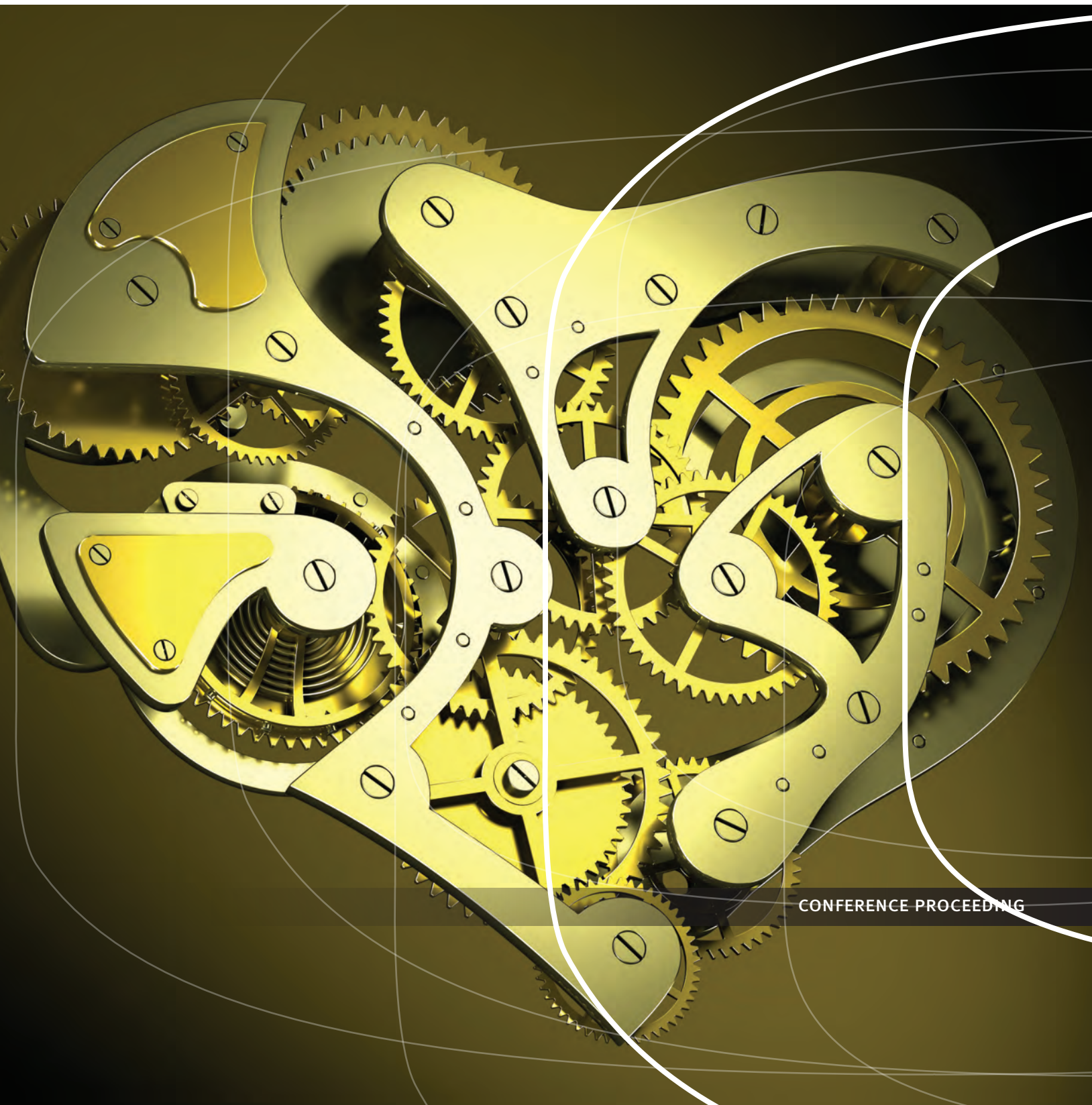


Co-ordination of research on working hours and health in the Nordic countries

Working hours and Health



CONFERENCE PROCEEDING



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Introduction

Services are requested and provided for around the clock in many public service jobs, e.g. police, health and elderly care, transportation and in certain industries e.g. the oil industry. It is therefore necessary to work outside ordinary working hours or in shifts all over the world, including the Nordic countries. Thus, 15–20% of the working force in the EU are working evening or night shifts (Costa *et al.*, 2004; Haus & Smolensky, 2006). With the development of the 24-7 society this type of working hours is likely to increase in the future.

The organisation of working hours has a large impact on employees' health and wellbeing. Night work is associated with both acute, passing effects such as poor sleep (Sallinen & Kecklund, 2010), decreased cognitive function (Dula *et al.*, 2001; Griffiths *et al.*, 2006), gastro-intestinal problems (Knutsson & Bøggild, 2010), as well as accidents and injuries (Folkard & Tucker, 2003). There is some, albeit limited evidence that the organisation of working hours increases risk of chronic disorders e.g. diabetes (Morikawa *et al.*, 2005; Suwazono *et al.*, 2006), peptic ulcer disease (Knutsson & Bøggild, 2010), cardiovascular disease (Bøggild & Knutsson, 1999), and breast cancer as well as possibly other cancers (Costa *et al.*, 2010).

However, the epidemiologic evidence for causality between shift work and disease is, despite intensive research during the last two decades, still limited (Bonde *et al.*, 2012; Frost *et al.*, 2009). Precise insight into causality is important in order to plan and prioritise proper and efficient preventive measures. Current recommendations concerning the most ergonomic ways to organise shift work have been made on the basis of general knowledge about fatigue and circadian rhythms (Wedderburn, 1991; Bonde *et al.*, 2012). A small number of these have been tested in intervention studies, but often these studies are relatively small and address several, sometimes conflicting recommendations. Many of the intervention studies have also been conducted in artificial laboratory environments, and there are few high-quality epidemiological studies. Hence, only poor scientific evidence for existing recommendations in relation to disease is found in systematic reviews (Bambra *et al.*, 2008; Joyce *et al.*, 2010; Merkus *et al.*, 2012; Vogel *et al.*, 2012).

The Nordic countries have a long tradition for research in working hours with strong research environments. As such, the Nordic countries already contribute to the field. However, to a large degree the research environments operate independent of each other. The overall purpose of the present project was to form a strong platform for joint future research in order to strengthen the impact of Nordic research on working hours. This process was facilitated by the arrangement of a workshop, where the Nordic research on working hours were coordinated and future perspectives and possible collaborations were discussed. The present report summarises the work from this workshop.

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Summary

The workshop on “Co-ordination of research on working hours and health in the Nordic countries” in 2013 was held at the National Research Centre for the Working Environment in Denmark on the 24th–25th October. The overall purpose of the project is to provide a platform for cooperation and development of high-quality research projects on working hours and health in the Nordic countries. The project is supported by the Nordic Council of Ministers.

The main outcomes of the project are:

- On-going research on working hours within the Nordic countries has been described in 27 abstracts, most of which were presented at the workshop.
- Existing cohorts on working hours within the Nordic countries have been documented in 9 abstracts.
- Common key variables on working hours in existing Nordic cohorts have been identified and documented in two tables. One table on large cohorts and one table on smaller study groups with more detailed information.
- Possibilities for collaboration and joint applications across countries, and pooling of cohorts have been discussed at the workshop.

The network that was established in the context of the workshop “Co-ordination of research on working hours and health in the Nordic countries” will continue as the more formal consortium “Working hours In the Nordic Countries” (WINC). The scope of WINC is to provide high-quality research on working hours and related health outcomes in the Nordic countries.

Furthermore, the following activities within the scope of the network are currently planned:

- A NIVA-course on Working hours and Health is scheduled in May 2014. Course leader is research professor Mikko Härmä from the Finnish Institute of Occupational Health. Members of the network participate as lecturers.
- The 22nd International Symposium on Shiftwork and Working Time will be held in Denmark in 2015. The scientific board will include representatives from WINC.

A date was set for the next workshop: 23rd–24th October 2014. The workshop is funded by the Nordic Council of Ministers. The main topics are:

- Identifying and documenting relevant registers on health outcomes across the Nordic countries.
- Proposing a consensus list of key self-reported variables to be included in cohorts on working hours in the Nordic countries.
- Possibilities for collaboration across countries/cohorts.

The participants at the workshop in 2013 were

Finland

- Professor Mikko Härmä, Finnish Institute of Occupational Health [Mikko.Harma@ttl.fi].
- Senior researcher Sampsa Puttonen, Finnish Institute of Occupational Health [Sampsa.Puttonen@ttl.fi].

Norway

- Researcher Jenny Anne S. Lie, National Institute of Occupational Health, Oslo [jenny.a.s.lie@stami.no].
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- Researcher Anette Harris, Department of Health promotion and Development, University of Bergen [Anette.Harris@iuh.uib.no].

Sweden

- Associate professor Göran Kecklund, Stress Research Institute, Stockholm.
- Associate professor Arne Lowden, Stress Research Institute, Stockholm.
- Research assistant Michael Ingre, Stress Research Institute, Stockholm.
- Associate professor John Axelsson, Department of Clinical Neuroscience, Karolinska Institute, Stockholm.
- Researcher Philip Tucker, Stress Research Institute, Stockholm.

Denmark

- Senior researcher Johnni Hansen, Danish Cancer Society Research Center, Copenhagen [johnni@cancer.dk].
- Professor Henrik Kolstad, Department of Occupational Medicine, Danish Ramazzini Centre, Aarhus University Hospital [henkol@rm.dk].
- PhD student Helene Tilma Vistisen, Department of Occupational Medicine, Danish Ramazzini Centre, Aarhus University Hospital [helvis@rm.dk].
- PhD student Marie Aarrebo Jensen, Department of Public Health, University of Copenhagen [maaj@sund.ku.dk].
- Postdoc Kirsten Nabe-Nielsen, Department of Public Health, University of Copenhagen [nabe@sund.ku.dk].
- Senior researcher Anne Helene Garde (project leader), the National Research Centre for the Working Environment [ahg@nrcwe.dk]
- Research assistant Simone Visbjerg Møller, the National Research Centre for the Working Environment [svm@nrcwe.dk].
- Professor Reiner Rugulies, the National Research Centre for the Working Environment and , Department of Public Health and Department of Psychology, University of Copenhagen [rer@nrcwe.dk].
- Professor Åse Marie Hansen, Department of Public Health, University of Copenhagen and the National Research Centre for the Working Environment [asemarie.hansen@sund.ku.dk].

Invited participants who were unable to attend

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1. Scope of the workshop “Co-ordination of research on working hours and health in the Nordic countries” in 2013

The scope of the workshop was to:

- describe on-going research on working hours within the Nordic countries
- document the status of existing cohorts on working hours within the Nordic countries
- identify and document common key variables on working hours in the existing Nordic cohorts
- discuss possibilities for collaboration across countries and pooling of cohorts.

Program at the workshop 2013

Thursday 24th October 2013

9.00–11.00	Coffee/tea and bread (registration)
11.00–11.30	Welcome and brief presentation of participants <i>Anne Helene Garde, NRCWE</i>
11.30–17.00	Presentations of ongoing research on working hours and relevant cohorts
11.30–11.45	Overview of ongoing research projects <i>Göran Kecklund – Stress Research Institute</i>
11.45–12.00	Sleep/fatigue prediction model <i>Michael Ingre – Stress Research Institute</i>
12.00–12.15	Measures of light exposure and the effects on circadian regulation, activity and health <i>Arne Lowden – Stress Research Institute</i>
12.15–12.30	The Karolinska WakeApp, a newly developed application measuring cognitive processes in the field <i>John Axelsson – Karolinska Institute</i>
12.30–12.45	Status for on-going projects in Bergen <i>Anette Harris – University of Bergen</i>

Thursday 24th October 2013	
12.45–13.00	Summing up and questions
13.00–13.45	Lunch
13.45–14.00	Shift work and breast cancer risk among Norwegian nurses <i>Jenny-Anne Sigstad Lie – STAMI</i>
14.00–14.15	Shiftwork, sleep and pain <i>Dagfinn Matre – STAMI</i>
14.15–14.45	FIOH- projects: - Finnair Health Study - Work Stress and Sleep in Shift Working Nurses and Sleepiness - Stress among long-haul truck drivers <i>Sampsa Puttonen – Finnish Institute of Occupational Health (FIOH)</i>
14.45–15.00	Summing up and questions
15.00–15.30	Coffee break
15.30–15.45	Working hours projects at The Danish Cancer Society <i>Johnni Hansen</i>
15.45–16.00	Project “In the middle of the night” <i>Marie Aarrebo Jensen – NRCWE/University of Copenhagen</i>
16.00–16.15	LUX@R – Night work, light at night, circadian disruption, and risk of breast cancer <i>Helene Tilma Vistisen – Aarhus University Hospital</i>
16.15–16.30	Shiftwork and Health <i>Anne Helene Garde– NRCWE</i>
16.30–17.00	Summing up <i>Anne Helene Garde</i>
19.00–	Dinner at le Basilic
Friday 25th October 2013	
8.30–9.00	Coffee/tea and bread
9.00–10.20	Presentations of existing databases on working hours
9.00–9.20	SLOSH database <i>Phil Tucker – Stress Research Institute</i>
9.20–9.50	Working Hours in the Public Sector project and database Wellbeing at work among airline pilots <i>Mikko Härmä – FIOH</i>
9.50–10.10	Danish Working Hour Database (DWHD) <i>Anne Helene Garde – NRCWE</i>
10.10–10.20	Summing up and questions
10.20–11.30	Identification of key variables on working hours in the existing Nordic cohorts Group discussions with main focus on databases with: Physiological/logbook data Questionnaire and register data

Friday 25th October 2013

11.30–12.00	Summing up
12.00–12.45	Lunch
12.45–13.45	Group discussion of possibilities for collaboration across countries/cohorts
13.45–14.15	Summing up
14.15–14.30	Coffee break
14.30–14.45	Structure of the report <i>Simone Visbjerg Møller – NRCWE</i>
14.45–15.00	Workshop on coordination of the research on working hours in the Nordic countries 2014 <i>Anne Helene Garde – NRCWE</i>
15.00–15.15	NIVA Education – Working Hours and Health <i>Mikko Härmä – FIOH</i>
15.15–15.30	22 nd International Symposium on Shiftwork and Working Time, Copenhagen <i>Anne Helene Garde – NRCWE</i>
15.30–16.00	Summing up and end of workshop – sandwiches to go <i>Anne Helene Garde – NRCWE</i>

2. Identification of key variables in existing cohorts and databases

At the workshop the network partners discussed and identified common key variables in existing cohorts and databases in the Nordic countries in order to form a platform for future research collaborations. The partners listed relevant variables on working hours and health, and indicated whether these variables are measured in existing databases and ongoing projects, cf. Table 1 and Table 2. Table 1 focuses on larger cohorts. The identification of key variables for this table was inspired by a consensus paper on defining shift work in cancer studies by Stevens *et al.* (Stevens *et al.*, 2011). Table 2 focuses on laboratory or field studies with more intensive measurements on fewer participants.

Table 1: Key variables on working hours in existing databases

Database Variables	WHPS + FPS	FINNAIR	SLOSH	SUSSH	RWHS	DWHD	WOLF	DWECS	WEHD	PUSHH
Institution	FIOH	FIOH	Stress Research Institute, Sweden	University of Bergen	University of Bergen	NRCWE	Stress Research Institute, Sweden and Karolinska Institute	NRCWE	NRCWE	NIOH, Oslo and University of Bergen
Contact	Mikko Härmä	Sampsa Puttonen	Göran Kecklund	Ståle Pallesen, Bjørn Bjorvatn	Anette Harris	Anne Helene Garde	Göran Kecklund	Elsa Bach	Elsa Bach	Stein Knardahl, Bjørn Bjorvatn
Population	Approx. 50,000 (Baseline)	Approx. 2,000	21,500	Approx. 3,000	2–5,000	Approx. 150,000	15,000	Approx. 15,000	16,300	Approx. 1,800
Follow-up period	2008→	2006 + 2009	2006→ (every 2nd year)	2008→ (5 waves) continuing	2008–2012 →	2007→ Every day	1993 (2 waves) 1997 (3 waves)	1990–2010 (5 waves)	2012→ every 2nd year	2010–2013
Lifestyle (Q)	X	X	X	X	X		X	X	X	X
Sleep Quality (Q)	X	X	X	X			X	X		X
Sleep duration	X	X								
Biobank		X		(X) Sub-groups (clock genes; n=650)						X
Clinical data				(X)			X			
Industry	Public sector	Airline employees	General population	Nurses	Health care sector	Public sector	Mix	General population	General population	Petroleum sector
SES	X (Isco)	X	X	X	X	X	X	X	X	X
Actual working hours (Day by day pay roll)	X	(X) Sub-groups			X	X				
Information on working hours (present pr. day/week) (Q)	X	X (Many!)	X	X			X	X	X	X
Work time control (Q)	X	X	X	X				X		X
Life time exposure to shift work	X (Q)	X	X	X	X					X
Psychosocial work environment (Q)	X	(X)	X	X	(X) Job satisfaction		X	X	X	X
Personal identification	X	X	X	X	X	X	X	X	X	X
Self-rated health (Q)	X	X	X	X	X			X	X	X
Retirement – intention to leave (Q)	X	X	X	X				X	X	
Sickness absence	Daily (R)	Q (R from a sub-group)	Long-term + annually (R+Q)	Daily (R) Long term	Daily (R) Short term and long term	Daily (R)	Linkage is possible	Annual (Q). Long-term linkage is possible	Annual (Q). Long-term linkage is possible	Self-report + possibility to link to registry data
Presenteeism	X	X	X	X	X(R)					X
Night work (non-day shift work)	X (R)		X	X	X(R)	X	x			X
Intensity (No. of non-day shift work)				x	X(R)	X	Norrland only (ca 50% of sample)			X

Database Variables	WHPS + FPS	FINNAIR	SLOSH	SUSSH	RWHS	DWHD	WOLF	DWECS	WEHD	PUSSH
Cumulative exposure (duration times over the work history)	X (R)	X	2008 only	X	X (R)					X
Permanent night shift	X (R)		X	X	X (R)	X	Follow up only			X
Rotating type	X (R)	Various shift systems			X (R)	X				X
Direction of rotation (Forward/ backward)	X (R)				X (R)	X				X
Rate of rotation (Daily change, 2–3–4 day change etc.)	X (R)				X (R)					
Morning shift	X (R)				X (R)	X				X
Start and end time of shifts	X (R)			X	X (R)	X				X
Rest periods after shift	X (R)	X		X	X (R)	X				X
Diurnal type		X	2008 only	X	X (Q)					X
Personality	X (Q)			X	X (Q) (Mini-IPIP)					
Influence on work schedule	X (Q)			X	X (Q)					
Reproductive health				x						
Accidents	X			x		X				

Q = Questionnaire, R=Register.

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WHPS: Working Hours in the Public Sector; FPS: Finnish Public Sector Study; Finnaair: The Finnair Health Study; SLOSH: Swedish Longitudinal Occupational Survey of Health; SUSSH: Survey of Shift

work, Sleep and Health; RWHS: Register study of Working hour, Health and Sickness absence; DWHD: Danish Working Hour Database; WOLF: Work-Lipids-Fibrogen; DWECS: Danish Work Environ-

ment Cohort Study; WEHD: Working Environment and Health in Denmark; PUSSH: Petroleum Survey of Shift work, Sleep and Health.

FIOH: Finnish Institute of Occupational Health; NRCWE: National Research Centre for the Working Environment, Denmark; NIOH: National Institute of Occupational Health, Norway.

Database Variables	In the Middle of the Night	Nurses	HYLTE	LUXAR	Shiftwork, sleep and pain	Shiftworkers in underground mines	Sleepines among Truck Drivers	PRISME	Bullying at work
Cumulative exposure (duration times over the work history)		X		X(B)			X		
Permanent night shift (not rotating)				X					
Rotating type		Irregular, continuous					Irregular, continuous		
Direction of rotation (Forward/backward)									
Rate of rotation		X					X		
(Daily change, 2-3-4 day change, weekly, fortnightly change etc.)									
Morning shift		X					X		
Start and end time of shifts		X		X(R)			X		
Rest periods after shift		X		X(R)			X		
Light at night				X(R)					

B=Baseline only, R= Repeated measures e.g. logbook.

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Nurses: Work Stress and Sleep in shift working nurses; LUX@R: Night Work, light at night, circadian disruption, and risk of breast cancer; PRISME: Psychosocial risk factors for stress, burnout and depression in inter-personal work.

NRCWE: National Research Centre for the Working Environment; FIOH: Finnish Institute of Occupational Health; AAUH: Aarhus University Hospital; NIOH: National Institute of Occupational Health, Norway.

3. Future collaborations

The network that was established at the workshop “Co-ordination of research on working hours and health in the Nordic countries” will continue as the more formal consortium “Working hours In the Nordic Countries” (WINC). The scope of WINC is to provide high-quality research on working hours and health related outcomes in the Nordic countries.

There was a fruitful discussion on possible future collaborations and a strong interest in pursuing possibilities to seek funding in EU initiatives such as Horizon 2020 and Joint Programming Initiative (JPI) “More Years, Better Lives” on the potentials and challenges of demographic change. Many of the suggestions were centered on the new type of data with daily information on working hours, where Nordic countries have a strong position.

A workshop will be held 23rd–24th October 2014. The workshop is funded by the Nordic Council of Ministers and the main topics are:

- Identifying and documenting relevant registers on health outcomes across the Nordic countries.
- Proposing a consensus list of key self-reported variables to be included in cohorts on working hours in the Nordic countries.
- Discussing possibilities for collaboration across countries/cohorts.

Furthermore, the following activities within WINC are currently planned:

- A NIVA-course on Working hours and Health is scheduled in May 2014. Course leader is research professor Mikko Härmä from the Finnish Institute of Occupational Health. Members of the network participate as lecturers.
- The National Research Centre for the Working Environment is hosting the 22nd International Symposium on Shiftwork and Working Time in Copenhagen in 2015. The scientific board will include representatives from WINC.

4. Abstracts reflecting presentations at the workshop – projects

4.1 Overview of on-going working time research projects at the Stress Research Institute

- *Project leaders (coordinators):*
Göran Kecklund, Torbjörn Åkerstedt and Constanze Leineweber.
- *Institute and country:*
Stress Research Institute, Stockholm University, Sweden.
- *Background:*
Stress Research Institute has a long tradition of doing quasi-experimental field studies and epidemiology related to shift and night work, and sleep/wakefulness, health/well-being and performance. This presentation will cover some on-going projects that are not included in the presentations by Ingre, Lowden and Tucker.

4.1.1 *Night work and cancer*

Torbjörn Åkerstedt coordinates a project related to night work and breast cancer. Several systematic reviews suggest that night work is a risk factor for breast cancer, although there are inconsistencies in the literature. The data set is based on the Swedish Twin-registry and the study is done in collaboration with Karolinska Institute (Prof. Kristina Alexanderson, head of the Section for Insurance Medicine). The study includes approximately 85,000 individuals and the exposure measure is accumulated night work. Preliminary results suggest a significant association. Since the twin-registry is linked to the cancer register it is possible to study also other types of cancer. It would also be possible to link the exposure data on accumulated night work to the “All Sweden” register, which includes all kinds of register data for approximately 5 million people, in the age range between 16–70 years, living in Sweden.

4.1.2 *Shift work and disturbed sleep*

There are few prospective studies on shift work and other kinds of difficult working time arrangements (e.g. overtime) and disturbed sleep. We are currently using the SLOSH (Swedish Longitudinal Occupational Survey of Health) cohort to examine how shift work affects insomnia-related sleep disturbances and non-restorative sleep. The SLOSH-cohort includes 4 waves (2006, 2008, 2010 and 2012) and approximately 17,000 individuals (including those that have retired and not responding to every wave). The analysis is coordinated by Torbjörn Åkerstedt.

4.1.3 *Work time control (WTC), disturbed sleep, health and work-non work balance*

Constanze Leineweber coordinates this project. A systematic review showed that there is relatively strong evidence for an association between WTC and health, sleep, job performance and work-non-work balance. However, most of the studies are cross-sectional and prospective studies are rare. This project aims at studying whether WTC may predict outcomes related to health, sleep etcetera using the SLOSH-cohort. The project starts 1 January 2014.

4.1.4 *Bus driver work situation and its relation to fatigue*

Bus drivers in public transport have very irregular shift schedules, which include early morning work, long work shifts and split shifts. Some drivers have permanent shift systems, such as steady night work or early morning work, whereas others use self-scheduling (to some extent). Anna Anund, National Road and Transport Research Institute (VTI), is the PI for this project, whereas we (coordinated by Göran Kecklund) are responsible for analysis of objective working time data, actigraphy and physiological indicators. The project includes several types of data, e.g. questionnaires and objective working time data from 231 drivers, actigraphy and sleep/wake diaries from approximately 60 drivers and physiological and behavioural data (driving performance) from an experimental field study on early morning work and split shifts.

4.2 Sleep and fatigue modelling

- *Core members of project group:*
Michael Ingre, Göran Kecklund and Torbjörn Åkerstedt.
- *Institute and country:*
Stress Research Institute, Stockholm University, Sweden.
- *Contact person and contact information:*
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4.2.1 Aim

This project aims to validate and develop methods for fatigue and sleep modelling of shift systems with and without the knowledge of sleep patterns. The project has several aims:

- Validate the original three process model of alertness including all processes and extensions made to it since its inception in 1990, including the sleep generator.
- Extend the model to include individual differences and reference limits accounting for 75% and 90% of all subjects (including the mean/median of 50%) as well as conditional probabilities of all levels of sleepiness to facilitate assessment of absolute and relative risk.
- Extend the model with functions for adapting the circadian component to individual differences (circadian type) and acclimatization to different time zones (jetlag) for flying personal and individuals.
- Re-estimate core model parameters with methods suitable for unbiased assessment of non-linear parameters in the presence of individual differences to avoid the ecological fallacy.
- Develop metrics for evaluating the safety and health implications of shift systems based on model predictions of sleep and sleepiness, including sleep deprivations, recuperation and circadian stress.

4.2.2 Method

The project uses sleep, work hour and sleepiness (Karolinska Sleepiness Scale) data from several projects of work hours including: air crew (n=91, 4,616 obs), train drivers (n≈46, two weeks of diary data), bus drivers (37,526 person days) and nurses (n=285, 29,433 shifts). Analyses are primarily performed using multilevel mixed effects linear and non-linear regression models in Stata together with mathematical sleep and fatigue modelling in R.

4.2.3 *News value*

Sleep and fatigue modelling has the potential to provide ecological “objective” estimates of safety and health risks in shift system based on the actual mechanisms of health and safety theory.

4.2.4 *Status of the project*

Preliminary work on objective work hours has been published in 2012 with descriptive data using a more traditional approach of classifying shifts and sequences. A paper is currently in late stages of preparation addressing aims 1–3 listed above. Work has started to combine data for development of health and safety assessment addressing aim 5. Some preliminary modelling of aim 4 is also on-going.

4.3 Impact of light exposure for adapting to day and shiftwork, above and below ground, as well as during different seasons

- *Members of the project group:*
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- *Coordinators/contacts:*
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- *Weblink to information about the survey:*
<http://www.stessforskning.su.se>

4.3.1 Aim

LKAB in northern Sweden offers excellent opportunities to study human adaptation to dark and light environments and it is on these environmental issues the research questions revolve around:

- What light and sleep behaviour favours a good fit for working (well-being, alertness, health)?
- Has the location of work, above or below ground, any importance of adaptation to work?
- How does the adjustment to work hours differ in different seasons?

Specific questions

- What is the significance of a gene derived chronotype for adaptation to shift work?
- What impact has work (above or below ground) for the quality of sleep and wakefulness?
- How are rhythm changes mastered during different lighting conditions (transition to night / day work)?
- What light behaviour is observed among workers with few opportunities for natural light intake and how does it affect recovery?
- How does seasonal change affect the above issues?

- What light exposure periods during the day seem especially important for a good recovery, perceived health and good job performance?
- What characterizes workers that are well or not well adopted to work hours in sleep-wake patterns/light behaviour/chronotype?

4.3.2 Method

Study 1 covers all employees ($\approx 1,200$ workers) that answer a question battery and give saliva for DNA testing. In the battery of questions they will give answers on sleep behaviour, sleep disorders, light behaviour and chronotype.

Study 2 consists of workers that will be followed over 2 weeks with actigraphs and light meters. Subjects will fill in a diary in which measures of sleepiness, fatigue, energy and mood across the day and sleep times are reported. The process is repeated so that groups are studied both in winter and in spring.

4.3.3 Status of the project

Study 1 has performed the data collection, study 2 is ongoing.

4.4 Influence of daylight exposure in the working population in Sweden

- *Project members:*
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- *Coordinators/contacts:*
Project manager Arne Lowden (arne.lowden@su.se), Stress Research Institute.
- *Weblink to information about the survey:*
<http://www.stessforskning.su.se>

4.4.1 Aim

The project aims to at an overall level give a description of daylight exposure in workers at the workplace as well and its possible effects on health, including sleep, mood, circadian rhythm, sleep timing and wakefulness.

4.4.2 Method

The Swedish Longitudinal Occupational Survey of Health (SLOSH) is used (N=7,324 workers).

4.4.3 Status of the project

Data on light exposure and health was collected in 2012 and now being analysed.

4.4.4 Perspectives

Preliminary data indicate that a low dosage of natural daylight exposure in connection to workdays in winter is related to elevated complaints of lowered mood, reduced energy, sleep complaints and low scored self-rated health. It seems that age and gender differ, young females reporting more complaints. These data indicate that it is needed to further

investigate the relationship between light and health especially during the dark period of the year in field settings.

4.5 Cognitive functions in the awakening brain

- *Project members:*
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- *Institute and country:*
Department of Clinical Neuroscience, Karolinska Institutet, Stockholm Sweden and Stress Research Institutet, Stockholm University, Stockholm Sweden.

4.5.1 Aim

Sleep inertia poses a problem for occupations where the workers need to make safety-critical decisions directly upon awakening. Since there is a limited knowledge of how sleep quality prior to awakening affects sleep inertia and different cognitive functions, we woke people from different sleep stages and made them perform a cognitive test battery directly upon awakening.

4.5.2 Method

Thirty-one non-shift-working participants (mean age 25 ± 4 SD yr, 10 women) went through the study protocol twice. The participants carried out a test battery (the newly developed *Karolinska WakeApp*) during baseline (2h prior bedtime), and directly upon awakening from slow wave sleep (SWS), NREM stage-2 sleep (N2), rapid eye movement sleep (REM), and 15 minutes before normal awakening. The test battery included tests for mathematical skill, short-term memory, working memory, semantic memory retrieval, and a probabilistic inference task – each test being 2min long and presented in a randomized order. Analyses from the 19 first participants are presented.

4.5.3 Results

Mathematical performance (addition task) was, as compared to baseline (intercept 14.2 correct calculations/test), significantly impaired after awakening from N2 (-2.5), SWS (-3.0), REM (-2.4; $p's < .001$), but not when awakened 15 min prior to the expected awakening (-.9). Performance on the *short-term memory* test showed the amount of mistakes to be 12% at baseline, a number that increased significantly after being awakened from SWS (+7%), REM (+3%), or the normal awakening (+4%, $p's < .05$), but not from N2 (+2%). The *working memory* test showed similar effects with significantly worse performance after waking up from SWS (-.8 less correct responses compared to baseline), REM (-.9, $p's < .05$), but not after waking up from N2 (-.5) or close to normal awakening (-.2); baseline intercept being 10.5. Retrieval of *semantic memory* (quiz questions) was impaired after waking from all sleep stages as compared to baseline, baseline (intercept 9.8 questions), SWS (-1.2), N2 (-2.0), REM (-1.4), normal waking (-1.4, $p's < .05$). The *probabilistic inference* task showed that people gathered more information (number of beads) before making decisions when awakened from sleep as compared to baseline, baseline (intercept 7.0 beads), N2-sleep (+.5), SWS (+.3), REM (+.3), and normal awakening (+.2; $p's < .05$).

All cognitive processes deteriorated during sleep inertia as compared to wakefulness with the exception that people gathered more information before making decisions when being awoken from sleep. In all, worst performance occurred upon awakening from SWS and REM-sleep, but some cognitive functions were not found to be significantly worse when awoken from NREM stage-2 sleep or close to the normal waking time. The newly developed WakeApp consisting of several short cognitive tests sensitive.

4.6 Effects of working hours on physicians' empathy

- John Axelsson, Karolinska Institutet.

4.6.1 *Aim*

There is little systematic knowledge of how working hours affects patient-doctor interactions. The purpose of the present project is to investigate how working hours affect physicians' empathy. We carried out two small pilot studies, one with the purpose to test existing empathy scales and one with the purpose to test a newly developed empathy that measure physicians' state empathy. We are now aiming to further validate this questionnaire and thereafter use it to investigate how working hours (type of shift and time over the shift) affect physicians' empathy.

4.6.2 *Method*

In the first study, 10 physicians were measured on 2 occasions (during a day shift and during a night shift) with two empathy scales, the Jefferson Scale of Physician Empathy and the Interpersonal Reactivity Index. In study 2, we developed a new 20-item questionnaire (in Swedish) for state empathy (1=no empathy at all, = very high empathy), which was based on how the physician interacted with the patients the last hour. Paper-based and electronic questionnaires containing were distributed to 57 doctors, of which 13 responded, once at the beginning of a shift and once at the end of a shift.

4.6.3 *Results*

The first study indicated non-significant effects on "hypothetical empathy," although the differences seen were in the direction that empathy towards the patients was worse on night shifts. The variation was, however, very small. The second study, measuring "state empathy" showed significant worse empathy for the main subscale "taking the patient perspective" at the end of the shift (-.5) as compared to the beginning of the shift (intercept 5.5, $p=.011$).

The second study indicated that the new state empathy scale might be sensitive to detect changes in physicians' empathy over a work shift. Further studies are needed to tests its validity and to systematically investigate how physicians' empathy to the patients are affected by their working hours and the consequences for the patients.

4.7 A prospective study of the association between shiftwork & prescription drug use

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<http://www.stressforskning.su.se/english/slosh/slosh-start>;
<http://www.ucl-sarc.org/finland.html>

4.7.1 Aim

Shiftwork is associated with an increased prevalence of gastro-intestinal problems, metabolic disorders, cardiovascular disease, musculo-skeletal disorders, mental ill-health and chronic sleep disturbance. Evidence of these associations comes from both self-report measures of health and objective measures such as medical diagnoses. However, there have been no studies to date examining the links between type of work schedule and register data of prescription drug use. The aim of this project is to analyze data from the Swedish Longitudinal Occupational Survey of Health (SLOSH) and the Finnish Public Sector Study to prospectively examine associations between shiftwork and the purchase of drugs associated with the health complaints listed above.

4.7.2 Method

SLOSH study is a nationally representative longitudinal cohort survey with a focus on the association between work organization, work environment and health. Since the start in 2006 follow-ups were conducted every second year (to date, 2008, 2010 and 2012). The sample currently comprises 21,489 respondents, either in gainful employment or not currently employed. All labour market sectors and occupations are represented, and the number of men and women is approximately equal. The Finnish Public Sector Study is ongoing prospective study of local gov-

ernment employees in 10 towns and 21 public hospitals in Finland carried out since 1997. In these analyses, we include data from surveys carried out in 2000–2002 (N = 48,598, response rate 68%) and in 2004 (N = 48,076, response rate 66%). For these respondents, questionnaire data have been linked to data on redeemed drug prescriptions up to the end of 2011, obtained from national registers.

4.7.3 Status of the project

Preliminary analyses of the data from SLOSH have been conducted, as follows. Separate analyses were conducted for “shiftwork” (i.e. schedules that may or may not include night work; N=2,506) and for “night work” (only schedules that include night work; N=1,116). In each case, the control group comprised respondents reporting themselves as doing “day work” only. Separate analyses were conducted for drugs related to each of six categories of health complaint, namely alimentary tract; type-2 diabetes; hypertension; musculo-skeletal pain; metabolic disorders; hypnotics and sedatives; and a combined category of anxiety and depression. Thus a total of 12 analyses were conducted. The analyses were based on identifying the first incidence of use for each participant i.e. analysis of “any incident use.” Every analysis included as covariates baseline age, sex, smoking status and educational level. Participants were excluded from the analyses of a particular type of drug if they reported having the relevant health complaint at baseline. Cox proportional hazard regression models were used to compute hazard ratios with 95% CIs.

There were no significant associations between either shiftwork or nightwork and the incident use of any drug. However, there were marginally non-significant trends suggesting that night workers were more likely to use hypnotics and type-2 diabetes medication. The absence of significant associations in the other analyses may reflect a lack of statistical power. We will explore this issue in the forthcoming analysis of the Finnish Public Sector Study.

4.8 Night work and quick returns as predictors of sick leave and medication use in health personnel

- *Members of project group:*
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- *Institute and country:*
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- *Contact person:*
Anette Harris and Øystein Vedaa (PhD candidate).

4.8.1 Aim

The aim of the project is to gain more knowledge about the association between night work, quick returns (short time between two shifts), sickness absence and use of medication.

The project consists of three sub-projects/papers that examine: 1) Night work as predictor of sick leave. This paper present data on the predictive power of night work related to short- and long-term sick leave; 2) Quick returns (short time between two shifts) as predictor of sick leave. This paper we will present data on the predictive power of quick returns related to short- and long-term sick leave; 3) Night work as predictor of medication use. This paper present data on the predictive power of night work related to prescription of hypnotics, anxiolytics and antidepressants. We will also explore if personality factors (morningness, flexibility and languidity) will moderate these associations.

4.8.2 Method

The study is a four years PhD project that starts in November 2013.

For the three papers we will use data for one year (2012) from the Register of Working hour, Health and Sickness absence (RWHS) database, consisting of approximately 2,500 health care workers.

Data for three-month periods will be used as we expect that heavy work strain in terms of night shifts and quick returns within such a period will affect subsequent sick leave and medication use during the following three-month period. Data from four three-month periods will be analyzed for their predictive power for subsequent sick leave and medication use the next three months. As we accumulate data we increase the statistical power and ensure that the data cover all seasons.

4.8.3 *Status of the project*

Participants were invited through email and intranet at the workplace in May 2013. Due to low response rate (28%) on the web-based questionnaire, a printed version were sent to the workers home address in October 2013.

4.9 PhD project on workplace bullying and mental health outcomes

- *Name of project:*
Health outcomes of exposure to workplace bullying; the moderating effects of personality and individual coping style.
- *Members of project group:*
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- *Contact person:*
Ståle Einarsen and Iselin Reknes (PhD candidate).

4.9.1 Aim

The aim of the present project is to gain more knowledge about the longitudinal relationship between workplace bullying and mental health problems.

The project consists of three sub-projects/papers that examine: 1) the longitudinal relationship between exposure to bullying behaviors and symptoms of anxiety, depression and fatigue; 2) the moderating effects of individual coping style on the bullying-health relationship; 3) the longitudinal relationship between exposure to bullying behaviors and sick-leave.

4.9.2 Method

The study is a four years PhD project that started in January 2012. The three papers use data from the SUSSH-survey. Paper 3 will also use register data from “Forløpsdatabasen Trygd” which gives information about number of sick-leave periods.

Data in the SUSSH-survey have been gathered since 2008/2009, with annual follow-up studies. The present PhD project will use data from the first and the second measurement (2010) – a time-lag considered long enough for negative health effects to develop as a result of being bullied.

4.9.3 Status of the project

The fifth data collection (2013) in the SUSSH-survey is almost done. Work regarding how to merge SUSSH-data with register data is in progress.

Paper 1 has already been published in International Journal of Nursing Studies; Reknes, I., Pallesen, S., Magerøy, N., Moen, B. E., Bjorvatn, B., & Einarsen, S. (2013). Exposure to bullying behaviors as a predictor of mental health problems among Norwegian nurses: Results from the prospective SUSSH-survey. *International journal of nursing studies*.

4.10 PhD Project on the consequences of shift work

- *Name of project: Shift work:*
Negative consequences and protective factors.
- *Members of project group:*
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- *External project group members:*
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- *Institute and country:*
Faculty of Psychology, University of Bergen, Norway.
- *Contact persons:*
Ståle Pallesen and Eirunn Thun (PhD candidate).

4.10.1 Aim

The aim of the project is to gain more knowledge about the negative consequences of shift work and factors which may protect against these negative consequences.

The project consists of three sub-projects/papers that examine: 1) Shift work as a predictor of anxiety and depression symptoms, controlling for age, gender, and the personality variables hardiness, morningness, languidity and flexibility. 2) Clock genes associated with shift work disorder, insomnia and sleepiness, controlling for age. 3) The consequences of shift work for pregnancy and birth (complications during pregnancy and delivery, as well as child characteristics such as birth weight), controlling for age, marital status, present job position and alcohol and tobacco use.

4.10.2 Method

The study is a four years PhD project that started in August 2011.

Data for paper 1 are the first three waves of “the survey on shift work, sleep and health among nurses” (SUSSH). Data for paper 2 are the first wave of SUSSH and saliva samples collected from the respondents. Data for paper 3 are the first four waves of SUSSH and data from the Medical Birth Registry.

4.10.3 Status of the project

The SUSSH project which the present PhD project is a part of started in the winter 2008/2009, and is an on-going longitudinal study with an annual data collection. Five waves have been collected so far.

Regarding the PhD-project, the first two sub-projects have been conducted, and we are awaiting data from the birth registry for the third sub-project. Status of the first two papers are submitted (paper 1), and in progress (paper 2).

4.11 Shift work and breast cancer risk among Norwegian nurses

- *Members of project group:*
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- *Weblink:*
www.stami.no

4.11.1 Aim

Breast cancer is the most common cancer in women in Western societies. Shift work, implying exposure to light at night and the subsequent reduction in the synthesis of the hormone melatonin, has been suggested as a contributing cause of this cancer. In 2007, the International Agency for Research on Cancer classified shift work that involves disruption of circadian rhythms as a probable human carcinogen, on the basis of limited evidence from epidemiologic studies, and sufficient evidence from animal models. The inconsistent results from the epidemiologic studies might partly be due to crude assessments of shift and night work characteristics and incomplete adjustment for confounding factors. Studies with more accurate measures of night work are needed, as well as studies to establish the pathways and mechanisms mediating the possible effect of night work to breast cancer risk. The objectives of this study were 1) to examine the relation between shift work and breast cancer risk with a more accurate exposure metric, 2) to investigate whether night work is related to subgroups of hormone receptor-defined breast cancer, and 3) to understand the mechanisms of the susceptibility to night-work related breast cancer by exploring i) the role of circadian gene polymorphisms and ii) epigenetic changes in the circadian genes.

4.11.2 Methods

The project started in June 2008, and objectives 1 and 2 and the first part of objective 3 were finalized in January 2013.

The design is a case-control study, nested within a cohort of 44,835 Norwegian nurses. Telephone interviews were made of 699 (74%) of the live cases diagnosed in 1990–2007 and 895 (65%) controls, cancer free at the time of the sampling, about work history and potential risk factors. 70% of the interviewed nurses returned a saliva-sample kit. A new exposure metric was developed, including both the intensity and duration of night work. In the first paper, analyses for all breast cancers combined were performed by logistic regression models. In the second paper, risks were evaluated for subgroups of breast cancer defined by the estrogen- and progesterone receptor status, by polytomous logistic regression models. In the third paper, we studied 60 single-nucleotide polymorphisms (SNPs) in 17 genes involved in the regulation of circadian rhythm or melatonin biosynthesis. The odds of breast cancer associated with each SNP were calculated in the main effects analysis, and in relation to night shift work. We found statistically significant associations between SNPs in the core circadian genes and also genes controlling biosynthesis of melatonin, with risk of breast cancer.

4.11.3 News value

The first paper suggests that breast cancer risk may be related to long duration with many consecutive night shifts. The second paper shows the strongest association for progesterone-receptor positive cases, suggesting that progesterone could play an important role in the detrimental effect of shift work.

The third paper shows significant and noteworthy associations between several polymorphisms in circadian genes, night work and breast cancer risk, in nurses who worked 3 or more consecutive night shifts.

4.11.4 Status of the project

Results: The highest risk of all breast cancers combined, was found among nurses who had worked for minimum 5 years in shifts schedules including 6 or more consecutive night shifts, when compared with nurses who never worked night shifts (OR= 1.8, 95% CI=1.1–2.8). With respect to hormone receptor-defined breast cancers, the highest risk was observed for progesterone receptor-positive tumors (OR=2.4, 95% CI=1.3–4.3).

In August 2013, a new collaborative project was initiated between NIOH and the NOFER institute in Poland, based on data from the same nested case-control study, to investigate epigenetic changes in the core circadian, melatonin receptors, and female hormone receptor genes and breast cancer risk in Norwegian nurses. The project is funded by the Norwegian-Polish funds.

4.12 Petroleum survey of shift work, sleep and health (PUSSH)

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- *Weblink:*
www.pussh.org

4.12.1 Aim

To generate new knowledge of effects of various work schedules interacting with work-content factors on sleep, fatigue, and health from working life in the petroleum sector. Link collected data to registry data on sickness absence, intervention measures, compensation, disability and retirement/pensions. Currently, one PhD project focus' on shift schedules and psychological and social factors at work as risk factors for poor mental health among offshore and onshore workers.

4.12.2 Method

The project is designed as a full prospective panel design. Baseline and follow-up surveys were conducted with one-year time lag. Data were gathered using both a web-based questionnaire and a paper and pencil

questionnaire. Both onshore and offshore workers were recruited from operator and contractor companies in the Norwegian Petroleum sector. A total of 1,700 workers have participated at baseline and currently approximately 670 workers have participated at follow-up. Data collection are planned to end in January 2014.

Instruments used in current phd project

QPS_{Nordic} was used to measure social and psychological exposures in the work environment. The instrument measure Quantitative job demands, Decisional demands, Learning demands. Positive challenges at work, Control of decisions and work pacing, Role clarity and Role conflict, Support from immediate superior and co-workers, Empowering and Fair leadership, Social climate, Commitment to the organization and Interaction between work and private life. The items are measured on a five-point rating scale with the following response categories: Very seldom or never, Rather seldom, Sometimes, Rather often, Very often or always. Individual differences were measured using the Eysenck Personality Questionnaire (EPQ), short version consisting of 12 questions (Eysenck, 1958). The items were measured on a four point scale ranging from Almost never, Quite seldom, Quite almost to Almost always.

The Hospital Anxiety and Depression Scale (HADS) were used as outcome, and consist of 14 questions. (Zigmond & Snaith, 1983). The items were measured on a four-point scale where respondents were asked to assess the degree to which they experience the various statements.

4.12.3 Status of the project

Data collection will be completed in January 2014. The first paper on working hours, work factors and mental distress will be submitted in October 2013.

4.13 Shiftwork, sleep and pain

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4.13.1 Aim

Pain is one of several negative health effects following shift work. A key challenge in understanding associations between shift work and pain is the time frame between exposure and effect, which is largely unknown (e.g., are hours, days, months or years of exposure needed?). Another challenge is to understand the mechanisms by which shift work sensitize the pain system. This is necessary in order to prevent and reduce shift-work related musculoskeletal pain.

The principal objectives of the present project are to determine i) if shift-work increases the sensitivity of the pain system, and ii) the time lag by which shift-work increases clinical musculoskeletal pain.

4.13.2 Method

The 5-year project started January 2012. It consists of two main parts, an experimental part and an epidemiological part.

Experimental study: By applying painful test stimuli in the laboratory in an experimental design under strictly controlled conditions, it is possible to understand mechanisms. 25 volunteers and 25 shift-working nurses participate in two cross-over lab studies with two conditions: normal sleep vs. sleep restriction. The subjects are their own controls. The sensitivity of the pain system is measured by psychophysical and electrophysiological (EEG) measures.

Field study: 120 shift-working nurses with musculoskeletal pain and 120 without pain participate. Daily reports of sleep and health complaints are accessed via smartphone over a full shift cycle. In this way we are able to investigate the time frame from exposure to effect in detail. An initial screening questionnaire will assess relevant psychosocial and mechanical exposure variables at baseline. In a sub-group, blood samples will be drawn to allow analysis of neuroimmunological factors relevant for pain.

4.13.3 Status of the project

The first experimental study (volunteers) is completed. Results show that two nights with 50% sleep restriction leads to increased sensitivity to mechanical and heat pain, and enhanced amplitude of event-related potentials (recorded by EEG), as an objective correlate of pain. Data collection of the second experimental study (nurses) started January 2013 and is about 2/3 complete. Data collection of the epidemiological part starts January 2015. A 3-year PhD-student starts on the project in January 2014.

4.13.4 Perspectives

The proposed project is relevant for several occupational branches practicing shift-work. Benefits may be 1) better assessment of risk factors for development of chronic pain, 2) knowledge for the planning of shifts schedules less harmful to health, 3) a potential for reducing sick leave.

4.14 The Finnair Health study

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4.14.1 Objective

To assess the risk for type 2 diabetes (T2D) and cardiovascular disease (CVD) among employees of a Finnish airline; to study the association of shift work with T2D and to test the feasibility of risk screening in occupational health care setting; The field study of the cohort: To develop and validate the most used shift work sleep disorder (SWD) screening questions and to develop the diagnostics of SWD in occupational health services.

4.14.2 Years of edition

Baseline data collection took place in 2006–2008 and the follow-up 2009–2010. The next follow-ups have not been scheduled. Field data collection took place in 2012–2013.

4.14.3 Population

In baseline each year one fifth of Finnair employees who are predominantly (over 95%) white Finns are invited for a check-up. The participation rates by age categories for men and women were 40% and 60% (<35 years), 50% and 60% (35–44 years), 57% and 68% (45–54 years), and 56% and 62% (≥55 years), respectively. Of all participants 36% were regular day workers, 35% nonflight shift workers, and 29% in-

flight workers, in the target group these per cents were 33%, 39%, and 28% respectively.

4.14.4 Method

Altogether 4,169 employees were invited for a health check-up in years 2006 to 2008 and 2,312 participated in this study. The check-up included physical examinations, questionnaires on working hours, sleep, and lifestyle, diabetes risk score FINDRISC, and blood tests. Lifestyle counseling was offered for those with increased T2D risk. Participants with the data of fasting glucose ($n = 2,237$) were invited to the follow-up in 2009–2010 in which 1,485 (66%) participated. The field study of the cohort: Volunteers were assessed with a 6-item questionnaire on symptoms of insomnia and tiredness while working different shifts and after two weeks on holiday, and 44 workers were recruited. 22 of them belonged to SWD group (77.3% men, average age 41.2 years) and 9 to control group (77.8% men, average age 47.9 years). Subjective sleep was measured using questionnaires and a 3-week sleep diary. Objective variables were collected using an actigraph during a three week period and psychomotor vigilance test (PVT) and a wireless 1-channel system recording sleep EEG from the forehead in connection with two morning shifts, two night shifts and two days off. In addition measurements included blood tests.

4.14.5 Topics and variables considered

The data includes variables of sleep, shift work sleep disorder, health, stress, working hours, work type, work stress, fatigue, t2d risk factors, among others. In addition the field study of the cohort includes variables of sleepiness and alertness.

4.14.6 Studies using the database

- Shift work sleep disorder (SWD) field study (2012–2013). Collaborative study of the FIOH, the National Institute of Health and Welfare, and Finnair Health Services.
- Screening and preventing of T2D through the agency of occupational health care: Nutrition and Shift work. A Collaborative study of the FIOH, the National Institute of Health and Welfare, and Finnair Health Services (2012–2013).

4.15 Work stress and sleep in shift working nurses

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4.15.1 Aim

Night shift work is highly prevalent and work shifts are often irregular in nursing work. In addition, personnel often suffer from work-related stress, which increases, sleep problems and the risk of cardiovascular diseases. The study tests the hypothesis that a long-term exposure to high psychosocial demands at work leads to altered cognitive functioning, high physiological load and poor adaptation to circadian stress through negative influences on sleep. In addition, we attempt to identify psychosocial and circadian stressors that are associated with impaired sleep and recovery in female nurses.

4.15.2 Method

The project included a laboratory study to measure cognitive functions and stress regulation and a three-week field study to measure sleep (sleep log, actigraphy), perceived and physiological stress (stress biomarkers and HRV), and recovery processes. The study subjects comprised 99 shift-working, female health care professionals who took part in the Finnish Public Sector Study in 2008, in which participants and the other employees of the ward ranked their level of job strain as either the highest or lowest quartile in Karasek's job strain model. The data collection was completed in 2011.

4.15.3 Status of the project

We are currently reporting the main results of the study.

Publications

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- Karhula, K., Härmä, M., Sallinen, M., Hublin, C., Kivimäki, M., Vahtera, J., Puttonen, S. (2013). Job Strain, Sleep and Alertness in Shift Working Health Care Professionals – a Field Study. *Industrial Health*, 51, 406–416.
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- Karhula, K., Härmä, M., Sallinen, M., Hublin, C., Virkkala, J., Kivimäki, M., Vahtera, J., Puttonen, S. (2103). Association of job strain with working hours, shift-dependent perceived work load, sleepiness and recovery. *Ergonomics*. Epub ahead of print.

4.16 Sleepiness and stress among long-haul truck drivers

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4.16.1 Aim

The study examined professional drivers' sleepiness and stress in different types (morning, day/evening, night) of shifts, the factors underlying the phenomena, and the relationship between the phenomena and driving style. Furthermore, an attempt was made to evaluate the effectiveness of a brief, one-time educational intervention designed to improve driver alertness on different shifts.

4.16.2 Method

Fifty-two long-haul truck drivers (mean age 38.1 years) from four medium-sized domestic haulage companies volunteered to the field study conducted as a randomised controlled trial. Four to five months before

and after the intervention all drivers underwent a 2-week measurement phase including subjective and objective measurements of sleepiness and stress at the wheel, sleep, alertness management behaviours, and vehicle-related parameters. Thirty-two drivers allocated to an intervention group received 3.5-hour educational intervention followed by a 4–5-month monitoring period. The remaining 20 drivers allocated to a control group continued working as usual.

4.16.3 Status of the project

Data collection completed. Scientific reporting going on.

4.16.4 Perspectives

The perspective of this study is to answer the following two questions: 1) To what extent do long-haul truck drivers show sleepiness and stress on different shifts and which are the most significant work- and individual factors underlying these phenomena. 2) Is it possible to reduce long-haul truck drivers' sleepiness through a feasible, half-day fatigue management training program. As sleepiness and stress are both recorded with various methods and at a high sampling rate while driving the data will provide a comprehensive picture of the situation on the ground. In addition, the project will provide an answer to the question of whether a single fatigue management training session is a sufficient sleepiness countermeasure in this group of workers.

4.17 Well-being at work among airline pilots

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4.17.1 Aim

The main aims of this study on airline pilots are: a) to find out the most critical underlying factors of well-being at work and b) to provide evidence-based proposals for practical measures to enhance well-being at work. The aim of the first part, the questionnaire and register study, is to clarify the extent to which the characteristics of work arrangements, working hours and flight history are associated with well-being at work among the pilots. The aim of the field study is to examine the build-up of workload and recovery over a long period of time (2 months) among the pilots in relation to specific flight arrangements (e.g., the number of flights, time-on-task during the flights, arrangements for recovery, staffing during the flights). Both of these aims are studied in three groups of pilots: a) those who have intercontinental flights only, b) those who have European flights only, and c) those who have both intercontinental and European flights. The second aim of the field study is to improve the validity of modeling methods used to predict alertness levels on the job.

4.17.2 Method

A web-based questionnaire on well-being, working hours and health, developed by the Finnair Health Care Services in co-operation with the Finnish Institute of Occupational Health (FIOH) and the Institute of Health and Welfare will be sent to all airline pilots of Finnair. A part of the pilots have responded the same questionnaire earlier, enabling us to do individual-level follow-up. The individual-level flight data, as well as sickness absence data from the period of 2005–2013 will be retrieved from the company records to link the specific exposure information on the number and type of flights and the characteristics of working hours to the earlier (small samples in 2006–2008 and 2009–2010) and new (2013, all airline pilots) questionnaire data. All questionnaire data will be analyzed separately for pilots flying intercontinental, European, and both intercontinental and European flights. Well-being at work will be studied in more detail in the field study. The study will include 2–3 groups of 20–30 airline pilots. In case of 2 group design, one group of pilots will fly intercontinental flights only and the other either European flights only or both intercontinental and European flights. In case of 3 group design, the study will include pilots flying intercontinental flights only, European flights only and both intercontinental and European flights. The field methodology will include diary methods tailored for different routes including e.g. NASA-TLX and KSS, as well as actigraph and HRV recordings in subgroups. The data collected with the KSS will be used to improve the validity of modeling methods used to predict alertness levels on the job.

4.17.3 News value

The results on the role of different work and flight arrangements as well as fatigue management behaviors in well-being at work will be utilized when selecting the best interventions and practices for improving the situation among the pilots. The flight-specific data will be used to optimize recovery opportunities during the most challenging routes. Workload and alertness modeling data will be utilized together with Stockholm University to improve alertness and work load prediction. The result will also be useful when evaluating and enhancing the work-leisure balance on specific flight routes and work schedules.

4.17.4 Status of the project

The project will start at the end of 2013.

4.18 Working Hours in the Public Sector (WHPS)

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4.18.1 Aim

There is a need to develop evidence-based methods for practice to evaluate and implement shift ergonomics in private and public companies world-wide. Epidemiologic evidence on the effects of night and shift work on health is still often inconsistent. Exposure assessment in large epidemiological studies on working hours has mostly been based on self-reported and nominal scale data prone to recall bias and other measurement error offering limited possibilities for analyses. The main aim of the current project is to develop working hours in the public sector of Finland. The specific aims of the project are:

- to develop objective methods for the evaluation of the characteristics of working hours in the public sector
- to bring objective working hour data to the Finnish Public Sector (FPS) study
- to study the effects of working hours on work stress, health and wellbeing using the new data base established by the current study.

4.18.2 Method

Objective daily working hour data (used for payroll) from 2008 forwards will be added to the Finnish Public Sector study, an on-going prospective study including biannual questionnaires on work, health and well-being for about 50,000 persons and wide employer and register databases of about 150,000 workers. The working hours will be retrieved from the company-based shift scheduling programme (Titania®) that is used in the whole public sector of Finland for payroll and including both the planned and realized working hours and shift preferences. Epidemiological data on working hour exposure is averaged for each year to calculate 32 individual working hour characteristics under the following dimensions: 1. *length of the working hours* (8 items related to the average weekly working hours and the length of individual shifts), 2. *Consecutive working days* (4 items), 3. *shift work* (6 items, % of different shifts), 4. *recovery between shifts* (4 items), 5. *social aspects of working hours* (3 items), 6. *variability of working hours* (3 items), 7. *predictability of working hours* and 8. *worktime control* (shift wishes, 3 items).

4.18.3 News value

The project will improve the methodology for exposure assessment in epidemiological studies. Secondly, the project will support the development of the evaluation of working hour characteristics in shift scheduling softwares used in the public sector of Finland. The project will also support the management and planning of working hours in the public sector by providing detailed bi-annual feedback on the change and characteristics of working hours in the different hospitals and towns of the public sector of Finland.

The project will create a new prospective dataset to study the associations, as well as natural and experimental interventions on the effects of working hours on different health measures (e.g. sleep, subjective health, temporary and permanent sick leave, morbidity, use of medication, accidents, participation into working life etc.)

4.18.4 Status of the project

Specific guidelines for shift ergonomics to be used in the objective (automatic) evaluation of shift ergonomics has been finished. Based on the co-operation with CGI, the evaluation tools will be implemented to the new shift scheduling versions of Titania®.

The current data on the working hours, retrieved from Titania® and based on the pilot-project in Helsinki City includes 20 wards of Social Services and Health Department, n=1,923 of which 12% are male and 88% female employees with mean age 38 years (SD 13) who have worked at least one work shift within the study period 2008–2012. The number of employees with data (at least one work shift) for each consecutive year 2008–2012 is 230. The proportion of part-time work varies from 20% year 2008 to 25% in 2012. Based on the preliminary results, the developed method using the 8 different dimensions of working hours can be used for multidimensional and accurate estimation of shift work exposure. The method itself is reliable but the individual characteristics of working hours should be combined cautiously. The further analyses of this current data (pilot-project) are underway at October 2013.

Data collection of the daily working hours has started from the different towns and hospitals belonging to the Finnish Public Sector study from 2008 onwards.

4.19 Can night shift-work shift epigenetic patterns?

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4.19.1 Aim

It has been hypothesized that light-at-night (LAN) in modern societies might be partially responsible for the elevated risk of breast cancer observed in industrialized nations, and night shift-work is regarded as the most extreme form of LAN exposure. It has been demonstrated that both genetic variants and methylation changes in circadian genes predispose individuals to breast cancer. However, whether shift work may contribute to epigenetic changes is still an unanswered question. The aim is study association between long term night work and global and locus-specific methylation changes.

4.19.2 Material and methods

The parent study is a Danish prospective cohort ("Diet, Cancer and Health"), which was established between 1993 and 1997 with the main purpose of studying the role of diet and cancer. Participants were all born in Denmark, free of any cancer and aged between 50 and 64 years at time of invitation (today between 65 and 79 years old). A total of 29,824 women completed a self-administrated questionnaire. These women were examined in order to obtain anthropometrical measures, and gave biological samples, including blood. The questionnaire included questions on food consumption, micronutrients (e.g. folate intake), other lifestyle factors (e.g. alcohol drinking, sun exposure, physical activity, and medical anamnesis) and reproductive factors. Based on individual linkage, information on the entire employment history on a company level is obtained from the Supplementary Pension Fund database, which covers information on all employments in Denmark since 1964. Information on individual working time is assessed from constructed Job Exposure matrix (JEM), based on interviews of lifetime occupational history,

including working time schedule for each job, with over 2,000 randomly selected employees, will be applied to the individual records.

A total of 300 subjects with no history of night- work and 300 with long-term (10+ years) work, respectively, will be selected from the cohort. These participants have archived blood samples available, which will be used for DNA extraction and subsequent epigenetic analysis, in order to determine the impact of shift work exposure on global DNA methylation, as well as methylation in the promoter regions of the core circadian genes.

4.19.3 Status of the project

The study is on-going and will end in June 2016.

4.19.4 Perspectives

Considering that millions of women worldwide are being exposed to ill-timed light, particularly through non-day work, there exists an urgent need to systematically study the possible biological impact of night-work, including the epigenetic consequences of this exposure.

4.20 Non-day time work and risk of selected cancers in Nordic men and women

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4.20.1 Aim

Whereas almost 20 epidemiological studies have reported on non-day work and breast cancer, there has only been published a few studies concerning the other cancers which has been hypothesized as associated with non-day work (e.g. prostate, colon, rectal, lung, skin, melanomas, endometrium, ovary, non-Hodgkin's and others). It is the aim of the present study to test the association between non-day time-work and selected other cancers than breast cancer based on Nordic linkage data. The relative risk of breast cancer will also be evaluated and regarded as a validation of the data linkage.

4.20.2 Material and methods

Bases on census data from Denmark, Finland, Iceland, Norway, and Sweden, a cohort of all 15 million work active persons aged 30–64 years, is established, including information on job-title. Follow-up for cancer morbidity is based on data from the five respective cancer registries and is from census until 2005. A Job Exposure Matrix (SIR) on shiftwork time is applied to the cohort. Standardized incidence ratios based on five-year age group and calendar periods are calculated.

4.20.3 Status of the project

The study has started and will end in late 2014.

4.20.4 Perspectives

About 20% of the population work non-day time, but only few studies have evaluated the association with other cancers than breast cancer. This study will estimate relative risk for non-day work and major cancer sites.

4.21 Non-day time work and risk of breast cancer in other women than nurses – A nested Danish case-control study

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4.21.1 Aim

There is sufficient evidence in experimental animals that exposure to light during the daily dark period (biological night) is carcinogenic. There is emerging, though limited evidence, that night-work may increase the breast cancer in females. The majority of recent epidemiological studies on non-day work and breast cancer have been based on relatively crude assessment of non-day work, and many studies have focused on nurses only. It is the aim of the present study to test the association between different types of non-day work (e.g. forward and back ward rotation, evening shifts, overnight shifts), including the modification from duration and cumulative number of shifts, timing of shifts (before and after first child birth), and chronotype, etc.

4.21.2 Material and method

It is a cases-control study nested within the cohort of employed Danish women born after 1930. Information on employed women is obtained from the Supplementary Pension Fund database, which cover information on all employments in Denmark since 1964. Information on working as a nurse is obtained from the Danish Nurses Association where over 95% of all Danish nurses are members. This group is excluded from the cohort of employees. Cases of histologically confirmed breast cancer are retrieved from the Danish Cancer Society. Controls (1:4) are selected at random from the female cohort of non-nurse employees. Information on detailed working time is obtained from each held job by telephone interviews. The same occur for all potential confounders (e.g. reproductive history, alcohol consumption, physical activity, and use of sex hormones).

4.21.3 Status of the project

Results are ready for submission to a scientific journal.

4.21.4 Perspectives

Most epidemiologic studies on non-day time work have crude an unspecific assessment of the working time, and some studies have incomplete assessment of potential confounder and potential individual susceptibility (chronotype). The present study of non-nurses attempts to limit these potential problems.

4.22 Non-day time work and risk of selected cancers in Danish men and women – A series of nested case-control studies nested in a prospective cohort

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4.22.1 Aim

There is emerging evidence that non-day work may increase female breast cancer risk. Thus, a positive association has been indicated in the majority of published studies on this topic. The hypothesis of non-day work and cancer risk does also include other major cancer in both men and women (e.g. prostate, colon, rectum, lung, skin, melanomas, ovary, endometrium, non-Hodgkin's and others), but only few epidemiological studies exist on the sites. It is the aim of the present study to test the association between non-day work and these cancers.

4.22.2 Material and methods

A Danish prospective cohort ("Diet, Cancer and Health") was established between 1993 and 1997 with the main purpose of studying the role of diet in cancer. Participants were all born in Denmark, were free of any cancer and aged between 50 and 64 years at time of invitation. A total of 57,053 participants (including 52.2% women and 47% men) accepted the invitation and completed a self-administrated questionnaire including information on potential causes of cancer, including some occupational exposures. These study participants were examined in order to obtain anthropometrical measures, and gave biological samples. Information on the entire employment history on a company level is obtained from the Supplementary Pension Fund database, which cover information on all employments in Denmark since 1964. Information on individual working time was, however, not obtained. In order to assess this

information a constructed Job Exposure matrix (JEM), based on interviews of lifetime occupational history, including working time schedule for each job, with over 2,000 randomly selected employees, will be applied. Cases of histologically confirmed cancers are retrieved from the Danish Cancer Society. Controls (1:5) are selected at random from the cohort and matched on sex, vital status and birth year (incidence density). Information on vital status and current address is obtained from the Central Person Registry. Information on all potential confounders is available from baseline questionnaire. Information on detailed working time and diurnal preference will be obtained from study subjects who are assessed with probable non-day work based on the JEM.

4.22.3 Status of the project

The study has started and will end in 2015.

4.22.4 Perspectives

About 20% of the population work non-day time, but only few studies have evaluated the association with other cancers than breast cancer. This study will estimate relative risk for non-day work and major cancer sites.

4.23 Risk of colo-rectal and prostate cancer in Danish men employed in the military – A nested case-control study

- *Project members:*
Johnni Hansen; Christina Funch Lassen.
- *Institute and country:*
Danish Cancer Society Research Centre, Copenhagen, Denmark.
- *Coordinators/contacts:*
Johnni Hansen (johnni@cancer.dk).

4.23.1 Aim

It has been hypothesized that non-day work may increase the risk of prostate and colo-rectal cancer. Further, there is sufficient evidence in experimental animals that exposure to light during the daily dark period (biological night) is carcinogenic. There are, however, only few epidemiological studies which have tested this hypothesis. It is the aim of the present study to test the association between non-day work and these cancers in men, including the modification effect from duration and cumulative number of shifts, number of consecutive shifts and chronotype.

4.23.2 Material and method

A cohort of all employed in the Danish military since 1964 has been established from the files of the Supplementary Pension Fund database, which cover information on all employments in Denmark since 1964. Cases of histologically confirmed colon and rectum, and prostate cancer are retrieved from the Danish Cancer Society. Age and sex matched controls (1:10) are selected at random from the military cohort (incidence density). Information on potential confounders and lifetime working time schedules is obtained by a questionnaire, and partly by telephone interviews.

4.23.3 Status of the project

Results are ready for submission to a scientific journal.

4.23.4 Perspectives

Prostate and colorectal cancer are among the most frequent cancer in men and both has been hypnotizes as associated with non-day time work. Further, little is known about men with non-day time work and risk of these cancers.

4.24 Non-day time work and risk of Parkinson's disease – A nested Danish case-control study

- *Project members:*
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4.24.1 Background and Aim

Oxidative stress has been implicated in Parkinson's Disease (PD) pathogenesis. Melatonin is a potent antioxidant which has been hypothesized to be beneficial in the prevention and treatment of PD. Working during the night involves exposure to light-at-night which decreases the normal nocturnal melatonin production. Previous epidemiological studies have shown that working rotating night shifts was associated both with a higher risk of cancer as well as a lower risk of PD. Further, working non-daytime disrupts a range of normal physiological rhythms and has wide impacts on shift workers. Physical or emotional stress, depending on its nature and magnitude, could either be neuroprotective or detrimental to dopaminergic neurons. The aim of this specific analysis is to examine whether a history of night work is linked to the risk of developing PD.

4.24.2 Material and methods

All about 17,500 cases of PD have been retrieved from the National Hospital Registry (1984–2009). For each PD patient five control subjects matched on year of birth and gender are randomly selected from the Danish Central Population Register, using incidence density sampling. A subpopulation of about 2,000 cases and 2,000 controls have been interviewed about the entire individual work history, including information on shift schedules in each job, in addition to information on known and potential confounders, e.g. tobacco smoking.

4.24.3 Status of the project

Results will be submitted to a scientific journal by the end of 2013.

4.24.4 Perspectives

The causes of Parkinson's disease remain almost unknown, and the association with non-daytime work has only been investigated in one previous study.

4.25 In the Middle of the Night – shift work and circadian disruption

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- *Coordinators/contacts:*
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- *Weblink to information about the survey:*
www.arbejdsmiljoforskning.dk/midtomnatten
(project description in Danish).

4.25.1 Aim

The causality between shift work and increased risk of certain diseases is, heavily debated in the public as well as in the scientific community, and is yet unsettled. This is also true for the role of specific shift work schedules e.g. the number of consecutive nights in a schedule. So in spite of a rather comprehensive scientific literature on this subject, studies with focus on the potential mechanisms linking specific shift work schedules and disease are needed. The overall purpose is to study the effect of the number of consecutive night shifts on the risk of disease by evaluating three potential mechanisms: 1) sleep disturbances, 2) melatonin suppression, and 3) circadian disruption.

4.25.2 Method

It is a three year project that started June 1st 2012. The study is designed as a cross-over intervention study, where approximately 85 participants are exposed to 3 different ways of organising night work: 2, 4, or 7 consecutive nights with a corresponding number of days for restitution. The study population consists of non-smoking police officers with shift work. All

measures are done by self-monitoring by use of questionnaires, logbooks, saliva and urine samples, actigraphy, actiheart and actual work schedules.

4.25.3 *Status of the project*

Data collection started in March 2013 and will be completed in November 2013.

4.25.4 *Perspectives*

The perspective of this study is to answer the question: What is preferable? Many consecutive nights and thereby fewer turns of the circadian rhythm or few consecutive nights and thereby more turns of the circadian rhythm? We know that shift work causes acute physiological responses, but we do not know to what extent these responses depend on the number of nights worked in a row. An important question is therefore, if there is an optimal way to organise night work, when this is inevitable. This project is unique because we will investigate the effect of the number of consecutive nights on acute physiological responses while the participants are in their natural environment. The results will add new knowledge on how short periods of night work affects the body compared to longer periods and the possible mechanisms linking shift work and disease.

4.26 LUX@R. Night work, light at night, circadian disruption, and risk of breast cancer

- *Members of project group:*
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- *Institute and country:*
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- *Weblink:*
www.luxar.dk (in Danish).

4.26.1 Aim

In 2007, the International Agency for Research on Cancer classified nightshift work that involves circadian disruption as probably carcinogenic to humans, based partly on an increased risk of breast cancer among long-term nightshifts workers. Since then, several epidemiologic studies have examined this relation. Despite these efforts, confounding and bias regarding the exposure assessment cannot be eliminated and is a methodologic Achilles heel in the studies leading to persisting uncertainty regarding causality. The main hypothesis linking night work with breast cancer is disruption of the nocturnal melatonin production.

The aim of the project is to examine: 1) night work and the risk of breast cancer, 2) light at night and risk of breast cancer, and 3) the influence of night work and light at night on the circadian rhythm.

4.26.2 Method

The project started May 2011 and is scheduled to end July 2015.

571 employees in occupations concerned with either outdoor work, indoor day work, and night work were recruited to a 7-day study period. The participant contributed with light exposure and activity measures for every minute, 24 hours a day for all 7 days, diary notes 2 times a day for all 7 days, saliva samples every fourth hour on 1 working day and 1 day off, a single blood sample and a basic questionnaire.

These data will be used to examine: a) the influence of night work and light at night on circadian disruption, and b) to form a JEM with information about light exposure to be used together with working hour information from the Danish Working Hour Database (DWHD) in analysing light at night and risk of breast cancer. In the study on night shift work and risk of breast cancer, the exposure will be based solely on DWHD.

4.26.3 Status of the project

Data was collected from May 2012 to May 2013 and is currently being prepared and data from DWHD is ready for analysis. The protocol for the first paper is currently in preparation.

4.27 Shift Work and Health

- *Members of the project group:*
- Anne Helene Garde (ahg@nrcwe.dk), Pernille Hjarsbech (pmi@nrcwe.dk), and Reiner Rugulies (rer@nrcwe.dk) from the National Research Centre for the Working Environment; Åse Marie Hansen (asemarie.hansen@sund.ku.dk) Dept. of Public Health, Copenhagen Stress Research Centre, University of Copenhagen; Jens Peter Bonde (jpb@bbh.regionh.dk) and Kristian Tore Jørgensen (Kristian.Tore.Joergensen@regionh.dk), Dept. of Occupational and Environmental Medicine, Bispebjerg University Hospital; Henrik Kolstad (henkol@rm.dk), Department of Occupational Medicine, Danish Ramazzini Centre, Aarhus University Hospital, Denmark; Johnni Hansen (johnni@cancer.dk), Danish Cancer Society Research Center.
- *Institute and country:*
National Research Centre for the Working Environment, Denmark.
- *Coordinators/contacts:*
Senior Researcher Anne Helene Garde and researcher Pernille U. Hjarsbech.
- Weblink to information about the survey:
<http://www.arbejdsmiljoforskning.dk/en/projekter/skiftarbejde-og-helbred>

4.27.1 Aim

The aim of this project is to strengthen the basis of the organization of shift work by investigating the impact of shift work on health. The project consists of three sub-projects that examine: 1) Shift work and sickness absence, 2) shift work and mental health and 3) night work and fetal death and pregnancy complications.

4.27.2 Method

The three subprojects are designed as prospective epidemiological studies using a study population of approximately 80,000 regional hospital employees, primarily health professionals. Shift work is measured by administrative data on working hours from the Danish Working Hour Database (DWHD). We operationalize shift work into three dimensions: 1) Working hours that disrupts circadian rhythm, particularly night

work, 2) socially disrupting working hours, i.e. evening and weekend work and 3) working hours that compromise restitution, e.g. short time between two shifts. Outcomes are measured as: 1) sickness absence, by information from DWHD, 2) mental health problems, by linking DWHD to the Register of Medical Products Statistics, which contains information on purchases of antidepressants, and to the Danish Psychiatric Central Research Register and 3) fetal death and pregnancy complications, by linking DWHD to the National Hospital Discharge Register and the Danish Medical Birth Register.

4.27.3 Status of the project

Data from DWHD is currently being prepared for analyses of shift work. The protocol for the first paper is in draft.

5. Abstracts reflecting presentations at the workshop – databases

5.1 Swedish Longitudinal Occupational Survey of Health (SLOSH)

- *Institute and country:*
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Workshop attendees representing SLOSH: Philip Tucker,
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- *Weblink:*
<http://www.stressforskning.su.se/english/slosh>

5.1.1 *Objective*

SLOSH study is a nationally representative longitudinal cohort survey with a focus on the association between work organization, work environment and health.

5.1.2 *Years of edition*

Since the start in 2006 follow-ups were conducted every second year (to date, 2008, 2010 and 2012). Continued follow-ups are planned for every other year for many years to come. Linked register data on participants are available from 1987 to 2012, while register data on work places are available from 1986–2007. Up-dates of registry data are planned for 2014 and beyond.

5.1.3 Population

All labour market sectors and occupations are represented, and the number of men and women is approximately equal.

5.1.4 Method

The SLOSH sample consists of all respondents to the Swedish Work Environment Surveys (SWES) 2003 (n=9,212) and 2005 (n=9,703), forming the main representative cohort of 18,915 individuals, plus those participants from the 2007 SWES living in Stockholm or Gothenburg areas (n=2,572). Thus, at present SLOSH contains information on 21,489 respondents. Since the start in 2006 follow-ups were conducted every second year (to date, 2008, 2010 and 2012). The participants are followed by means of a postal questionnaire of which there are two versions: one for those currently in gainful employment and one for those currently not in gainful employment. This means that participants are followed also after they have temporarily or permanently left work. The proportion of currently employed participants in the sample varies from 86% in 2006 to 74% in 2012 and response rates vary between 65% and 57%. In addition to questionnaire data, the database is linked to national registers, both prospectively and retrospectively for all respondents.

5.1.5 Topics and variables considered

SLOSH includes variables on work hours (detailed) and other aspects of work (e.g. type of work, psychosocial and physical work environment, work-time control, interference between work and private life, job satisfaction, and intention to leave), health (e.g. self-rated health, diagnosed diseases, physical functioning, sleep, depression and sickness absence), social factors outside work (e.g. family structure, housing, education and subjective social status), and health behaviours (e.g. smoking and exercise). The non-worker version substitutes the work section with questions about the respondents' current life situation (retired, unemployed, studying etc.) and related experiences, but is otherwise identical to the workers' questionnaire. Register data is available for objective health measures (i.e. hospitalization, sickness absence, purchases of prescribed drugs, cancer, cardiac disease and death), as well factors such as education, employment and income. Registry data on work places contains information on e.g. size of work place, change in number of employees between years, and proportion of employees with a certain educational levels.

5.1.6 Studies using the database

- A prospective study of the association between shiftwork & prescription drug use (Tucker).
- Light intake in relation to sleep problems, season and health (Lowden).

5.2 Work-Lipids-Fibrogen (WOLF)

- *Institute and country:*
Stress Research Institute, Stockholm University, Sweden (in collaboration with the former Working Environment Institute, the Institute of Environmental Health at Karolinska Institute and the Institute of Social Medicine in Sundbyberg).
- *Coordinators/contacts:*
Principal Investigators: Peter Westerholm, Work and Health, National Institute for Working Life; Lars Alfredsson, IMM – Institute of Environmental Medicine, Karolinska Institute; Anders Knutsson, IHV – Department of health sciences, Mid Sweden University; Göran Fahlén, IHV – Department of health sciences, Mid Sweden University; Hans Goine, IHV – Department of health sciences, Mid Sweden University; Maria Nordin, Occupational and Environmental Medicine, Department of Public Health and Clinical Medicine, Umeå University; Bernt Karlsson, Occupational and Environmental Medicine, Department of Public Health and Clinical Medicine, Umeå University; Eleonor Fransson, IMM – Institute of Environmental Medicine, Karolinska Institute; Töres Theorell, Stress Research Institute, Stockholm University; Hugo Westerlund, Stress Research Institute, Stockholm University; Torbjörn Åkerstedt, Stress Research Institute, Stockholm University.
- *Workshop attendees representing WOLF:*
 - Philip Tucker, philip.tucker@su.se
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- Weblink: www.wolfstudy.se

5.2.1 Objective

To investigate working life and lifestyle effects on health – especially in blood, fat, and fibrinogen.

5.2.2 Years of edition

There are three datasets in WOLF, each comprising data from self-completed and physical examinations. WOLF-Norrland was conducted between 1996 and 1998 (N=4,802); WOLF-Stockholm was conducted between 1992 and 1995 (N=5,720); WOLF-F & WOLF-AO were two 5-year follow ups of WOLF-Norrland, conducted between 2000 and 2003

(N=4,236). An additional follow up questionnaire survey for all participants was conducted in 2009 (N=6,700).

5.2.3 Population

Servicework sector and industrial sector employees.

5.2.4 Method according to data collection

WOLF is a longitudinal epidemiological study. The original sample is 10,522 (WOLF-Stockholm, N=5,720; WOLF-Norrland, N=4,802) with 4,236 participating in the follow up WOLF-F. The sample comprises employees of selected companies, recruited through occupational health centers. Participants completed detailed questionnaires and were subject to medical examinations conducted by occupational health professionals. Linked register data is also available.

5.2.5 Topics and variables considered

The WOLF questionnaire included questions about the living conditions and physical and psychosocial work environment. It covered a wide range and raised areas such as noise and air pollution at work, the presence of heavy lifting at work, stress and relationships with managers and colleagues, and matters of exercise, smoking, diet, sleep, health and disease. Medical examination data includes blood pressure, BMI and analyses of blood samples (total cholesterol, high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol and fibrinogen).

5.3 Register study of Working hour, Health and Sickness absence (RWHS)

- *Institute and country:*
RWHS is established in Norway in collaboration between the University of Bergen (Faculty of Psychology and Faculty of Medicine and Dentistry) and Haukeland University Hospital, (HMS department).
- *Coordinators/contacts:*
The steering committee is composed of the following researcher who initiated and established the database:
 - Postdoc Anette Harris, Research Centre for Health Promotion, Faculty of Psychology, UiB. anette.harris@uib.no
 - Professor Ståle Pallesen, Department of Psychosocial Science, Faculty of Psychology, UiB. Staale.Pallesen@psysp.uib.no
 - Director of Human Resources, Trond Søreide, HMS department, Haukeland University Hospital. trond.soreide@helse-bergen.no
 - Adviser, Phd, Erling Svensen, HMS department, Haukeland University Hospital. erling.svensen@helse-bergen.no

5.3.1 *Objective*

The overall objective of the database is to generate more knowledge and to increase our understanding of the negative health effects of shift work and to identify personality variables that might be related to shift work tolerance. More specific we wants to gain knowledge about what kind of work schedule that works best for the individual.

In practice this is carried by using a short questionnaire on background variables and personality factors that might be related to shift work tolerance and ask for permission to connect these data with accurate working hours, sickness absence and use of psychopharmacological drugs over the last five years.

5.3.2 *Years of edition*

The cohort includes accurate registration of working hours, sick leave and use of medication in the period 2008 to 2013 and questionnaire data from 2013.

5.3.3 Population

All health care workers (nurses, nurse assistants, radiographers, bioengineers, physiotherapists, occupational therapists, midwife etc) currently working at Haukeland University Hospital.

5.3.4 Method

Procedure: Together with the invitation to participate, the health care workers are informed that data related to their shift work history and sick leave over the last five years will be allocated for the researchers and linked to their questionnaire data. The health personnel will also be asked to give their permission to link these data with data from the national prescription registry.

The RWHS database contains of:

- Register data from 2008–2013:
 - Precise information on individual work schedules (timing for coming and leaving work every day). Data from the organisations payroll register.
 - Precise information on individual sickness absence, short term and long term. Data from the organisations payroll register.
 - Precise information on individual use of psychopharmacological. Data from the Norwegian Prescription database.
 - Information about, job, department and first date of employment from the organisations register.
- Questionnaire data collected once, in 2013:
 - Demographic and backgrounds variables (gender, age, socioeconomic status, marital status, children living at home, years with shift work, participation regarding work schedules, and subjective feelings of recovery after work.
 - The Diurnal Scale.
 - The revised Circadian Type Inventory.
 - The mini IPIP.
 - Subjective Health Compliants.
 - Job satisfaction.

Sample size and expected response rate: About 5,000 health personnel of the aforementioned categories will be invited to participate. With an expected response rate of 50 per cent, the yielded sample will amount to 2,500 subjects.

5.3.5 Study using the database

One PhD based on RWHS data is ongoing:

1) Night work and quick returns as predictors of sick leave and medication use in health personnel. A PhD project (Øystein Vedaa) funded by the Faculty of Psychology, UiB.

5.4 Working Hours in the Public Sector (WHPS)

- *Institute and country:*
Finnish Institute of Occupational Health, Finland
- *Coordinators/contacts:*
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Finnish Public Sector study (FPS):
Prof. Jussi Vahtera (FIOH and Turku University) and Prof. Mika Kivimäki (FIOH and University College London).
- *Weblink:*
http://www.ttl.fi/fi/tutkimus/hankkeet/tyoaikojen_kehittaminen_kunta_alalla/sivut/default.aspx

5.4.1 Objective

To study the working hours of the public sector and their association with work, health and wellbeing

5.4.2 Years of edition

Objective daily working hour data (used for payroll) from 2008 forwards will be added to the Finnish Public Sector study (FPS). The database on working hours will be updated bi-annually among the organizations willing to participate.

5.4.3 Population

The database is linked to the organizations belonging to the Finnish Public Sector (FPS) study. The population covers local government employees of 10 towns and employees in 21 public hospitals that provide municipal services and public specialized health care in the provinces of Southern, Western, and Northern Finland. The main data sources of FPS consist of employers' records and several national registers (n=over 150,000), and survey data every 2–4 years (n=about 50,000). The longi-

tudinal study was initiated in 1990s and is today the largest occupational cohort study in Finland and one of the largest in Europe.

5.4.4 Method

The register data on working hours will be collected bi-annually together with the register and survey data.

5.4.5 Topics and variables considered

The database includes the exact timing of objective daily working hours (used for payroll) and absences from work from 2008–2012 (to be updated biannually). The specific topics of the epidemiologic research on the association of working hours with health and wellbeing will be formulated later. For epidemiologic research, the following working hour variables have been considered:

Main dimension	Subdimension
1. Length of working hours	1.1 Average working hours between two free days (h) 1.2. % of long (>48 hours) working hours between two free days 1.3. Average weekly working hours (h) 1.4. % of long (>48 hours) working weeks 1.5. Average length of work shift (h) 1.6. % of long (≥ 12 hours) work shifts 1.7. Average length of night shift ¹ (h) 1.8. % of long (≥ 12 hours) night shifts
2. Consecutive working days	2.1. Average of consecutive working days 2.2. % of long spells (>6) of daily shifts 2.3. Average no of consecutive night shifts 2.4. % of long spells (>4) of consecutive night shifts
3. Shift work	3.1. % of early morning shifts ² 3.2. % of evening shifts ³ 3.3. % of night shifts 3.4. % of morning ⁴ and night shift combinations (on same day) 3.5. % of morning and evening double shifts (on the same day) 3.6. % of non-day (morning or day ⁵) shifts
4. Recovery between shifts	4.1. Average time between shifts (h) (in cases with time between shifts < 48 hours) ⁶ 4.2. % of short shift intervals (≤ 11 hours) 4.3. Average length of recovery after the last night shift (hours) 4.4. % of short recovery periods (< 28 hours) after the last night shift
5. Social aspects of working hours	5.1. % of annual leave days/annual contract days 5.2. % of week-ends with work ⁷ 5.3. % of single free-days /all free days

Main dimension	Subdimension
6. Variability of working hours	6.1. MAD of shift starting times (h) 6.2. MAD of shift ending times (h) 6.3. MAD of shift length (h)
7. Predictability of working hours	7.1. Realization % of planned shifts
8. Worktime control	8.1. The use of shift wishes (%) 8.2. % of realized shift wishes/ working days 8.3. % of realized shift wishes /planned wishes

¹ night shift: ≥ 3 hours between 23–06, does not start before 18.

² early morning shift: starts before 06:00.

³ evening shift: starts at 12:00 or later and ends after 18:00.

⁴ morning shift: starts between 06:00–07:00.

⁵ day shift: starts after 07:00 and ends no later than 18:00.

⁶ shift intervals ≥ 48 hours excluded.

⁷ work shift during Saturday, Sunday or both.

5.4.6 Studies using the database

- Working Hours in the Public Sector.
- Project Finnish Public Sector study.

5.4.7 Perspectives

The project will create a new prospective dataset to study the associations, as well as natural and experimental interventions on working hours in relation to different health outcomes (e.g. sleep, subjective health, sickness absence, morbidity, use of medication, accidents, participation into working life, disability pensions etc.).

5.5 Petroleum survey of shift work, sleep and health (PUSSH)

- *Institute and country:*
National institute of occupational health, Oslo, Norway, Department of global public health and primary care, University of Bergen, Bergen, Norway, and Department of psychosocial science, University of Bergen, Bergen, Norway.
- *Coordinators/contacts:*
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PhD student Mona Berthelsen (Mona.Berthelsen@stami.no), National institute of occupational health, Oslo, Norway.
Professor Bjørn Bjorvatn (Bjorn.Bjorvatn@isf.uib.no), Department of global public health and primary care, University of Bergen, Bergen, Norway.
- *Weblink:*
<https://www.pussh.org/>
<http://www.stami.no/forskning-fra-avdeling-for-arbeidspsykologi-og-fysiologi?lcid=1033&proid=63750&subavd=0&selected=1>

5.5.1 Objective

Primary objectives of PUSH is to establish a database with prospective data on working hours, psychological and social work factors, sleep, safety and health. Second, we will link collected data to registry data on sickness absence, intervention measures, compensation, disability and retirement/pensions. Third, we have the opportunity to obtain saliva, and blood samples from a sub-group of the respondents.

5.5.2 Years of edition

The PUSH database is updated continuously until completed data collection.

5.5.3 Population

The database contains information on employees in the Norwegian Petroleum sector, both onshore and offshore workers employed in operator and contractors companies.

5.5.4 Method according to data collection

The study is designed as a full prospective panel design. Baseline and follow-up surveys were conducted with one-year time lag. Data were gathered using both a web-based questionnaire and a paper and pencil questionnaire. A total of 1,700 workers (out of 3,107 invited) have participated at baseline and currently approximately 670 workers have participated at follow-up.

5.5.5 Topics and variables considered

The questionnaire covers the following topics regarding working hours and key variables: detailed variables on working hours, background information, sleep disturbances, use of sleep related medications, work organization, psychological and social factors at work, mechanical and chemical exposures, safety and risk perception, accidents, recovery after work, reproduction, personality, physical activity, alcohol use, smoking, shift work locus of control, work ability, mental health, and health complaints.

5.5.6 Studies using the database

“Working hours, health, and safety – a longitudinal prospective study among nurses and offshore and onshore petroleum workers in Norway – Psychological and social factors at work as risk factors for poor mental health in workers.”

5.6 SURvey of Shift work, Sleep and Health (SUSSH)

- *Institute and country:*
SUSSH is established in Norway in collaboration between the Faculty of Psychology and Faculty of medicine and Dentistry at the University of Bergen (UoB.)
- *Coordinators/contacts:*
The steering committee is composed to the following researcher who initiated and established the database:
 - Professor Ståle Pallesen, Faculty of Psychology, UoB Norwegian Competence Center for Sleep Disorders, Haukeland University Hospital. Staale.Pallesen@psysp.uib.no
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 - Nils Magerøy, PhD, 3Outpatient Clinic for Work Related Traumas and Psychosocial Stress, Haukeland University Hospital. Nils.Mageroy@uni.no

5.6.1 *Objective*

This project should contribute with new knowledge and understanding of the effects of shift work on sleep, diurnal rhythms and health among Norwegian nurses. Secondary aim is to explore the hypothesis that there is a relationship between clock genes and individual shift work tolerance.

5.6.2 *Years of edition*

A cohort study including a total of 2,964 nurses was established in 2008. The plan is to collect data annually for at least 10 years. Data collection from wave 5 (2013) is nearly finished (2013). The response rates for waves 2–4 varied between 75% and 80% (of those who participated at wave 1).

5.6.3 *Population*

Nurses, members of the Norwegian nurses organisation in 2008, updated yearly.

5.6.4 Method

The respondents have agreed to have their survey data linked with specific health registers, such as the FD Trygd (which is a database containing objective information about sickness absence) as well as with the birth registry. Data about sick leave have just been obtained from FD Trygd. The project has been approved by the Regional Committee for Medical Research Ethics, Western-Norway (no. 088.88), by the Norwegian Data Inspectorate (08/01235/IUR), and by the Norwegian Health Directorate. In the questionnaire waves that have been answered by the nurses so far all included questions about demography, work (schedule, percentage of full-time equivalent, leave of absence, type of work place, number of years with night shift work, total number of lifetime night shifts, number of night shifts last year) and sick leave (days and spells). Several of the waves also included questions about smoking, exercise, caffeine consumption, quick returns, and work-related accidents causing harm to oneself, patients or equipment. In addition, several well-validated questionnaires addressing different topics have been included: Hospital Anxiety and Depression Scale (comprising 14 questions pertaining to non-vegetative symptoms of anxiety and depression),¹ the SF-12 Health Survey (assessing quality of life),² Job Satisfaction Index (5 items assessing satisfaction with current job),³ the Bergen Insomnia Scale (6 items assessing insomnia symptoms),⁴ the Bergen Shift Work Sleep Questionnaire (23 items assessing sleep and sleepiness problems related to different shift as well as free time),⁵ Epworth Sleepiness Scale (8 items assessing daytime sleepiness),⁶ the Fatigue Questionnaire (13 items measuring somatic and mental fatigue),⁷ the revised Circadian Type Questionnaire (11 items measuring flexibility and languidity),⁸ The Diurnal Scale (7 items reflecting the morningness-eveningness dimension),⁹ the Alcohol Use Disorders Identification Test-Consumption (3 items assessing alcohol consumption),¹⁰ the Turnover Intention Scale (3 items),¹¹ the Swedish Demand-Control-Support Questionnaire (17 items assessing psychological work demands, decision latitude and social support)¹², the Work-Family Interface Scale (14 items measuring positive and negative work-family spillover)¹³, and the Negative Acts Questionnaire (10 items measuring exposure to workplace bullying)¹⁴. In addition, we have collected saliva samples from 756 nurses that have been analyzed for a set of clock genes.

5.6.5 Dissemination

Several articles have already been published from the project.^{5, 15–30} External researchers can apply for access to SUSSH data, which normally will be granted if the proposal does not overlap with already existing publications plans.

PhDs

Two PhDs based on SUSSH data have so far been published:

- Ingvild Saksvik-Lehouillier defended her thesis entitled “Shift work tolerance and adaptation to shift work among offshore workers and nurses” April 24, 2012.
- Elisabeth Flo defended her thesis entitled “Sleep and health in shift working nurses”, February 22, 2013.

Two PhDs based on SUSSH data are ongoing:

- Eirunn Thun is working on a thesis entitled: “Shift work: negative consequences and protective factors”
- Iselin Reknes is working on a thesis entitled: “Health outcomes of exposure to workplace bullying; The moderating effects of personality and individual coping style.”

One Postdoc based on SUSSH data is ongoing:

- Siri Waage: A longitudinal study on shift work, sleep and health among Norwegian nurses

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- Øyane NMF, Pallesen S, Moen BE, Åkerstedt T, Bjorvatn B. Associations between night work and anxiety, depression, insomnia, sleepiness and fatigue in a sample of Norwegian nurses. *PLOS ONE* 2013;8:e70228. .
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5.7 Danish Working Hour Datase (DWHD)

- *Institute and country:*
DWHD is established in Denmark in collaboration between The National Research Centre for the Working Environment, The Danish Cancer Society, Aarhus University Hospital, and Copenhagen University.
- *Coordinators/contacts:*
The steering committee is composed of the following researchers who initiated and established the Danish Working Hour Database (DWHD):
 - Senior Researcher Anne Helene Garde, National Research Centre for the Working Environment, ahg@nrcwe.dk
 - Senior Researcher Johnni Hansen, The Danish Cancer Society, johnni@cancer.dk
 - Professor Dr. Henrik Kolstad, Department of Occupational Medicine, Danish Ramazzini Centre, Aarhus University Hospital, henkol@rm.dk
 - Professor Åse Marie Hansen, Dept. of Public Health, Copenhagen Stress Research Centre, Copenhagen University asemarie.hansen@sund.ku.dk
- *Weblink:*
www.nrcwe.dk/dwhd

5.7.1 Objective

The overall the objective of the DWHD is to establish a national prospective database of valid and accurate registrations of individual working hours. A secondary aim is to provide an opportunity to investigate possible associations between working, well-being and health, etc.

In practice this is carried out through the establishment and operation of a database based on existing registrations of public employees in all five Danish regions.

5.7.2 Years of edition

DWHD is updated annually since 2007.

5.7.3 Population

In total DWHD contains information on regional employees, mainly in the health care sector including all Danish public hospitals.

Method: The research database Danish Working Hour Database (DWHD) contains:

- Precise information on individual timing for coming and leaving work every day for all employees in the five Danish regions in the period from 2007 to 2012. Original data is provided for the purpose of payment of individual wages.
- There is information for each individual regarding: job, department, first date of employment, as well as daily information about absences from work each day during their employment for example: own sick leave, child sick etc.

DWHD includes approx. 250.000 unique individuals in total, approx. 150,000 unique individuals pr. year. Response rate is close to 100%.

5.7.4 Topics and variables considered

DWHD includes variables on working hour (detailed), sickness absence, job, department, first date of employment, age, gender, and has the possibility for coupling with national registers on disease.

5.7.5 Studies using the database

The following projects are using data from DWHD:

- Shift work and health: a research project that examines the importance of shift work on health, including: sick leave, mental health and abortion. <http://www.arbejdsmiljoforskning.dk/en/projekter/skiftarbejde-og-helbred>
- LUX@R: a research project on light exposure at night – and outdoor work and potential impacts on health. www.luxar.dk

5.7.6 Perspectives

Research groups who want to use data from the Danish Working Hour Database (DWHD) may apply to the steering committee.

5.8 Danish Work Environment Cohort Study (DWECS)

- *Institute and country:*
National Research Centre for the Working Environment, Denmark.
- *Coordinators/contacts:*
Elsa Bach, Director of Research Coordination
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- Weblink to information about the cohort/database:
<http://www.arbejdsmiljoforskning.dk/da/arbejdsmiljoedata/nak2005>

5.8.1 *Objective*

The objectives of DWECS are:

- Surveillance of the working population, monitoring:
 - prevalence of occupational risk factors
 - prevalence and incidence of health symptoms
 - lifestyle and habits

To estimate changes of health and labor market status as possible consequences of occupational risk factors.

5.8.2 *Years of edition*

DWECS was carried out every five years from 1990 to 2010.

5.8.3 *Population*

The cohort is representative for the Danish working population aged 18–59 years. The population size vary from 8,583 (1995) to 14,453 (2010) respondents.

5.8.4 *Method according to data collection*

Participants were randomly drawn from Danish residents aged 18–59 years in 1990, and at each following wave the population is supplement-

ed with age and migration panels to ensure representativity of the Danish working population. In 2005 the cohort was further supplemented by an additional representative sample of the working population.

From 1990–2000 data was collected by telephone interviews, in 2005 data was collected using either telephone interviews (10%) or postal or web-based questionnaires (90%) and in 2010 all data was collected using postal or web-based questionnaires. The questionnaires consist of 55–62 questions. Response rates vary from 53% (2010) to 90% (1995).

Topics and variables considered:

- Background of the respondents in terms of sex, age, labour market status, job and sector.
- Working time, work organisation, workloads, work pace and health promotion at the workplace.
- Physical work environment such as; noise, vibrations, wet work, security and accidents, physical demands, work postures, chemical and thermal risk exposure etc.
- Psychosocial work environment such as; emotional demands, skill discretion, decision latitude, bullying, violence, support from employer and colleagues, work-life balance etc.
- Lifestyle and habits, health and disease symptoms including self-rated health and doctors' diagnoses, if any, work ability, sickness absence and planned time of retirement.

Examples of questions regarding working hours are:

- How many hours do you usually work every day in your main job?
- Work organisation: What time of the day do you usually work in your main job?
- Flexible working hours: Is it possible for you to organize your own working hours one day in advance?
- Work-life-balance: Is it commonly accepted that you make private phone calls to your children during working hours?

5.8.5 Perspectives

DWECS could contribute with unique possibilities of future research on working hours based on individual repetitive prospective data on working hours in a large study sample.

5.9 Working Environment and Health in Denmark 2012–2020 (WEHD)

- *Institute and country:*
National Research Centre for the Working Environment, Denmark.
- *Coordinators/contacts:*
Elsa Bach, Director of Research Coordination
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Email: eba@NRCWE.dk
- *Weblink to information about the cohort/database:*
<http://www.arbejdsmiljoforskning.dk/da/arbejdsmiljoedata/arbejdsmiljoe-og-helbred-20/arbejdsmiljo-og-helbred-2012>

5.9.1 Objective

The objectives of WEHD are:

- Surveillance of the working population, monitoring:
 - prevalence of occupational risk factors
 - prevalence and incidence of health symptoms
 - lifestyle and habits
- To estimate changes of health and labor market status as possible consequences of occupational risk factors.
 - Years of edition: WEHD is carried out every second year from 2012 to 2020. It is a continuation of the Danish Work Environment Cohort Study (DWECS), but in contrast to DWECS, WEHD consists of new samples at each wave.

5.9.2 Population

The cohort is representative for the Danish working population aged 18–64 years.

5.9.3 Method according to data collection

The sample consists of two sub-samples: 35,000 persons were randomly selected among all employees aged 18–64 years in Denmark, while addi-

tional 15,000 were selected to represent 1,000 selected workplaces. The response rate for the randomly selected sample is 50%. A new sample will be drawn every second year.

The respondents in both samples received a postal invitation to the survey including a link to a web-based questionnaire.

5.9.4 Topics and variables considered

- Background of the respondents in terms of sex, age, labour market status, job and sector.
- Working time, work planning and organisation, work engagement, workloads, work pace and health promotion at the workplace.
- Physical work environment such as: noise, vibrations, wet work, security and accidents, physical demands, work postures, chemical and thermal risk exposures, etc.
- Psychosocial work environment such as: emotional demands, skill discretion, decision authority, bullying, violence, support from employer and colleagues, work-life balance, etc.
- Lifestyle and habits such as alcohol consumption and physical activity level, health and disease symptoms including pain, self-rated health and doctors' diagnoses, if any, work ability, sickness absence and planned time of retirement.

Examples of questions regarding working hours are:

- How many hours do you usually work on a normal week including overtime work?
- Work organisation: What time of the day do you usually work in your main job?
- Work-life-balance: Are you available for work outside normal working hours?

5.9.5 Perspectives

WEHD provides the possibilities to investigate potential associations between organisation of working hours and various health outcomes, cross-sectional as well as prospective by linking to national registers.

6. Previous studies – list of publications from 2008–2013

Below is a list of peer-reviewed scientific publications from the participants of the workshop. Publications are listed once under the institution of the first author, who is a member of the project.

6.1 Publications from University of Bergen, Norway

Bjorvatn, B., Dale, S., Hogstad-Erikstein, R., Fiske, E., Pallesen, S., & Waage, S. (2012). Self-reported sleep and health among Norwegian nurses in intensive care units. *Nursing in Critical Care*, 17, 180–188.

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Flo, E., Bjorvatn, B., Folkard, S., Moen, B. E., Grønli, J., Nordhus, I. H., & Pallesen, S. (2012). A reliability and validity study of the Bergen Shift Work Questionnaire in nurses working three-shift rotations. *Chronobiology International*, 27, 937–946.

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Flo E, Magerøy N, Moen BE, Pallesen S, Bjorvatn B. Skiftarbeid gir søvnproblemer. *Sykepleien* 2013; 3: 68–69.

Fossum IN, Bjorvatn B, Waage S, Pallesen S. Effects of shift and night work in the offshore petroleum industry: a systematic review. *Ind Health*. 2013 Nov 6; 51(5):530–44.

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- Kunst, J. R., Løset, G. K., Hosøy, D., Bjorvatn, B., Moen, B. E., Magerøy, N., Pallesen, S. (in press). The relationship between shift work schedules and spillover in a sample of nurses. *International Journal of Occupational Safety and Ergonomics*.
- Natvik, S., Bjorvatn, B., Magerøy, N., Sivertsen, B., & Pallesen, S. (2011). Personality factors related to shift work tolerance in two-and three-shift workers. *Applied Ergonomics*, 42, 719–724.
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- Roelen CAM, Magerøy N, van Rhenen W, Groothoff JW, van der Klink JJJ, Pallesen S, Bjorvatn B, Moen BE. Low job satisfaction does not identify nurses at risk of future sickness absence: results from a Norwegian cohort study. *International Journal of Nursing Studies* 2013; 50:366–373. PMID: 23044050.
- Roelen CAM, Bültmann U, Groothoff JW, van Rhenen W, Magerøy N, Moen BE, Pallesen S, Bjorvatn B. Physical and mental fatigue as predictors of sickness absence among Norwegian nurses. *RINAH* 2013; 36: 453–465. PMID:23970440.
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- Saksvik-Lehouillier, B., Bjorvatn, B., Hetland, H., Sandal, G. M., Moen, B. E., Magerøy, N., & Pallesen, S. (2013). Individual, situational and lifestyle factors related to shift work tolerance among nurses that are new to and experienced in night work. *Journal of Advanced Nursing*, 69, 1136–1146.
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- Saksvik, I. B., Bjorvatn, B., Harvey, A. G., Waage, S., Harris, A., & Pallesen, S. (2011). Adaption and readaption to different shift work schedules measured with sleep diary and actigraphy. *Journal of Occupational Health Psychology*, 16, 331–344.
- Saksvik, I. B., Bjorvatn, B., Hetland, H., Sandal, G. M., & Pallesen, S. (2011). Individual differences in tolerance to shift work. A systematic review. *Sleep Medicine Reviews*, 15, 221–235.
- Schreuder, J. A. H., Roelen, C. A. M., Groothoff, J. W., van der Klink, J. J. L., Magerøy, N., Pallesen, S., Bjorvatn, B., & Moen, B. E. (2012). Coping styles relate to health and work environment of Norwegian and Dutch hospital nurses: A comparative study. *Nursing Outlook*, 60, 37–43.
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- Vedaa, Ø., Bjorvatn, B., Magerøy, N., Thun, E., & Pallesen, S. (in press). Longitudinal predictors of changes in the morningness-eveningness personality among Norwegian nurses. *Personality and Individual Differences*.
- Waage, S., Harris, A., Pallesen, S., Saksvik, I. B., Moen, B. E., & Bjorvatn, B. (2012). Subjective and objective sleepiness among oil rig workers during three different shift schedules. *Sleep Medicine*, 13, 64–72.

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- Waage, S., Pallesen, S., Moen, B. E., & Bjorvatn, B. (2013). Sleep and health in oil rig workers – before and after two week work period offshore. *Industrial Health*, 51, 172–179.
- Waage S, Odeen M, Bjorvatn B, Eriksen HR, Ursin H, Hollund BE, Moen BE. Still healthy after extended work hours? Ten hours shift, twenty-one days working period for tunnel workers. *Ind Health*. 2010;48(6):804–10.
- Warpe H, Bjorvatn B, Waage S, Hovlid E, Pallesen S. Vet lite om helsefarene ved turnusarbeid. *Sykepleien* 2013; 11: 54–57.
- Øyane N, Pallesen S, Moen BE, Åkerstedt T, Bjorvatn B. Associations between night work and anxiety, depression, insomnia, sleepiness and fatigue in a sample of Norwegian nurses. *PLoS One* 2013; 8: e70228. PMID:23950914.

6.2 Publications from Finnish Institute of Occupational Health, Finland

- Puttonen, S., Kivimäki, M., Elovainio, M., Pulkki-Råback, K., Hintsanen, M., Vahtera, J., Telama, R., Juonala, M., Viikari, J.S., Raitakari, O.T., Keltikangas-Järvinen, L. (2009). Shift work in young adults and carotid artery intima-media thickness. The Cardiovascular Risk in Young Finns study. *Atherosclerosis*, 205, 608–613.
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- Hirvonen, K., Puttonen, S., Gould, K., Korpela, J., Koefoed, V. F., & Müller K. (2010) Improving the saccade peak velocity measurement for detecting fatigue. *Journal of Neuroscience Methods*, 187, 199–206.
- Puttonen, S., Oksanen, T., Vahtera, J., Pentti, J., Virtanen, M., Salo, P., & Kivimäki, M. (2010). Is shift work a risk factor for rheumatoid arthritis? The Finnish Public Sector study. *Annals of Rheumatic Disease*, 69, 679–680.
- Puttonen, S., Viitasalo, K., Härmä, M. (2011). Effect of shift work on systemic markers of inflammation. *Chronobiology International*, 28, 528–535.
- Viitasalo, K., Lindström, J., Hemiö, K., Puttonen, S., Koho, A., Härmä, M., Peltonen M. (2012) Occupational Health Care identifies risk for type 2 diabetes and cardiovascular disease. *Primary Care Diabetes* 6:95–102.
- Jukka S. Alasaari J.S., Lagus, M., Toivola, A., Ollila, H., Kivimäki, M., Vahtera, J. Härmä M., Puttonen S., J., Paunio, T. (2012) Environmental Stress Affects DNA Methylation of a CpG rich promoter region of Serotonin Transporter Gene in a Nurse Cohort. *PlosOne*, 7(9):e45813.
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8. Sammenfatning

Workshoppen "Coordination of research on working hours and health in the Nordic countries" blev afholdt på det Nationale Forskningscenter for Arbejdsmiljø i Danmark d. 24. og 25. oktober 2013. Det overordnede formål med projektet er at etablere en platform for samarbejde og udvikling af forskningsprojekter af høj kvalitet omhandlende arbejdstid og helbred i de nordiske lande. Projektet er finansieret af Nordisk Ministerråd, og de vigtigste resultater fra dette års projekt er, at:

- Igangværende forskningsprojekter omhandlende arbejdstid i de nordiske lande er blevet beskrevet i 27 abstracts, hvoraf de fleste blev præsenteret på workshoppen.
- Eksisterende kohorter omhandlende arbejdstid i de nordiske lande er blevet beskrevet i 9 abstracts.
- Der er identificeret fælles nøglevariabler for arbejdstid i eksisterende kohorter i de nordiske lande, hvilket er dokumenteret i to tabeller. Den ene tabel viser en oversigt over variabler i større kohorter, mens den anden viser en oversigt over studier med mindre studiepopulationer og mere detaljeret information.
- Mulighederne for fremtidigt samarbejde og udarbejdelse af fælles projektansøgninger på tværs af de nordiske lande blev diskuteret. Således blev mulighederne for pooling af nordiske kohorter også gennemgået.

Det netværk, der blev etableret i forbindelse med workshopen 'Coordination of research on working hours and health in the Nordic countries' fortsætter som 'Working hours In the Nordic Countries' (WINC). Formålet med WINC er at fremme og gennemføre forskning af høj kvalitet inden for feltet arbejdstid og helbredsrelaterede udfald i de nordiske lande. Følgende aktiviteter er planlagt i regi af WINC:

- Et NIVA-kursus om arbejdstid og helbred afholdes i maj 2014. Kursusansvarlige er Mikko Härmä fra Finnish Institute of Occupational Health. Medlemmer af WINC deltager som undervisere.
- Konferencen "The 22nd International Symposium on Shiftwork and Working Time" bliver afholdt i Danmark i 2015. Den videnskabelige kommitte består bl.a. af repræsentanter fra WINC.



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Co-ordination of research on working hours and health in the Nordic countries

This report presents a summary of a workshop entitled “Co-ordination of research on working hours and health in the Nordic countries.” The workshop was held at the National Research Centre for the Working Environment in Denmark on the 24th–25th October. The overall purpose of the project was to provide a platform for cooperation and development of high-quality research projects on working hours and health in the Nordic countries. The project was supported by the Nordic Council of Ministers.

The report includes a summary of the main outcomes of the project and a description of previous and ongoing studies as well as existing cohorts on working hours from participating institutions in the Nordic countries.

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