportunity to establish a common definition, i.e. the one of hybrid work and thus, contribute to a new paradigm in research.

## Conclusions and future research

The aim of this thesis was to investigate how academic teaching and research staff practice telework and how telework affects their well-being at work. Another aim was to investigate the experiences of academic managers leading teleworkers in academia. The findings in this thesis showed that telework in academia could impact on academics' conditions for recovery and well-being in work in a positive as well as in a negative manner. The academics' seemed more relaxed during teleworking days, and switched more between different physical behaviors, than when working at the conventional workplace. Telework was sometimes a resource for handling physical pain, and a strategy to return to work after burnout and long-term sick-leave. Telework was considered a necessary resource for academics to handle their professional demands in teaching and research by enabling the extension of workhours to cope with high workload, and provided conditions for uninterrupted worktime and concentration to perform complex work tasks. A high frequency of telework was associated with stress due to indistinct organization and conflicts at work, and if academics' teleworking did not correspond with coworkers' and managers' professional needs it could lead to dissatisfaction, lack of trust and restrictions of telework. In telework, professional work demands, and culture could challenge academics' ability to restrict their working hours in time and space, which could force work during leisure while being sick. This could in the long run result in burnout. Physical presence and social relationships at the conventional workplace were the core for academic managers when leading teleworkers in academia, but academics did not express the need for social support by managers. Telework could restrict managers insight in and control over academics' presence at the conventional workplace, work performance and well-being in telework and therefore argue for follow-up and regulation of telework. The COVID-19 pandemic forced an increased digitalization of academics' work tasks, which managers hope to maintain after the pandemic. For the future, some managers suggested increased regulation of telework options while others argue for adopting more hybrid work solutions. Managers generally lacked sufficient resources as remote leadership training, customized technologies and premises for hybrid work solutions, and practical guidance as OHS directives from their management to provide academics with support for work performance and well-being in telework. For the future, managers therefor requested an improvement of such factors to facilitate their leadership, and academics' work performance in telework. In summary, the use of different research designs and methods when studying telework in academia showed that telework could impact biological, psychological, social and professional aspects of academics' well-being in telework. The perspective of academic managers showed that the organizational context could impact on the conditions for providing academics with support in telework. We argue for future studies to adopt different research designs and methods when studying well-being in telework, and especially consider the impact of professional and organizational context for this purpose.

## Practical implications

The findings from this thesis provide knowledge that may facilitate the promotion of well-being and a sustainable work environment during telework in academic institutions. Academic employer may consider the following aspects:

- There may be needs for practical support such as desk equipment to support academics' ergonomic conditions in telework and in order to prevent them from developing physical health complaints
- Telework may facilitate academics' mental recovery and their handling of physical pain and injuries, and might thus be a plausible return-to-work strategy in academic institutions.
- The combination of high workload and insufficient organizational resources may be a risk for academics intensifying and extending their working hours, and also continue working while being sick, during telework.
- There might be a risk that the conditions for work performance and well-being in telework solely becomes an individual responsibility because of the academic profession's self-managed nature.
- Insufficient communication and interaction among coworkers in telework may complicate work performance and impact negatively on work relations.
- Telework may be considered as a necessary option for the performance of complex work tasks (e.g. research) if the conventional workplace lacks conditions for uninterrupted worktime.
- Telework regulations and policies may be considered a threat to academics work performance, and may be interpreted as managements' lack of trust.
- There may be unequal conditions for telework depending on gender, work tasks and educational field.
- The needs of academic staff and management may differ in terms of social interaction and telework regulations.
- Academic managers may lack sufficient resources as remote leadership training, customized technologies and premises for hybrid work solutions, and practical guidance as OHS directives from their management to support their staffs' needs for work performance and well-being in telework.

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**Papers**

Associated papers have been removed in the electronic version of this thesis.

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