Effects of shift work and psychological and social work factors on mental distress

Studies of onshore/offshore workers and nurses in Norway

Mona Berthelsen

Thesis for the degree of philosophiae doctor (PhD)
at the University of Bergen

2017

Date of defence: 10.02.2017

SCIENTIFIC ENVIRONMENT

I have been employed as a PhD student at the research group for Organizational and Psychosocial Work Environment, Department of Work Psychology and -Physiology, National Institute of Occupational Health. I was affiliated with the Graduate school of Clinical and Developmental Psychology, at Department of Psychosocial Science, Faculty of Psychology, University of Bergen.

My supervisor has been Stein Knardahl MD, PhD, Head of Department, Professor, at the Department of Work Psychology and -Physiology, National Institute of Occupational Health. My co-supervisor has been Professor Ståle Pallesen at Department of Psychosocial Science, Faculty of Psychology, University of Bergen.

ACKNOWLEDGEMENTS

I would like to thank the Research Council of Norway and the National Institute of Occupational Health (STAMI) who funded the current research, providing me the opportunity and means to engage in work important to me. STAMI has been a truly enjoyable place to work.

My deepest gratitude goes to my supervisor Stein Knardahl. We have had many interesting discussions that have contributed to the current thesis. You have provided me the freedom to work independently as well as in collaboration with you. Your high standards, ambitiousness, and thoroughness have inspired me to work hard to reach my goals.

I also wish to thank my co-supervisor Ståle Pallesen, for always providing thorough feedback and helpful advice.

To every one of my co-authors, Bjørn Bjorvatn, Nils Magerøy, Bente Elisabeth Moen and Reidar Tyssen - thank you for providing valuable contributions to the current articles. Special thanks go to Nils Magerøy, Ståle Pallesen, Bjørn Bjorvatn and Bente Elisabeth Moen for inviting me to write an article on data from the Survey on Shift work, Sleep, and Health among nurses.

To all my wonderful colleagues at the research group for Organizational and Psychosocial Work Environment - you have provided an inclusive, inspiring, academic, social and supportive environment to be a part of. A special thanks goes to Jan Emberland whom I had the pleasure of sharing office space with during the work with the current thesis.

I also wish to thank Jan Olav Christensen for giving valuable feedback on the final part of this work, and to Alexander Frantz William Nissen for proofreading.

Thanks go to all the participating companies and employees who invested much time in completing the comprehensive questionnaires that formed the basis of the current studies.

Finally, I would like to thank my dear parents, Reidun and Bjørn, my brothers, Kjetil and Stian, Lisbeth, and all my fantastic friends for always believing in me, supporting me, and encouraging me in times of struggle.

ABSTRACT

Many services depend on having staff 24 hours a day, including petroleum onshore and offshore facilities, and the health care sector. Employees engaged in shift work are exposed to working hours outside the standard 8-16 working day. Working at evenings or nights, or rotating between different combinations of daytime, evening time, and nights may be challenging to the individual in terms of regulation of circadian rhythm, sleep deprivation or challenges to work-family balance, which in turn may affect the mental health of workers. Work is a central part of most peoples' lives. Thus, events occurring in relation to work may affect the mental health of workers in both positive and negative ways.

The overall aims of the current thesis were to elucidate the ways shift schedules in combination with psychological and social conditions at work may influence the mental health of workers. To gain such knowledge a range of different shift schedules employed in the petroleum industry and within the health-care sector were studied. Furthermore, emphasis was on how working conditions relate to mental health by studying working conditions as predictors of mental health and mental health as predictor of working conditions.

Participants were recruited from six companies operating in the Norwegian onshore- and offshore petroleum industry, and from members registered in the Norwegian Nurses Organization.

Study 1 analyzed 1471 employees operating at onshore and offshore facilities. Differences in mental distress between various shift schedules were elucidated by comparing offshore shift types with zero, seven or 14 consecutive nights. Permanent-daytime (14 days) was compared with permanent-night shift (14 days), and swing shift (7 nights / 7days) was compared with permanent-night shifts. Among onshore workers, permanent-day shift was compared with rotating-shift work (day, evening and night). No statistical significant differences in mental distress between workers in different shift schedules were demonstrated. Six psychological and social work exposures were studied. Differences in work exposures between the shift schedules were demonstrated. Onshore revolving-shift workers reported lower *job control* compared with onshore daytime workers. Offshore swing-shift workers reported lower *job control* compared to permanent-night and -day workers offshore. Permanent night-workers reported higher *job control*, *fair- and empowering leadership,* and *support from co-workers*

and superior compared to swing-shift workers. Associations between the six work factors and mental distress were analyzed separately for onshore and offshore workers, and with increasing level of adjustment. A specific hypothesis for study 1, was to elucidate whether the personality trait neuroticism influenced associations between work factors and mental distress. Onshore workers exhibited associations between job demands, job control, role conflict, and support and mental distress. Adjusted for neuroticism only role conflict reached statistical significance, whereas adjusted for all work factors only job control reached statistical significance. Among offshore workers all six work factors were associated with mental distress, also when adjusted for neuroticism. When adjusted for all work factors, role conflict and support were no longer statistically significant. In the fully adjusted model job demands, role clarity, and support reached statistical significance.

Study 2 elucidated prospective effects of shift work, and six psychological and social work factors on mental distress among nurses. Specific to this study were the elucidation of moderating effects between shift work, and work factors on mental distress, elucidation of cross-lagged effects between work exposures and mental distress, and analyzing symptoms of anxiety and depression as separate outcomes. A total of 1582 nurses responded both at baseline and follow-up, and were included in the study. This study analyzed effects of night work compared to non-night work, and rotating-shifts with permanent-shifts. No statistical significant effects of shift schedules on anxiety and depression were demonstrated. However, differences in work exposures between shift schedules were demonstrated. Nurses working nights reported higher levels of role clarity and job demands, and lower levels of decision authority compared to non-night workers. Nurses working rotating-shifts reported higher levels of job demands, role clarity, and skill discretion, and lower levels of role clarity and decision authority compared to permanent-shift nurses. No statistically significant moderation effects between night work and rotating-shift work, and work content on mental distress were demonstrated. Study 2 demonstrated distress-to-work effects, where baseline symptoms of anxiety and depression predicted follow-up reporting of role clarity, role conflict, fair leadership, and social support. Work-to-distress effects were also demonstrated between job demands and symptoms of depression.

Study 3 elucidated prospective effects of shift work, job type, psychological, social and physical work factors on mental distress among offshore workers. Both direct effects and interaction effects were examined. Unlike the two other studies, study 3 included job type,

and exposure to noise and cold as predictors of mental distress. Furthermore, effects of 12 specific psychological and social work factors on mental distress were elucidated. Study 3 also examined reverse effects, but not with cross-lagged models as in paper 2. A total of 531 offshore workers responded both at baseline and follow-up, and were included in the study. In this study swing-shift was compared to permanent-day time. No statistically significant effects of shift work, or job type on mental distress were detected. Furthermore, no statistically significant moderation effects between shift work, and work exposures, or job type and work exposures on mental distress were detected. However, work-to-distress and distress-to-work effects were demonstrated. Nine out of twelve psychological and social work factors, and exposure to noise and cold were associated with follow-up mental distress. Adjusted for baseline distress, only exposure to noise reached statistical significance. Adjusted for all work exposures, only quantitative demands reached statistical significance. Baseline mental distress was associated with 11 out of 12 follow-up psychological and social work exposures, and exposure to noise. Adjusted for baseline work factor only learning demands was predicted by baseline mental distress.

In conclusion, none of the shift schedules studied in the current thesis seems to affect the mental health of workers. However, this does not mean that such effects do not exist. The current thesis has pointed to several methodological challenges of studying mental health effects of shift work. Among these factors the healthy worker effect is central. Another possible explanation for the current findings may be that shift work may not be as important for mental health as hypothesized, at least not in Norway. Effects of shift work on mental distress seem not to be moderated by work content. However, this does not mean that such effects do not exist. The lack of moderating effects may be explained by methodological short comings such as restricted variance in exposures and outcome, or the healthy worker effect. Work content seems to affect the mental health of workers, and the mental health of workers seems to affect the perception of work content. However, the study of the reciprocal relationship between work content and mental health problems would benefit from employing longitudinal designs with different follow-up intervals in order to capture both short- and long term effects of work exposure. It seems reasonable that mental health problems may affect the perception of working conditions more promptly than exposure to adverse working conditions affect the mental health of workers.

LIST OF PAPERS

Paper 1:

Berthelsen M, Pallesen S, Bjorvatn B, Knardahl S. (2015) Shift schedules, work factors, and mental health among onshore and offshore workers in the Norwegian Petroleum Industry. *Industrial Health*, 53(3), 280–292, DOI: 10.2486/indhealth.2014-0186.

Paper 2:

Berthelsen, M., Pallesen, S., Magerøy, N., Tyssen, R., Bjorvatn, B., Moen, B.E., Knardahl, S. (2015) Effects of Psychological and Social Factors in Shiftwork on Symptoms of Anxiety and Depression in Nurses: A 1-Year Follow-Up. *Journal of Occupational and Environmental Medicine*, 57(10), 1127-1137, DOI: 10.1097/JOM.0000000000000532.

Paper 3:

Berthelsen M, Pallesen S, Bjorvatn B, Knardahl S. Effects of offshore swing-shift and psychological, social, and physical working conditions on mental distress – a prospective study. (Manuscript under revision).

LIST OF ABBREVIATIONS

ACTH – Adrenocorticotropic Hormone

ANS – Autonomic Nervous System

CFI – Comparative Fit Index

CRH – Corticotrophin-Releasing Hormone

DCSQ - The Swedish Demand-Control-Support Questionnaire

DIFFTEST – χ^2 Difference Test

DSM-V – Diagnostic and Statistical manual of Mental disorders. Fifth edition.

EPQ – Eysenck Personality Questionnaire

FIML – Full Information Maximum Likelihood

GAS – General Adaptation Syndrome

GZLM – Generalized Linear Models

HADS – Hospital Anxiety and Depression Scale

HPA – Hypothalamic-Pituitary-Adrenocortical system

ICD-10 – International Classification of Diseases. 10^{th} edition.

MANOVA – Multivariate Analysis of Variance

MAR – Missing At Random

MCMC – Marcov Chain Monte Carlo

MI – Multiple Imputation

MLR – Maximum Likelihood Estimator

NREM – Non-Rapid Eye Movements

PUSSH – Petroleum Survey of Shift work, Sleep and Health

QPS_{Nordic} – General Nordic Questionnaire for Psychological and Social Factors at Work

REM – Rapid Eye Movements

RMSEA – Root Mean Square of Approximation

SCN – Suprachiasmatic Nucleus

STYRK – Standard Classification of Occupations

SUSSH – Survey of Shift work, Sleep and Health among nurses

SWSD – Shift Work Sleep Disorder

TLI - Tucker-Lewis Index

VLPO – Ventrolateral Preoptic area

WLSMV – Weighted Least-Squares Estimator

CONTENTS

1. INTRODUCTION

1.1 Scope of the thesis

Since the industrial revolution and the invention of electric light, people have worked after dark. Shift-systems for working around-the-clock were developed to secure continuous production in several industries. Today, working at nights or evenings is as normal as working at daytime. However, because humans are diurnal beings (biologically preprogrammed to be awake during daytime when there is daylight, and asleep during night when it is dark), it is assumed that being awake, and work at night time may be harmful. Consequently, much effort has been devoted to identify potential health problems associated with working shifts (see Kantermann, Juda, Vetter, & Roennenberg, 2010; Wang, Armstrong, Cairnes, Key, & Travis, 2011 for reviews). Disturbed sleep is the most common health problem reported by shift workers. The term "Shift Work Sleep Disorder" (SWSD) has been applied to describe a circadian disruption in relation to a work schedule that overlaps with the normal time for sleep, further characterized by insomnia and excessive sleepiness (Schwartz & Roth, 2006). Systematic reviews and meta-analyses have concluded that night work may increase the risk of coronary heart disease (Vyas, et al., 2012), metabolic disturbances (Gan, et al., 2014; Wang, et al., 2014), breast cancer (He, Anand, Ebell, Vena, & Robb, 2015; Heikkila, et al., 2016), and prostate cancer (Rao, Yu, Bai, Zheng, & Xie, 2015). However, few studies have examined whether shift work may be associated with mental health problems, and the results of the studies are mixed (see Fossum, Bjorvatn, Waage, & Pallesen, 2013; Vogel, Braungardt, Meyer, & Schneider, 2012 for reviews). A major problem in shift-work research has been to compare results across studies. One reason for this is that shift schedules are organized in highly variable ways in different industries around the world. Another reason is the way researchers analyze shift schedules. Often, “shift work” is compared to “day work”, and what constitutes “shift work” may be highly variable. Consequently, different studies on shift work and health have studied different exposures, or combination of different exposures, that all may cause different health problems. The present thesis aims at elucidating associations between several specific types of shift schedules and mental distress in different industries.

Mental health problems are frequent reasons for sickness absence and disability pension. A report on prevalence of mental health problems in Norway developed by researchers at the National Institute of Public Health, revealed that 30 to 50 per cent of the adult population are

at risk of experiencing at least one episode of mental health problems during their lifetime. Twenty to 25 per cent of these episodes pertain to anxiety and 15 to 20 per cent pertain to depression. Furthermore, 10 to 30 per cent of the adult population is at risk for experiencing one such episode during one year. The report also revealed that at all times, 10 per cent of the population suffer from anxiety, and six to 12 per cent suffer from depression http://www.fhi.no/artikler/?id=42699. Thus, identifying factors that may cause and/or buffer such suffering, would enable preventive actions with regard to the onset and persistence of, and recovery from mental health problems.

Work is a central part of most peoples' lives. Work provides income, and may fulfill purposes as self-realization, social contact, and sense of belonging. Given these purposes and all the time spent at work, events occurring in relation to work may affect the health of workers in both positive and negative ways. Much research has been conducted on effects of "the psychosocial work environment" on workers' mental health. The majority of these studies have investigated factors of the Job strain model by Robert Karasek (Karasek, Brisson, Kawakami, Houtman, Bongers, & Amick 1998), or the Effort-Reward-Imbalance model by Johannes Siegrist (Siegrist, 1996). Thus, some psychological and social work factors have been shown to be relatively consistently associated with mental health problems (see Bonde, 2008; Netterstrøm, et al., 2008; Nieuwenhuijsen, Bruinvels, & Frings-Dresen, 2010; Stansfeld & Candy, 2006; Theorell, et al., 2015 for reviews). Prospective studies have demonstrated work-distress associations, but research on reverse or reciprocal associations between work factors and mental health problems are scarce (de Lange, Taris, Kompier, Houtman, & Bongers, 2004; Ibrahim, Smith, & Muntaner, 2009; Lang, Bliese, Lang, & Adler, 2011). Also, only a limited set of work factors have been studied with regard to mental health problems. Hence, knowledge of a broad range of specific working conditions is lacking.

In many workplaces several work tasks are not performed during nights, hence work tasks and staffing differ between regular day and night shift. Therefore, exposures during work-shifts may differ and affect associations between shift types and health outcomes. Moreover, the appraisal of psychological, social and physical work factors may differ between shift types. Differences in perception of work across different shift schedules were demonstrated by Parkes (2003). For instance, offshore swing-shift workers reported higher exposure to *physical* job stressors compared to offshore day workers, and day workers reported higher *job control* compared to shift workers. Thus, different shift schedules may interact with different

work factors to produce different mental health outcomes. Knowledge of such interactions is lacking.

The aims of the current thesis were threefold; to i) elucidate effects of working specific shift schedules on workers' mental distress, ii) elucidate direction of associations between a broad range of psychological and social work factors and mental distress, and iii) elucidate if potential mental health effects of working specific shift schedules were moderated by psychological and social work factors. Together, this should significantly add to the current knowledge in the field.

1.2 Definition of shift work

There is no unanimous definition of "shift work". Costa (2003) defined shift work in general terms "as a way of organizing daily working hours in which different persons or teams work in succession to cover more than the usual 8 hour day, up to and including the whole 24 hour day" (p. 84). Such a general definition includes a number of potential *different* shift schedules outside "conventional" working hours. Shift-work schedules may differ in many parameters (e.g. time of day, duration of shift, shift rotation, length of recovery period). Furthermore, work tasks during night shifts may differ from work carried out during daytime, hence exposures during the work period may differ. "Shift work" may also differ from day work in terms of extraneous, non-work parameters that may confound conclusions about relationships. Stevens and colleagues (2010) pointed out that the lack of precise definitions of shift work poses a problem when determining potential health effects of working shift. Stevens and colleagues (2010) therefore proposed domains that should be covered in epidemiological studies of shift work and health.

> 1) shift system (start time of shift, number of working hours per day, forward- or backward rotating system, rotating or permanent shift), 2) years on a particular non-day shift schedule and cumulative exposure to the shift system over the subject's working life, and 3) shift intensity (number of consecutive nights or days, and free periods. (Stevens et al., 2010 p. 6)

The current thesis aspired at meeting these criterial domains when assessing the shift systems employed in the Norwegian petroleum industry and the health-care sector.

1.3 The distinction between work exposure, outcome and mediating mechanisms

Studies of the influence of non-physical work exposures on mental health have been conducted under the heading of studying "work stress", "psychological stress", "mental stress" or "psychosocial stress". Furthermore, specific psychological and social work factors are often referred to as "measures of stress". The use of the term "stress" may refer to exposures, outcomes, and mediating mechanisms and contributes to conceptual confusion. The current thesis avoids the term "stress". Work factors have been studied as work exposures that might have psychological consequences and thus influence the mental health of workers, operationalized as symptoms of anxiety and depression or mental *distress*.

1.4 Biological, emotional, and cognitive mechanisms involved in response to challenges

Current knowledge of how exposures at work may affect the health of workers depends on integration of research into biology, physiology and psychology. Thus, a brief overview of central contributions to the field may be useful.

Much effort has been devoted to elucidate biological, emotional and cognitive mechanisms involved in the way people respond to challenges in life. Emotions consist of a subjective experience of affect, a neurobiological response, cognitive perception or appraisal, and behavior (Barlow, 2002).

Early knowledge of the *fear* response came from the works of Walter Cannon. He became interested in the autonomic nervous system activity associated with emotions and environmental challenges (Cooper, 2008). In the 19th century, Claud Bernard claimed that the regulatory functions of the body maintained an optimal regulation of the body's internal processes (milieu interieur) independent of the external environment. Cannon later introduced the concept of *homeostasis* to describe these processes. Cannon showed that the body has mechanisms involving the activation of the sympathetic nervous system and the secretion of adrenalin in response to threats. Thus, emotions induced by challenging situations disrupt

homeostasis by initiating the secretion of adrenaline that facilitates actions that are conducive to adaptation. The theory became known as "the fight or flight"- response (Cannon, 1922). The fight or flight response pertains to the acute physiological response pattern when experiencing emotions such as *fear*. Later, after performing a series of experimental studies where rats were exposed to different physical stimuli, Hans Selye claimed that the body reacted or *adapted* in a stereotyped/general manner to different environmental demands (Selye, 1934/1998). He formulated a theory known as "The general adaptation syndrome" (GAS) claiming that the adrenal hormone cortisol mediated somatic responses to any challenge. The idea was that the organism continuously deals with the challenges and adapt to those (Lovallo, 2005). Selye claimed that disease develops when the body's production of cortisol diminishes (Selye, 1998). Selye's research pointed to associations between patterns of response and health. Selye later coined the term *stress* to describe "the non-specific response of the body to any demand made upon it" (Selye, 1973, p. 1). Later, he introduced the concept *stressor* to separate stimuli from response (Selye, 1975). In 1988, the concept of *allostasis* was proposed by Sterling and Eyer (1988), to describe the process of maintaining homeostasis through change. According to the theory a constant maintenance of allostasis may result in allostatic load, which may produce illness.

After several improvements of the methods for measuring different hormones, it was clear that different endocrine systems react differently to different stimuli. Mason claimed that most challenges also presented psychological consequences (Mason, 1971). Mason pointed out the difficulty of isolating harmful physical stimuli from the psychological evaluation of them and emotions accompanying them. Thus, the general hormonal response to different challenges could be a result of the similar emotional reactions to these challenges (Knardahl, 2005). Later, Richard Lazarus (1984/1993) emphasized the role of subjective *appraisal* and *coping* in dealing with challenges. According to Lazarus, an individual actively appraises and evaluates the environment to derive meaning. The individual evaluates what poses a challenge and which options and resources he or she considers available to meet the demand. An event may be evaluated as "irrelevant", "benign" or "stressful" by the individual, and if evaluated as "stressful", the individual further evaluates the events' likeliness of causing harm or not. Lazarus and Folkman (1984) pointed out that psychological stressors achieve their threat value not from their physical ability to do harm, but from their appraised threat value. Consequently, a specific stressor will not cause the same amount of strain in all persons as persons will vary in their ability to cope with perceived stressors (Lovallo, 2005).

These are complex interacting systems, and it is therefore inherently difficult to separate physiological responses from the psychological interpretation of them and simultaneously experienced emotions.

1.5 Mental distress - symptoms of anxiety and depression

A comprehensive overview of the history of research on anxiety and depression is beyond the scope of the current thesis. However, a brief discussion of different perspectives on the ontology and etiology of anxiety and depression will be provided in order to contextualize the findings in the current thesis.

1.5.1 What is anxiety?

Throughout history scientists have reflected on the phenomenon of anxiety and depression. A comprehensive review is provided in "Anxiety and its Disorders" by David H. Barlow (2002). Barlow (2002) suggested that the etiology of anxiety consists of a generalized biological vulnerability, a general psychological vulnerability, and a specific psychological vulnerability. He proposed that individuals may inherit a genetic predisposition to "nervousness" or "neuroticism". Furthermore, individuals may develop a general psychological vulnerability as a consequence of an inability to cope with unpredictable negative life events – a diminished sense of control. Thus, the concepts of "locus of control" (Rotter, 1966) and "attributional style" are central to the development of anxiety. Barlow, also proposed that individuals may develop anxiety by learning what is dangerous, thus, determining the object or situations that become the focus of fear.

Influential contributions to the understanding of anxiety come from Søren Kierkegaard (1844/1969), and Rollo May (1950), who both suggested that anxiety is existential. Kierkegaard suggested that anxiety concerns how individuals relate to "the dangerous" within themselves. He believed that anxiety is rooted in fear of death, nonexistence, nonbeing or nothingness. May suggested that the cause of anxiety may be threat to essential personal values that define one as an individual or one's existence as a whole (death or meaninglessness). Central to these contributions is that anxiety concerns perception of danger. However, they both believed that anxiety is not necessarily something negative or disease.

Howard Liddell (1950) described anxiety as the “shadow of intelligence”, as a natural consequence of being conscious, and the ability humans have to plan for the future and reflect on the past. Consequently, experiencing some form of anxiety is viewed as inevitable where the purpose is motivation to act. However, as Barlow (2002) pointed out, such responses might not be viewed as "intelligent" when people alter their behavior for example by avoiding daily situations because of feelings of fear or anxiety. Such avoidance behavior might be seen as a consequence of people's need for finding an explanation for or cause of their experiences - the cause of the feeling is attributed to cues in the situation where they experienced it, regardless of whether these cues were the actual cause of anxiety. Consequently, such situations are avoided just in case anxiety should occur. A central feature of anxiety is that the individual senses danger, but does not consciously know why. Maybe the "ungraspableness" of the situation is the reason for the persistence of the state - without knowing the cause of experiencing anxiety one cannot do anything to improve the situation.
These insights lead theorists to distinguish between *fear* and *anxiety*. “*Fear* was seen as a response to a specific, observable danger, while *anxiety* was seen as a diffuse, objectless apprehension" (Barlow, 2002, p 7). Barlow (2002) elaborates on these definitions. He views anxiety as a future-oriented mood state associated with preparation for possible, upcoming negative events. Fear is viewed as an alarm response to a present or imminent perceived or real danger. Thus, *anxiety* is about what might happen – *fear* is about what is happening or is believed to be happening.

1.5.2 The role of cognition in anxiety

Much research has been devoted to the role of cognition in anxiety. Schachter and Singer’s (1962) “appraisal theory” proposed that individuals, when noticing arousal, appraise the context and attribute a causal relationship following the perception of an undifferentiated arousal state. Consequently, the same level of arousal may be attributed to positive or negative emotions depending on context. However, replications of the experiment found that unexplained arousal was perceived negatively, regardless of context (Marshall & Zimbardo, 1979).

Weinberg (2010) distinguishes between arousal and anxiety. *Arousal* is defined as “a blend of physiological and psychological activity in a person falling along a continuum from deep sleep to extreme excitation”, whereas *anxiety* is defined as “a negative emotional state

(feeling fearful and uncomfortable, experiencing dread) characterized by nervousness, worry, and apprehension and associated with activation and arousal of the body". Thus, increased heart rate could be an increase in arousal or anxiety depending on the context of the situation. The difference is that *arousal* is not automatically associated with pleasant or unpleasant events but may be either or, whereas anxiety is always considered unpleasant.

Lazarus' work on the appraisal process in perception brought this field further. According to Lazarus, it is the individuals' appraisal of the potential impact the event has on the individual itself that is important for the emotional response. However, appraisal theories cannot explain irrational emotions, which often occur when experiencing anxiety. Thus, research has elucidated the potential of cognitive biases when individuals interpret events or emotions. A major influence in this field is the work of Aaron Beck and colleagues (Beck, Emery, & Greenberg, 2005). Beck recognized that actions associated with fear that was appropriate when humans were hunter-gatherer, may not be as relevant to psychological challenges experienced in a modern society. Beck emphasized the role of cognition in situations where danger is misperceived, where emotions are inappropriate, exaggerated or disordered, through faulty information processing. Thus, in his view the problem in anxiety disorders concerns individual cognitive "schemata" where reality continuously is interpreted as dangerous. Automatic thoughts and images relevant to danger trigger inappropriate physiological, psychological and motor components of the anxiety response. There is evidence that anxiety disorders are characterized by a preconscious attentional bias toward personally relevant threat stimuli and a bias to interpret ambiguous information in a threat-relevant manner (Craske, Rauch, Ursano, Prenoveau, Pine, & Zinbarg, 2009). Furthermore, results from neuroimaging studies indicate elevated amygdala responses to threat cues as a common characteristic across anxiety disorders (Craske et al., 2009).

1.5.3 Contemporary classification of anxiety

Mental-health problems in active, working individuals usually tend to consist of light to moderate symptoms of depression or anxiety. Thus, specific anxiety- or depression *disorders* have not been a focus in the current studies even though people may suffer from such disorders and still be well functioning workers. However, it may be useful to provide an overview of contemporary view of anxiety.

Anxiety is divided into several specific disorders by the "International Classification of Diseases" (ICD-10) and the "Diagnostic and Statistical manual of Mental Disorders" (DSM). The DSM-V (2013) identifies several anxiety *disorders* that share features of excessive fear and anxiety and related behavioral disturbances. The DSM-V utilizes the definitions of fear and anxiety provided by Barlow (2002). "Fear is the emotional response to real or perceived threat, whereas anxiety is anticipation of future threat" (DSM-V, 2013, p.189). These two states are viewed as overlapping but also distinct. According to DSM-V, *fear* is associated with autonomic arousal (e.g. sweating, trembling, heart palpitations, and nausea), thoughts of immediate danger, and escape behaviors, whereas *anxiety* more often is associated with muscle tension, vigilance in preparation for future danger (worry), and avoidant behavior. Furthermore, anxiety disorders are viewed as different from each other in the types of situations or objects that induce fear, anxiety, avoidance behavior, and the associated cognitive ideation. In order to be classified as a *disorder*, a certain persistence of the state is required. Whether the fear or anxiety reported by an individual is excessive, is determined by the clinician, taking cultural context into consideration.

The DSM-V have been criticized for classifying *disorders* that are scientifically unsound, as well as introducing definitions of states that will result in the diagnostization of false positives (Frances, 2013). The practice of categorical classification of mental disorders has been criticized for exhibiting poor validity (e.g. Bjelland & Dahl, 2008). Such classification systems view individuals as either sick or healthy, thus not reflecting the dimensional nature of such states. Recently, psychologists have questioned the value of classifying anxiety into various disorders. The critique pertains to the question to what extent individuals benefit from having a diagnosis with regard to recovery from or dealing with their anxiety. In Norway, diagnoses included in the ICD-10 or DSM-V give certain rights to economic compensations during sick leave or disability pension. Also, having a diagnosis may give the individual a feeling of recognition for his or her suffering. It should be noted that not all people are aware that they suffer from anxiety. Thus, interpretation of somatic reactions is central to the intensity and persistence of anxiety as well as which actions individuals chose to cope with the situation. People may complain of dizziness or nausea without realizing that it might be symptoms of anxiety. Furthermore, emergency personnel admit many "heart attacks" that turn out to be anxiety attacks. People often attribute unexpected somatic sensations to illness and become afraid. When the body becomes aroused without any apparent reason, most people become concerned and try to figure out why.

Symptoms of anxiety were measured by the Hospital Anxiety and Depression Scale in the current thesis. The anxiety items assess worry about possible harmful events occurring to self or others, restlessness, panic, tension and objectless fear (Keedwell & Snaith, 1996).

1.6 What is depression?

Much of the theorizing about the etiology of anxiety has also been applied to depression because both states often co-occur. Despite many psychological and biological theories regarding the pathogenesis of mood disorders, the etiology of major depressive disorder remains unknown (see Drevets, Price, & Furey, 2008 for a review). It is beyond the scope of the current thesis to provide a detailed discussion of the etiology of depression. However, a brief overview of some perspectives will be presented.

As with anxiety, philosophers view depression as a natural part of being conscious human beings. According to Popoveniuc (2014), depression is based on self-reflection, but with an inability to shift attention away from the self to others or the outside world. He also views depression as a tendency to interpret events in an extremely negative way. Others view depression as a response to adversity, involving sadness and low mood (Hagen, 2011). Zigmond and Snaith (1983) who developed the Hospital Anxiety and Depression Scale which is used in the current thesis, define depression as a "mood disorder" dominated by anhedonia – "loss of pleasure", sadness, or retardation. However, depression may also consist of feelings of hopelessness, guilt and low self-esteem (Mykletun, Stordahl, & Dahl, 2001). Thus, depression may manifest itself in various ways in different individuals, and have different causes.

Research on the etiology of depression has been grounded in biological, psychological and social theories (see Risk Factors in Depression, 2011, ed. by Keith S. Dobson & David J.A. Dozois). From a biological perspective the cause of depression is viewed as malfunctioning brain functions, e.g. an imbalance of neurotransmitters that might be restored by treatment with anti-depressants (see Drevets et al, 2008 for a review). It has also been proposed that depression may be triggered by an inflammation in the brain (e.g. Berk, et al., 2013). From a psychological and social perspective, depression is thought to arise from negative life events. A major contribution to the field has been Becks cognitive theory of depression (Dozois &

Beck, 2011). According to cognitive theories depressed or depression-vulnerable individuals are hypothesized to exhibit attention, interpretation, inferential, and memory biases for negative stimuli (see Hankin, et al., 2009 for a review). From an evolutionistic perspective, depression is viewed as way of adapt to events, such as biasing cognition to avoid losses or disengaging from unobtainable goals (Durisko, Mulsant, & Andrews, 2015).

1.6.1 Contemporary definitions of depression

The Diagnostic and Statistical Manual of Mental Disorders (DSM-V®) (Arnow, Wroolie & Zack, 2015) classifies various depressive disorders, the most common being "major depressive disorder". In addition to the cardinal symptoms of major depressive disorder *"sad or low mood and /or anhedonia"*, the DSM-V (2013) identifies the following symptoms of major depressive disorder:

> significant weight loss or change in appetite, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive guilt, impaired concentration or indecisiveness, and recurrent thoughts of death, suicidal ideation, or a suicide attempt or plan. (p. 113)

According to the DSM-V, symptoms must be present most of the day, nearly every day, for at least two weeks. Furthermore, in order to be diagnosed with major depressive disorder one must report at least five of the aforementioned symptoms where at least one of them must be depressed mood or anhedonia.

The depression dimension of The Hospital Anxiety and Depression Scale used in the current thesis is constructed to measure anhedonia (Zigmond & Snaith, 1983).

1.7 Distinguishing between anxiety and depression

“More than the dreadful, but vitalizing anxiety in the face of the salience of death, depression brings about hopelessness and depletes every innate living thrill" (Popoveniuc, 2014, p. 23). Research on anxiety or depression often report co-occurrence of the states. However, not all

anxious individuals are suffering from depression, but many depressed individuals show anxious tendencies. This observation has lead researchers to view anxiety as a precursor for depression. The thinking of Clark and Watson (1991) provides a useful theoretical framework for distinguishing anxiety and depression.

1.7.1 The tripartite model of fear, anxiety and depression

Numerous studies have demonstrated moderate to high correlations between self-report measures of anxiety and depression (Watson, Clark, & Carey, 1988). The "tripartite model" of fear, anxiety, and depression (Clark & Watson, 1991), suggests that "anxiety" and "depression" have some symptoms in common, while other symptoms are specific to each. The model proposes that *anxiety* and *depression* are both defined by high levels of *negative affect* or a "general distress" factor, but are distinct from each other by *positive affect* (Clark & Watson 1991) which only co-occur with anxiety. The model holds that absence of positive affect is specific to depression, and symptoms of physiological hyper-arousal are specific to anxiety. Thus, the tripartite structure of anxiety and depression consists of "general distress", "physiological hyperarousal", and "anhedonia". The structure of the model has been supported in different samples across age and health status (Watson, et al., 1995). However, the model has received criticism due to a lack of specificity within different anxiety and depression disorders (e.g. den Hollander-Gijsman, et al., 2012).

1.8 The relationship between personality traits and mental health problems

A large body of studies has been conducted linking personality traits and mental health problems (see Kotov, Gamez, Schmidt, & Watson, 2010 for a meta-analysis). According to the tripartite model of anxiety and depression, *positive* and *negative affect* are highly associated with the personality traits *extraversion* and *neuroticism*, respectively (Watson, Wiese, Vaidya, & Tellegen, 1999). Clark and colleagues (1994) argued that all anxiety and depressive disorders are associated with neuroticism, and depression is also negatively associated with extraversion. A meta-analysis found support for this notion, but also found the personality trait (low) conscientiousness to be important for mental health problems (Kotov, et al., 2010). Study 1 of the current thesis includes Hans Eysencks measure of neuroticism to assess whether neuroticism affects associations between work exposures and mental distress.

Eysenck (1967) suggested personality to vary along two dimensions – introversion to extraversion, and neurotic to emotionally stable. He based his theory on different intensity levels of arousal in the brain. According to Eysenck, negative emotions are associated with either too high or too low arousal, whereas positive emotions are associated with moderate levels of arousal. Furthermore, he suggested that individuals differ in their resting level of arousal, and in their optimal level of arousal. Consequently, he viewed consistent behavior to be determined by levels of arousability. An "introverted" person would find his or her optimal level of arousal at a lower level of stimulation than an "extroverted" person. According to Eysenck, the neurotic-stable dimension is associated with autonomic nervous system (ANS) reactivity, which feeds back to the limbic system. "Neurotic" individuals are thought to have intense nervous system activity, and not to habituate easily to stimuli. Anxious individuals are thought to have both high resting levels of arousal and high ANS reactivity (Barlow, 2002). Thus, *neurotic* individuals may be more sensitive or aware of potential harmful events.

1.9 Shift work and health

The main mechanisms suggested behind a negative impact of night work and shift work on workers' mental health are (i) disruption of the body's circadian rhythm, (ii) disturbed sleep and, (iii) coping responses during challenges (See Figure 1). All three pathways involve an altered hormonal composition in the brain and regulation which also are central to the phenomenon of anxiety and depression. Thus, in theory, shift workers may develop mental health problems because of sleep problems caused by the specific shift schedule. Hence, working nights and not suffering from sleep problems may not affect mental health. Because sleep problems and mental health problems tend to co-occur (Franzen & Buysse, 2008), a shift worker may have mental health problems involving sleep problems but caused by other factors than the specific shift schedule. Furthermore, unsuccessful coping of work- to family- to social life, may produce worry or conflicts as well as anxiety and depression in workers. Most of us will agree that suffering from sleeplessness is a mentally challenging experience. Whether sleeplessness becomes a problem and thus may affect mental health depends on the individuals coping with the situation and attributions of the causes of the suffering. A newly educated nurse may experience sleep problems as well as panic and anxiety realizing that he or she have educated him or her to a profession involving shift schedules they cannot choose

or master. Offshore workers have this choice to a larger extent, because many of them have the opportunity to seek onshore daytime jobs e.g. as a mechanic or electrician.

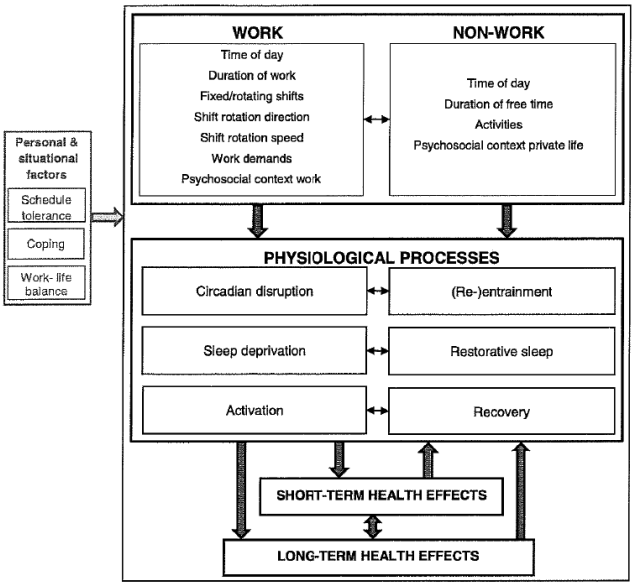

Figure 1. A comprehensive model on nonstandard working schedules and health (Merkus, Holte, Huysmans, Mechelen, & van der Beek, 2015). Reprint is permitted through the Creative Common License (http://creativecommons.org/licenses/by/4.0/).

1.9.1 Pathogenic pathways of work schedules to health

Shift workers may experience challenges in balancing work and private life that may have psychological consequences and affect mental health. Other pathways concern diurnal rhythms. Although, sleep problems have not been a focus in the current thesis, a discussion of relevant sleep-related mechanisms may be useful.

Sleep problems are the most frequent health problems reported by shift workers and have been extensively studied (e.g. Vogel et al, 2012). Disturbance of the body's circadian clock as well as sleep deprivation are two mechanisms believed to be involved in development of diseases following shift work. These two pathways, and the third concerning work-family interface, interact in complex ways and may lead to disease in many ways. However, common

to all three pathways is that they describe disturbances in the body and mind possibly caused by exposures external to the body.

1.9.1 Sleep regulation

Several hypotheses have been proposed to explain why humans and animals sleep (see Vyazovskiy, 2015 for a critical discussion of proposed hypotheses regarding the function of sleep). In short, it is believed that the main function of sleep is to allow the body to restitute and repair damaged cells (Bjorvatn, 2012). Sleep-wake alternations are controlled by a *circadian* factor (process C), a *homeostatic* factor (process S) (Borbely, 1982), an *ultradian process*, *behavior*, and the interaction between these factors (Bjorvatn, 2012).

1.9.1.1 Circadian rhythms

The circadian cycles are controlled by the suprachiasmatic nucleus (SCN), which is a small group of neurons located in the hypothalamus. The SCN influences the sleep/wake cycle, and other physiological and behavioral rhythms. The circadian rhythm is independent of prior sleep and waking, and determines the alterations between high and low somnolence during the 24-hour period (Borbély & Achermann, 1999). There seems to be some individual differences regarding the length of the endogenous circadian rhythm. Regulation of the circadian rhythm is affected by stimuli denoted as time givers, of which light and darkness are the most important ones. Signals from the retina of the eyes are communicated to the SCN. Signals travel from the SCN to the ventrolateral preoptic area (VLPO) and to the pineal gland where melatonin is secreted during the evening and night. The level of melatonin in the blood, and the core body temperature are markers of the circadian rhythm (Kantermann, et al., 2010). Other environmental factors that affect circadian rhythms are eating and drinking, exercise and social interaction. The *timing* of sleep and sleep *length* are determined by the body's circadian rhythm (Bjorvatn, 2012). Thus, sleep length will vary according to the time of day a person goes to sleep relative to the person's circadian rhythm. Studies show that short sleep length is a frequent problem reported by night workers (Bjorvatn, 2012).

1.9.1.2 Homeostatic process

The concept of *homeostasis* describes the process of which the physiology of the body is maintained constant at an optimal level. Borbély (1982) was the first to apply the term to

sleep. Individuals' need for sleep builds up during wakefulness, and decreases during sleep. The homeostatic process determines sleep *depth* or intensity (Bjorvatn, 2012). The longer time since last sleep, the deeper the sleep. Slow-wave activity in non-REM sleep has been proposed as a marker for process S (Archer & Oster, 2015). However, the nature of this homeostatic process is still unclear. The regulation of hormone release and reception in the brain involved in sleep and wakefulness is complex, and will not be discussed in the current thesis. However, the important point to note is that during shift work, the regulation of hormones may be disturbed and affect health in various ways.

1.9.1.3 The ultradian process

The ultradian process describes the alteration between non-REM and REM sleep (Rapid Eye Movements) during the sleep episode (Borbély & Achermann, 1999). Sleep varies considerably during the night. Sleep depth and sleep length are usually assessed by polysomnography; measuring brain activity (electroencephalography), muscle tension (electromyography), and eye movements (electrooculogram). By analyzing such measures, sleep may be divided into five different sleep stages (Bjorvatn, 2012). Stage one is a transitional phase between wakefulness and sleep and constitutes less than 5 per cent of total sleep during normal sleep. Stage two – light sleep - constitute about 50 per cent of total sleep. Stage 3 and 4 – deep sleep – are considered the most important phases for sleep quality, and constitute about 20-25 per cent of total sleep. Deep sleep occurs mostly during the first three to four hours of the sleep period, and during REM sleep.

1.9.1.4 Behavior

Sleep and wakefulness are also adjusted by habits and behavior. When working night-shift, both the circadian and homeostatic factors tell the brain to go to sleep. However, night-workers still manage to stay awake by being active. Likewise, fixed bed- and wake-up times may promote sleep. Also, night workers may use medications such as melatonin or hypnotizers to promote sleep. The fact that people actively take actions to cope with their working hours makes it difficult to assess how circadian and homeostatic processes are affected by working hours (Kantermann, et al., 2010).

1.9.2 Sleep in shift workers

The effects of shift work on sleep concern both reduced sleep duration, disturbed patterns of sleep, and altered sleep quality (Bjorvatn, 2012). Specifically, shift workers experience premature awakenings, as well as reduction in REM-sleep and stage 2 sleep. However, deep sleep (Stages 3 and 4) seems not to be affected by work schedules (Culpepper, 2010). Reductions between 1 and 4 hours in total sleep duration have been reported by night-shift workers (Kantermann, et al., 2010). The need for sleep builds up during wakefulness. Thus, being awake for a long time during the day increases sleep depth. However, a problem many night workers face is difficulty maintaining sleep when the brain physiologically is in "wake-up" mode. Furthermore, the exposure to light on the way home from work in the morning may reset the circadian rhythm (Bjorvatn, 2012).

There is an ongoing debate whether permanent night shift is better than rotating shift for circadian adjustment and health. A review examining studies on melatonin secretion rhythm among permanent onshore night workers concluded that less than 3 per cent of the workers showed complete circadian adjustment (Folkard, 2008). However, studies on physiological and psychological adaptation to night work offshore show that, on average, adaptation occurred after five to six consecutive nights (see Parkes, 2012 for a review). There is no clear-cut answer to which type of shift-schedule is "the healthiest". People differ in tolerance to shift- or night work. Consequently, shift work may affect the health of workers differently. Furthermore, shift-schedules are highly variable depending on sector and country. Studies have shown that using a clock-wise rotating system, minimizing quick returns, and ensuring sufficient recovery time is beneficial for the health of workers (Costa, 2010).

1.10 Work schedules as risk factors of mental health: summary of previous studies

No direct impact of shift work on mental health has been clearly demonstrated (Vogel, et al., 2012). Few studies have examined mental health effects of shift work in offshore settings, and study 3 of the current thesis is to my knowledge the first prospective one to examine such relationships. Ljoså, Tyssen, and Lau (2011) found that offshore workers in shift schedules including night work showed increased risk of mental distress (HCL-5) compared to day workers offshore. However, when adjusted for psychological and social work factors the

association was no longer statistically significant. Parkes (1999) reported similar results. Offshore swing-shift workers showed increased risk of psychological distress (GHQ cases) compared to day workers, but when adjusted for job type the association was no longer statistically significant.

Studies conducted on nurses and other populations show mixed results. A cross-sectional study of nurses in Turkey showed that night workers reported higher level of anxiety compared to nurses working daytime. That study showed no significant differences regarding depression (Selvi, Özdemir, Özdemir, Aydin, & Besiroglu, 2010). Furthermore, a prospective study of nurses in Taiwan found that rotating-shift workers reported poorer sleep-quality and mental health compared to nurses working daytime (Lin, et al., 2012). However, a Danish prospective study of nurses found that shift workers reported *better* mental health than day workers (Nabe-Nielsen, Garde, Albertsen, & Diederichsen, 2011).

A British 10-year longitudinal study showed that men working nights for more than 4 years had increased risk of symptoms of anxiety and depression compared to men who had never worked nights. The same study showed that women working varied shifts had increased risk of symptoms of anxiety and depression compared to women who had never worked varied shifts (Bara & Arber, 2009). Results from a longitudinal study in the Netherlands showed a small increasing impact of shift work on development of depressed mood among males during a ten-year period. However, when adjusted for demographic and work-related factors, these effects were no longer statistically significant (Driesen, Jansen, Amelsvoort, & Kant, 2011). One study has examined mental health effects of changing from non-shift work to shift work. The results showed that workers high in sleep-reactivity had increased risk of developing shift work sleep disorder (SWSD) compared to workers low in sleep-reactivity. Workers who developed SWSD also reported higher increase in symptoms of anxiety and depression (Kalmbach, Pillai, Cheng, Arnedt, & Drake, 2015). Thus, development of symptoms of anxiety and depression in shift workers may depend on sleep disturbances. Another study examined potential mental health effects of changing from shift work to day work. The results showed that nurses changing from night work to daytime work reported a decrease in symptoms of anxiety and depression from baseline to two-year follow-up (Thun, et al., 2014), indicating that selection may play a major role (Knutsson & Åkerstedt, 1992). Selection effects have also been demonstrated by Driesen and colleagues (2011). Retrospective analyses showed a higher risk of depressed mood among current and former male shift workers

compared to workers who had never worked shift. However, when adjusted for demographic and work-related factors, these effects were no longer statistically significant. The same study analyzed the impact of depressed mood with regard to changes in work schedules. The risk to change from shift to day work or from shift to sickness absence was higher if depressed mood was reported at baseline (Driesen, et al., 2011). It is reasonable to assume that individuals that experience extensive problems with working shift or nights, will solve the problem by choosing another schedule that fit better if possible.

In summary, the results from studies of effects of shift work on worker' mental distress are inconclusive. In several of the studies the results are statistically significant in unadjusted analyses only. Knowledge of long-term health effects of shift- or night work is still lacking.

1.11 Limitations of previous studies of work schedules as risk factors of mental health

The inconclusive evidence of effects of shift work on worker mental health may be due to several factors, for example the variability of shift schedules studied and the challenge of measuring the exposure history of workers. There is some evidence of selection and healthy worker effects; i.e. that people who do not cope with working night change to day work (or a new job). Consequently, associations between shift schedules and mental health problems will be underestimated. Furthermore, the diversity of instruments used to measure "mental health" make it difficult to conclude across studies. In addition, the pathogenesis of mental health problems is complex.

1.12 Sleep problems and mental health

Night workers may develop sleep problems due to disturbances in circadian regulation, the homeostatic processes, strain, behavioral factors, or a combination of all factors. The relationship between sleep problems and mental health problems has been extensively studied (see Baglioni, et al., 2011 for a meta-analysis). Overall, studies report of co-occurrence of sleep problems and clinical depression (Franzen & Buysse, 2008). However, whether sleep problems cause mental health problems or whether it is the other way around is debated (see Herrick & Sateia, 2016 and Staner, 2010 for reviews). Depressed individuals do not

necessarily experience sleep problems and individuals experiencing sleep problems are not necessarily depressed. Furthermore, depression may be characterized predominantly by feelings of hopelessness, sadness, or lowered self-esteem, all of which may be related to different kinds of sleep problems. However, there is evidence for a sleep-problem-to-depression pathway. A meta-analysis concluded that non-depressed individuals with insomnia had a twofold risk of developing depression compared to individuals with no sleep problems (Baglioni, et al., 2011).

Studies using polysomnography have revealed that depressed patients have both disturbed homeostatic and circadian sleep regulation (Riemann, Berger, & Voderholzer, 2001; Steiger & Kimura, 2010). Symptoms related to disturbed circadian regulation in depression include delayed sleep onset, non-restful sleep, early morning awakening, daytime fatigue, a decrease in slow-wave sleep, and increase in REM sleep (Riemann, et al., 2001; Wichniak, Wierzbicka, & Jernajczyk, 2013). Wichniak and colleagues (2013) argued that normalization of circadian rhythms may decrease the risk for developing depression, and also increase recovery from depression. Diminished slow-wave sleep and disturbed sleep continuity in depression have been attributed to disturbances of homeostatic processes S (Borbély & Achermann, 1999). It has been suggested that lack of sleep may be caused by illness-specific neurobiological changes and low levels of daytime activity. Accordingly, one symptom of depression is diminished interest in activities (Wichniak et al., 2013).

Changes in the interaction between the *nervous system* and the *endocrine system* have been observed in depressed individuals. Hyperactivity of the *hypothalamic-pituitary-adrenocortical* (HPA) system has been proposed as an explanation for both sleep problems and depression (Steiger & Kimura, 2010; Wichniak et al., 2013). The HPA-axis is a complex set of interactions between the hypothalamus, the pituitary gland, and the adrenal glands. The HPA-axis regulates many somatic bodily processes e.g. digestion, the immune system and emotions. During depression, regulation of *corticotrophin-releasing hormone* (CRH), *adrenocorticotropic hormone* (ACTH), and *cortisol* is altered which may impair sleep and enhance sleeplessness (Hestad, 2009). The secretion of cortisol commonly increases when the individual responds to challenging events. Evidence for the HPA-hyperactivity hypothesis comes from studies of treatment with anti-depressives. A normalization of HPA-axis hyperactivity has been shown to be related to improvement of sleep in patients with depression treated with anti-depressives (Held, Künzel, Ising, & Schmid, 2004).

Sleep problems related to anxiety disorders tend to manifest themselves as difficulties in initiating sleep and maintaining sleep (Papadimitriou & Linkowski, 2005). Because of the co-occurrence of sleep problems and anxiety disorders, it has been debated whether insomnia and anxiety represent one underlying disorder with a spectrum of symptoms or represent two distinct disorders (Uhde, Cortese, & Vedeniapin, 2009). However, results from prospective studies on the direction of associations are mixed. A prospective study with an 11-year follow-up period (Neckelmann, Mykletun, & Dahl, 2007) found insomnia to be a risk factor for developing anxiety. A study on adolescents found that in the majority of cases diagnosed with both anxiety and insomnia, anxiety disorder occurred prior to insomnia. Furthermore, in the majority of cases diagnosed with both depression and insomnia, insomnia occurred first (Johnson, Roth, Breslau, 2006). Others have concluded on a bidirectional relationship between insomnia and symptoms of anxiety and depression. Baseline insomnia predicted new cases of high anxiety and high depression, and baseline anxiety and depression predicted new cases of insomnia (Jansson-Fröjmark & Lindblom, 2008).

In summary, the pathways are multi-factorial and almost impossible to decompose to elements independent of each other. Nevertheless, studies have found associations between shift work and sleep problems, where sleep problems may be related to a disturbance in the circadian rhythm and homeostatic regulation. Furthermore, sleep problems, social, or family problems related to working shifts may induce reactions in the individual that may in turn affect both sleep and mental health.

1.13 Psychological and social work factors

Several systematic reviews show associations between psychological and social work factors and mental health problems such as symptoms of anxiety and depression (Bonde, 2008; Netterstrøm, et al., 2008; Nieuwenhuijsen, et al., 2010; Siegrist, 2008; Stansfeld & Candy, 2006). However, research has often been conducted under the heading of "psychosocial work factors" or *the* "psychosocial work environment". These terms have been avoided in the current thesis because it is not clear what the terms refer to. Some of the studied work factors in the current thesis refer to work content or task demands, while others refer to perceptions of the social environment. The studied social factors are of interest because they are assumed to

influence employee perceptions, emotions, and behaviors (Martikainen, Bartley, & Lahelma, 2002).

General models regarding effects of work on mental health have not been studied in the current thesis. Instead, we aimed at studying effects of a broader range of work factors on mental health problems defined by "The General Nordic Questionnaire for Psychological and Social Factors at Work" (Dallner, et al., 2000). However, previous studies of "psychosocial work factors" and mental health seem to be dominated by the demand-control model and the effort-reward imbalance model. Thus, only few aspects of the total range of relevant psychological and social factors at work have been studied in terms of how these factors affect worker mental health. Furthermore, the work factors measured by the aforementioned models have been criticized for being too broad and general, making successful interventions at work difficult (Christensen & Knardahl, 2010, Finne, Christensen, & Knardahl, 2014). However, the models provide a theoretical framework for how different aspects of work may affect the health of workers. Thus, a brief overview of the models may be useful.

1.13.1 Models of job strain

The demand-control model of Robert Karasek (1979) also known as the job strain model, is the most known and studied model in occupational health psychology. The model proposes that health and well-being are determined by the employees' perceived demands and their opportunity to control the work situation. Central to the model is the interaction between demands and control. Later, Karasek and Theorell (1990) proposed four different types of jobs based on dichotomized combinations of job demands and job control: "Passive jobs" (low demands/low control), "Active jobs" (high demands/high control), "Low strain jobs" (low demands/high control), and "High strain jobs" (high demands/low control). According to the model, "Active jobs" is viewed as healthy and "High strain jobs" as unhealthy. The model further holds that effects of perceived demands and control on health are moderated by social support (Karasek & Theorell, 1990). Thus, "high strain jobs" do not necessarily have to be unhealthy if the individual receives high social support.

The effort-reward imbalance model was introduced by Johannes Siegrist in 1986 (Siegrist, Siegrist, & Weber, 1986; Siegrist, 1996). The model is based on the hypothesis that formalized social exchange, mediated trough the work role, is rooted in contracts of

reciprocity of cost and gain. According to the model, experiencing a lack of high cost and low gain (high effort/low reward) will result in negative emotions (e.g. feeling unfairly treated), and strain. Siegrist (2000) assumed that repeated lack of expected reward will impair successful self-regulation, and produce continuous strain in the individual, and increase the risk of illness. Moreover, the model includes individual differences in the experience of effort-reward imbalance. Individuals characterized by a motivational pattern of excessive commitment to work and high need for approval (overcommitment), are at increased risk of strain from effort-reward imbalance. According to the model, these individuals expose themselves to/take on higher demands at work, or make more effort than needed. Consequently, the frustration of not receiving expected reward increases. Siegrist claimed that this tendency to overcommit is a psychological risk factor in its own, even without structural conditions of imbalance at work (Siegrist, et al., 2004).

1.13.2 Psychological and social exposures at work to mental health: summary of previous studies

Systematic reviews have demonstrated prospective associations between psychological and social work factors and *depression* (Bonde, 2008; Netterstrøm, et al., 2008; Siegrist, 2008; Theorell, et al., 2015), *common mental disorders*, defined as mild to moderate depressive and anxiety disorders (Stansfeld & Candy, 2006), and *distress* (Nieuwenhuijsen, et al., 2010). The majority of studies included in these reviews have studied the job strain model (combination of high demands/low control) and the effort-reward imbalance model (high effort/low reward). However, some of the included studies have elucidated direct effects of job demands and job control, and some studies included other work factors such as bullying, organizational justice, or emotional demands. Theorell and colleagues (2015) concluded with moderately strong evidence for associations between *job strain*, *bullying*, and development of *depressive* symptoms. Limited evidence was shown for effort-reward imbalance, conflicts, psychological demands, limited skill discretion, low support, unfavorable social climate, lack of work justice, job insecurity, long working hours and development of depressive symptoms. Bonde (2008) reported consistent associations between *job strain* and risk of *depression*, whereas Netterstrøm and colleagues (2008) reported consistent associations between high *psychological demand*s, and low *social support* and development of *depression*. The evidence for association between decision latitude and depression was contradictory. Siegrist (2008) demonstrated associations between high demands and low control, and high effort and low

reward and risk of depression. Stansfeld and Candy (2006) found evidence for associations between *job strain*, *effort-reward imbalance* and *common mental disorders*. Direct effects of low *decision latitude*, low *social support*, high *psychological demands*, high *job insecurity* on common mental disorders were also demonstrated. Nieuwenhuijsen and colleagues (2010) demonstrated evidence for associations between *effort-reward imbalance*, high *job demands*, low *job control*, low *support* from *co-worker* and *supervisor*, low *procedural* and *relational justice* and risk of *distress*. The reviewed studies seem to support the notion that job strain and effort-reward imbalance may predict future development of depression, common mental disorders and distress. However, one review only found modest support for the job strain hypothesis (de Lange, Taris, Kompier, Houtman, & Bongers (2003). Instead support for *main effects* of job demands, job control and social support on subsequent strain was demonstrated. Both the demand-control model and the effort-reward imbalance model have been criticized for measuring too broad and unspecific work factors, as well as excluding other relevant work factors that may affect worker health.

One prospective study has examined mental health effects of working conditions among offshore workers (Nielsen, Tvedt, & Matthiesen, 2012). The prevalence of psychological distress was 9 percent at baseline and 8 percent at follow-up in that study. Furthermore, near miss accidents, risk perception, poor safety climate, tyrannical leadership, laissez-faire leadership, job demands, and workplace bullying were associated with follow-up psychological distress. However, when adjusted for baseline distress and all factors, laissez-faire leadership and bullying were associated with psychological distress (Nielsen, et al., 2012).

A few prospective studies have examined effects of a broad range of specific psychological and social work factors on subsequent mental distress (Finne, et al., 2014; Finne, Christensen, & Knardahl, 2016). These studies also addressed the issue of health effects of long time exposure to adverse working conditions, as well as individual-level versus department-level effects. According to Finne and collegues (2014) *role conflict* was the most consistent risk factor for *mental distress*, whereas *support from immediate superior*, *fair leadership*, and *positive challenges* at work were protective of *mental distress*. Finne and colleagues (2016) demonstrated individual-level (baseline-distress-adjusted), and multilevel (average exposures) associations between *role conflict*, *decision control*, *positive challenges*, *support from immediate superior*, *fair leadership*, *social climate*, *human resource primacy*, *rumors of*

change, and mental distress. *Role conflict* was also demonstrated as a substantial contributor to mental distress in a prospective study of 12 550 individuals from the general Norwegian population (Johannessen, Tynes, & Sterud, 2013). That study also demonstrated associations between *high emotional demands*, low *job control*, *bullying*, *job insecurity* and subsequent mental distress.

One aim of the current thesis was to elucidate directions of associations between psychological and social work exposures and mental distress. The majority of prospective studies in this field have only examined work-to-health associations. However, two studies examining lagged effects between *job demands* and *job control* and *strain*, found support for work-to-health associations only (Carayon, 1992, 1993). Furthermore, one study found evidence of a *reciprocal* relationship between, *job demands*, *job control*, *supervisor support* and *mental health*, although work-to-health associations were causally predominant (de Lange, et al., 2004).

1.13.3 Limitations of previous studies of psychological and social exposures at work to mental health

The majority of studies examining effects of psychological and social work exposures on worker mental health have been dominated by the demand-control model and the effort-reward imbalance model. Although a few studies have studied a broader range of work factors, there is a lack of knowledge of how the totality of work exposures may affect the mental health of workers. Furthermore, effects of specific work exposures may be moderated or mediated by other work exposures and produce different health outcomes. Consequently, model building of such effects beyond the demand-control and effort-reward imbalance models is warranted.

With few exceptions, prospective studies have examined work-to-health associations between work exposures and mental health outcomes. Consequently, knowledge of health-to-work effects is lacking. It is plausible to assume that working conditions and aspects of mental health affects each other in complex ways. Thus, working conditions may cause mental health problems, and mental health problems may cause alteration in perception of working conditions.

A problem in longitudinal research concerns exposure time and severity. Exposure over a long time period, with low severity may produce the same health problem as short but severe exposure. However, de Lange and colleagues (2004) found support for a 1-year time lag examining lagged effects between job demands, job control, support and mental health with a 1-year, 2-year and 3-year time lag.

1.14 Psychological, social and physical work factors in the current thesis

A central aim of the current thesis was to explore how the different work exposures relate to mental health problems. Psychological and social work factors were assessed by The General Questionnaire for Psychological and Social Factors at Work (QPS_{Nordic}) (Dallner et al., 2000) in study 1 and 3, and by the QPS_{Nordic} and the Swedish Demand-Control-Support Questionnaire in study 2 (Hagberg & Hogstedt, 1993; Karasek & Theorell, 1990; Theorell, et al., 1988; Theorell, Michelsen, & Nordemar, 1991).

The concepts addressed by the QPS_{Nordic} originate from models and theories about *job stress*, *motivation, organizational behavior, job satisfaction* and *occupational health* (Dallner et al., 2000). The QPS_{Nordic} was originally developed to:

> serve as a tool for assessing psychological, social, and organizational work conditions: 1) when organizational development and interventions are carried out, 2) for research into or for assessment of associations between work and health, and 3) for documentation of changes in work conditions. (Lindström, et al., 1997, p. 9)

Furthermore, the instrument was designed to ”a) yield comprehensive data covering essential psychological and social factors in order to establish a solid base for interventions and organizational change and, b) to provide comprehensive data for scientific studies on relationships between work and health" (Lindström, et al., 1997, p. 15).

The reliability and validity of the QPS_{Nordic} scales have been thoroughly assessed, and the instrument has shown good psychometric properties (see Dallner et al., 2000; Wännström, Peterson, Åsberg, Nygren, & Gustavson, 2009a; Wännström et al., 2009b for detailed

descriptions of validation procedures). An elaborate description of the conceptual, theoretical, and empirical background of the work factors may be found in Lindstöm et al. (1997).

The Swedish Demand-Control-Support-Questionnaire (DCSQ) is based on the Demand-Control Model by Karasek and Theorell (Hagberg & Hogstedt, 1993; Karasek & Theorell, 1990; Theorell, et al., 1988; Theorell, et al., 1991), and a support dimension added to the model by Johnson and Hall (1988).

1.14.1 Job demands

Job demands was defined as ""stress sources" or "stressors" present in the work environment" by Karasek (1979, p.287). Dallner et al. (2002) defined job demands as "all those occurrences, circumstances, and conditions in the workplace that require the individual to act or respond" (p. 26). Because individuals may perceive the same work event or condition in different ways, the same event may be evaluated as "motivational" by some individuals and as "demanding" by others depending on the individual capacity to meet the "demand". Consequently, job demands do not inherently cause distress. The QPS_{Nordic} (Dallner et al., 2000) separates aspects of the job demands concept into several specific subjectively appraised demands. Study 1 and 3 of the current thesis included *quantitative demands* (amount of work, time pressure), *decision demands* (demands on quick decisions, often of a complex nature) and, *learning demands* (demands on education and training). Study 2 included *psychological demands* as measured by the DCSQ (working fast, working hard, require too great work effort, time pressure). Thus, somewhat different aspects of *job demands* were assessed in study 2 compared to study 1 and 3.

1.14.2 Job control

Karasek (1979) defines job control (decision latitude) as "the working individual's potential control over his tasks and his conduct during the working day" (p. 290). Job control is defined as a combination of *skill discretion* (opportunity to learn new things, repetitive tasks, requirement of creativity), and *decision authority* (decision of how to carry out work tasks, and what should be done). These two dimensions were included in study 2. Dallner and colleagues (2000) define *control* as autonomy (control over how and when to perform work tasks), and participation in planning and decision-making. The QPS_{Nordic} dimensions *control*

of decision (influence of how to carry out work tasks, amount of work, who to work with, decisions on own work), *control of work pacing* (decide work pace, breaks, working hours) and *positive challenges* (usefulness of skills and knowledge, meaningfulness, challenging in a positive way) at work were included in study 1 and 3. The requirement to execute skill may be seen both as a challenge and as a resource. *Skill discretion* and *positive challenges,* and *decision authority* and *control of decision* may have some conceptual similarities.

1.14.3 Support

Support in the context of work refers to the resources provided by significant others for the individual (Dallner et al., 2000). Hence, support received from the same source may affect individuals in different ways. Support may be a) *emotional support* (empathy, caring), b) *instrumental support* (technical aid and assistance), c) *informational support* (advice, information, suggestions), and d) *evaluating support* (feedback, affirmation, social comparison) (House, 1981). The QPS_{Nordic} dimensions *support from superior* (listening and helping, appreciation), and *support from co-workers* (listening and helping) were included in study 1 and 3.

The DCSQ support dimension included in study 2 assesses support more generally (pleasant atmosphere, good collegiality, co-workers are there for me, understanding of having a "bad" day, get along with supervisors and co-workers) (Sanne, Torp, Mykletun, & Dahl, 2005).

1.14.4 Role expectations

Role expectations have frequently been studied under two distinct concepts, namely role ambiguity and role conflict (Cook. Hepworth, Wall, & Warr, 1981; Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964; Kelloway & Barling, 1990; Rizzo, House, & Lirtzman, 1970). Role ambiguity refers to a situations were role expectations are unclear or unknown (Dallner et al., 2000). Role conflict refers to situations were two or more expectations are incompatible. Role conflict may result when a) one person has two or more conflicting roles, b) receiving conflicting messages from one person and, c) receiving conflicting messages from two or more persons (Dallner et al., 2000). Study 1 and 3 included the QPS_{Nordic} dimensions *role clarity* and *role conflict*. Role clarity refers to situations were goals and expectations regarding a role are clearly defined and perceived by the employee. Role

unclearness occurs when the individual is unsure of the job content and does not know what is expected. Role conflict occurs when an employee receives conflicting requests or experience conflicts between demands and resources. Role conflict is included as a *job demand* in the DCSQ by the item "Do conflicting demands often occur in your work?". This item was excluded from the job demand scale in study 2 to distinguish potential mental-health effects of job demands (DCSQ) from mental-health effects of role conflict (QPS_{Nordic}).

1.14.5 Leadership

A leader of an organizational unit may be a source of support, psychological resources or challenges through the style of leadership executed. The concept of *empowerment* is a central aspect of such theories. "Psychological empowerment" refers to an individuals' intrinsic motivation or orientation to his or her work role through meaning, competence, self-determination, and impact (Thomas & Velthouse, 1990). The QPS_{Nordic} dimensions *empowering leadership* (encouraged to participate in decisions, express opinions, develop skills) and *fair leadership* (treat workers fairly, distribute work fairly, source of stress) were included in the current studies. The concept of fair leadership is related to the concept of "organizational justice" which pertains to fair treatment of employees at the workplace (e.g. Elovainio, Kivimäki, & Vahtera, 2002; Ylipaavalniemi, et al., 2005).

1.14.6 Physical factors

Physical work exposures such as noise have been shown to affect the mental health of workers (e.g. Folscher, Goldstein, Wells, & Rees, 2014; Sjoedin, Kjellberg, Knutsson, Landstroem, & Lindberg, 2012; Stansfeld & Matheson, 2003). However, there is a paucity of studies exploring effects of cold on mental distress. Two studies have shown that exposure to cold may affect cognitive processes and mood (Palinkas, 2000; Palinkas, et al., 2005). Exposure to noisy and cold environments is especially relevant for drill-floor and engine-room workers offshore. Exposure to noise and cold together with psychological and social work factors were included in study 3 of the current thesis.

2. Study objectives

The overall aim of the studies of the current thesis was to elucidate the ways working hours in combination with psychological and social conditions at work may influence the mental health of workers. To gain such knowledge a range of different shift schedules employed in the petroleum industry and within the health-care sector were studied. Emphasis was on identifying interaction effects between various shift schedules and a broad range of psychological and social working conditions when it comes to the mental health of workers. Such interaction effects have rarely been studied. Furthermore, emphasis was on how working conditions relate to mental health by studying working conditions as predictors of mental health and mental health as predictor of working conditions.

Study 1 aimed to elucidate effects of specific shift schedules on worker *mental distress* in a cross-sectional sample of Norwegian on- and offshore petroleum workers. Specific shift schedules were compared against each other in order to identify potential mental health effects of night work and various forms of rotating shift work. A broad range of psychological and social work factors were studied to elucidate whether various shift schedules differ in work content and the influence of working conditions on the mental health of workers. The role of neuroticism as a potential confounder (or explanation) of the relationship between working conditions and mental health was tested.

Study 2 aimed to elucidate whether it is the time of the day the work is performed or the nature of the shift schedule that matter for *symptoms of anxiety and symptoms of depression* in a prospective sample of Norwegian nurses. Shifts including night work were compared to shifts without night work, and rotating shifts were compared to permanent shifts. A central aim in study 2 was to elucidate interaction effects of night work and rotating shift work and psychological and social work conditions on the mental health of workers, as well as direction of associations between such work conditions and symptoms of anxiety and depression.

Study 3 aimed to elucidate whether it is the time of the day the work is performed or the nature of the shift schedule that matters for worker *mental distress* in a sample of offshore petroleum workers. Permanent day workers were compared to swing-shift workers. Direction of associations and interactions between shift schedules and working conditions on worker mental distress were also elucidated in this paper, adding exposure to *cold* and *noise,* as well

as analyzing a comprehensive set of specific psychological and social work factors. The effect of *job type* was also elucidated in study 3.

3. METHODS

3.1 Recruitment procedure

The studies in the current thesis were based on data from prospective surveys in two populations; onshore and offshore workers in the Norwegian Petroleum industry, and members of the Norwegian Nurses Organization. Study 1 and 3 were part of the project "Petroleum survey of shift work, sleep and health" (PUSSH), and study 2 was part of the project "Survey of shift work, sleep and health among nurses" (SUSSH). Subjects in study 1 and 3 were recruited from six companies, representing three onshore facilities in Norway, and 12 offshore oil rigs in the North Sea. Subjects in study 2 were recruited from the members list of the Norwegian Nurses Organization using stratified selection based on time elapsed since graduation, in this case 0 to 11 months, 1 to 3 years, 3.1 to 6 years, 6.1 to 9 years and 9.1 to 12 years, respectively. The companies who participated in study 1 and 3 received oral presentations prior to the survey to communicate the aims of the study. Participating companies also received written reports as well as oral presentations of results as a tool for organizational development and as an aid for monitoring the psychosocial work environment after the survey. The surveys gathered data by web-based questionnaires and by paper-and pencil questionnaires. All responses were treated confidentially and in accordance with the guidelines and license from the Data Inspectorate regarding storing of personal information of health. Participation was voluntary and informed consent was provided prior to responding.

3.2 Subjects

The three studies included in the thesis analyzed data from different samples, although study 1 and 3 overlap to a certain extent. Study 1 analyzed baseline data from both onshore- and offshore workers. Study 3 included offshore workers only, who responded both at baseline and follow-up. Study 2 included nurses who responded both at baseline and follow-up. An overview of baseline subject characteristics from all three studies is presented in table 2.

Table 1. *Subject characteristics at baseline, Paper 1, and baseline for employees that responded two times, Paper 2 & 3.*

	Paper 1: onshore and offshore workers N=1471		Paper 2: Nurses N=1582		Paper 3: Offshore workers N=578	
	N	%	N	%	N	%
Sex						
Male	1170	93.2	144	9.1	564	97.6
Female	86	6.8	1430	90.9	14	2.4
Age						
<30	150	11.9	602	38.1	36	6.2
30-39	336	26.6	676	42.7	135	23.4
40-49	428	33.9	216	13.7	200	34.6
50-59	276	21.8	81	5.1	152	26.3
>59	74	5.9	7	0.4	55	9.5
Shift schedule						
Onshore						
Permanent day	143	11.8	122	8.0		
Revolving shift	166	13.7				
Day and evening			401	26.4		
Permanent night			126	8.3		
Three-shift			871	57.3		
Offshore						
Permanent day	210	17.3			121	20.9
Permanent night	44	3.6			24	4.2
Swing-shift 7n/7d	464	38.2			284	49.1
Swing shift 7d/7n	187	15.4			104	20.9
Years with night work						
< 1	115	8.9	203	15.1	16	2.8
1-5	347	26.9	673	50.1	131	22.7
6-10	246	19.1	308/157[a]	23.0/11.7[a]	96	16.6
11-15	280	21.7			125	21.6
16-20	140	10.8			67	11.6

21-25	76	5.9			32	5.5
26-30	54	4.2			21	3.6
> 30	33	2.6			14	2.4
Mental distress[b]						
Anxiety	34/90[c]	11.5/10.2[c]	302	19.2	46	8.3
Depression	52/130[c]	17.7/14.7[c]	132	8.4	74	13.4

[a] /more than 10 years of night work

[b] HADS cut off ≥ 8

[c] onshore workers/ offshore workers

3.3 Design

Study 1 was a cross-sectional design whereas study 2 and 3 were prospective panel designs. Study 2 conducted follow-up after 12 months. Study 3, had a follow-up period of on average 12 months. However, each data collection at offshore installations lasted for on average six months, whereas data collection at onshore installations ranged from one to three months. The cross-sectional sample of study 1 included all respondents invited at baseline, whereas study 3 included only offshore workers who responded both at baseline and follow-up.
The PUSSH-project recruited *companies*, not individuals. Thus, all workers currently employed in each company at the time of data collection at both time points were invited to participate in the survey. Consequently, new employees at follow-up were included, but employees who had left the company at the time of follow-up data collection were not invited to participate. The SUSSH-project recruited individual nurses, representing a cohort that was followed over time.
As presented in Table 2 the sample of petroleum workers consists primarily of males and the sample of nurses consists primarily of females. Although some associations may be gender specific, and some overlap of offshore workers in paper 1 and 3 exists, the three studies represent different populations, which should enable evaluation of the consistency of the observed associations.

3.4 Measurement of exposure

3.4.1 Shift schedules

The studies of the present thesis studied shift schedules that are common in the Norwegian petroleum industry onshore and offshore, and in the health-care sector. In the Norwegian petroleum offshore industry, a work period normally comprises two weeks of consecutive twelve hour-shifts followed by four weeks off. The most frequent shift type is "swing-shifts" were workers alternate between 7 nights/7 days, or 7 days/7 nights. Permanent day and permanent night shifts, working 14 consecutive days or nights also occur. Night shifts normally start at 7 p.m. and end at 7 a.m. Day shifts normally start at 7 a.m. and end at 7 p.m. At onshore installations in Norway the most frequent working pattern is a continuous six-week shift schedule, with five weeks at work and one week off. On week days the shift duration is normally 8 hours and on weekends 12 hours. Most workers work either permanent daytime or revolving shifts (alternating between daytime, evening and night shift), but 2-shift (daytime, evening) also occur.

Nurses' night shifts in the Norwegian health-care sector are usually 9 to 10 hours of duration, beginning between 9 and 10 p.m. and ending between 7 and 8 a.m. Permanent-night workers do not normally work more than three consecutive nights, followed by two days off. Also, they normally work every third weekend. Day shifts and evening shifts are usually 7 to 8 hours of duration. Day shifts begin between 7 and 9 a.m. and end between 2 and 3 p.m. Evening shifts begin between 1 and 3 p.m. and end between 8 and 10 p.m. Nurses working in a 3-shift schedule, rotating between day, evening, and night shift usually work two to four nights per month.

Shift schedules in study 1 and 3 were recorded by a hierarchy of questions starting with “Do you have a working hour arrangement that includes night work?”, with the response categories, “yes” and “no”. Offshore respondents answering “Yes”, were then asked to specify his or her working arrangement with the following alternatives: “Permanent night shift”, “Alternate shift 7 nights / 7 days” (swing shift), “Alternate shift 7 days / 7 nights (swing shift), “Full shift 14 days/ 14 nights every other work period” and “Other night work”. Offshore respondents answering “No”, were asked to specify his or her working hour

arrangement using the following alternatives: “Permanently daytime”, “Staggered shift” and “Other day work”.

Onshore workers answering “Yes” to night work, were asked to specify his or her working hour arrangement using the following response categories: “Permanent night”, “Revolving shift” and “Other night work”. Onshore workers answering “No” to night work, were asked to specify his or her working hour arrangement using the response categories “Permanent days”, “2-shift” and “Other day work”.

In study 2 of nurses, shift schedules were recorded by asking “Check one box that best describes your work schedule in your present job”, with response categories: “Only daytime”, “Only evening time”, “Both daytime and evening time”, “Only night time”, Rotating shift work (three shift) and “Other schedule with both day and night shifts”.

3.4.2 Job type

The companies supplied lists of employees' standard classification of occupations (STYRK) developed by Statistics Norway (www.ssb.no). STYRK is based on the International Standard Classification of Occupation (ISCO-88). All participants were categorized into one of four categories according to education level and job type. The categories were 1. Production (ISCO 8 and 9, n=254), 2. Maintenance (ISCO 7, n=81), 3. Administration (ISCO 3 and 4, n=143), and 4. Management (ISCO 1 and 2, n=60).

3.4.4 Psychological, social and physical work exposures studied for the current thesis

The psychological and social work exposures were assessed by the General Nordic Questionnaire for Psychological and Social factors at work (QPS_{Nordic}) (Dallner et al, 2000) and the Swedish Demand-Control-Support Questionnaire (Karasek & Theorell, 1990) (study 2). The QPS_{Nordic} was constructed to assess a comprehensive set of specific psychological, social and organizational factors important in the work place and to health (Dallner et al., 2000). The intentions of use of the instrument were

> a) to yield comprehensive data on important psychological and social factors to establish a solid basis for initiating and evaluating interventions and organizational change, b) to produce comprehensive data for scientific studies on relationships between work and health, and c) to provide documentation on changes in working conditions. (Dallner et al., 2000, p. 21)

The QPS_{Nordic} comprises 25 scales, each consisting of two to five items, addressing specific work factors, as well as single items to address other relevant aspects of work. Although a broad range of work exposures were included in the questionnaire of study one and three, ten of the 25 scales were included in the current studies. Brief descriptions of each work exposure studied are presented in Table 1.

Table 2. *Description of psychological and social work factors studied in the current thesis*

Scale/item	**Description**	**Number of items**
Quantitative demands[a]	Time pressure and amount of work	4
Decision demands[a]	Demand for attention and making quick and complex decisions	3
Learning demands[a]	Demand for training and skill acquisition	3
Job demands[b]	Demand to work fast and hard with much effort, sufficient time to complete work tasks	3
Role clarity[a]	Clarity of objectives, responsibility and expectations	3
Role conflict[a]	Conflicting requests, demand and resource discrepancy	3
Positive challenges[a]	Meaningfulness of work, usefulness of skills and positively challenging work	3
Decision control[a]	Influence of decision of work tasks, amount of work and choice of co-workers	4
Control work intensity[a]	Influence of work pace, breaks and working hours	4
Skill discretion[b]	Requirement of skills and creativity, opportunity to learn, repetitive work	3
Decision authority[b]	Influence of decision of which work tasks to conduct	2

	and how	
Support immediate leader[a]	Instrumental and emotional support	3
Support co-worker[a]	Instrumental and emotional support	2
Social support[b]	Pleasant atmosphere, collegiality, emotional support, get along with co-workers and superiors	6
Empowering leadership[a]	Encouraged to participate in decisions, express opinions and develop skills	3
Fair leadership[a]	Fair distribution of work tasks, equal treatment of workers and whether the relation to immediate superior is stressful	3
Exposure to cold	Amount of work time exposed to cold out- or indoors	1
Exposure to noise	amount of work time exposed to noise so loud that one has to shout to communicate	1

[a] The General Questionnaire for Psychological and Social factors at work (QPS_{Nordic})

[b] The Swedish Demand-Control-Support Questionnaire

3.5 Psychological and social exposures at work - scale construction

In study 1 and 3, psychological and social work exposures were measured by the General Questionnaire for Psychological and Social factors at Work, QPS_{Nordic} (Dallner et al., 2000). A brief description of each work factor included in the individual studies, and the number of items each factor consists of is presented in table 2. The items were measured on a five-point rating scale with the following response alternatives: "very seldom or never" (1), "rather seldom" (2), "sometimes" (3), "rather often" (4), "very often or always" (5). Paper 1 and 3 both included twelve work factors. However, due to the many comparisons in paper 1, ten of the specific factors measuring various aspects of *job demands, job control, social support and leadership* were merged into those four general factors. In study 2, psychological *job demands, skill discretion, decision authority,* and *social support* were measured by items translated from the Swedish Demand-Control-Support Questionnaire (Hagberg & Hogstedt, 1993; Karasek & Theorell, 1990; Theorell, et al., 1988; Theorell, et al., 1991). The response categories for job demands, skill discretion and decision authority refer to the frequency of occurrence and ranged from 1 (Yes, often), 2 (Yes, sometimes), 3 (No, seldom) and 4 (No,

almost never). The social support scale was rated on a four point scale ranging from 1 (Fully agree) to 4 (Fully disagree). *Role clarity, role conflict* and *fair leadership* were measured by the QPS_{Nordic}. All scales were computed as the mean of the items corresponding to each factor.

3.6 Physical work exposures

Exposure to noisy and cold environments is especially relevant for drill-floor and engine-room workers offshore. Exposure to noise and cold was measured by the following questions: "How much of your working day are you exposed to noise that is so loud that one must stand close to each other and shout to be heard?" and "How much of your working day are you exposed to cold, i.e. work outdoors in the winter or in cold spaces etc.?". The answers were rated on a six-point scale with the following response alternatives: "Never", "Very seldom", "Ca ¼ of the time", "Ca half of the time", "Ca ¾ of the time and "Almost all the time".

3.7 Mental distress

Mental distress was measured by the Hospital Anxiety and Depression Scale (HADS) in all three studies. The HADS consists of 14 items, with seven items alleged to measure anxiety and seven items alleged to measure depression (Zigmond & Snaith, 1983). The depression scale emphasizes individuals' mood, retardation (things slow down) and diminished interests in activities and the ability to feel happy about events. The anxiety items assess worry about possible harmful events occurring to self or others, restlessness, panic, tension and objectless fear (Keedwell & Snaith, 1996). Respondents were asked to rate how often they had experienced various symptoms of anxiety and depression during the last week. The responses were measured on a four-point scale. For example, the statement "I feel tense or "wound up" reflects anxiety, with the response categories "most of the time" (3), "a lot of the time" (2), "from time to time" (1), and "not at all" (0). The statement "I still enjoy the things I used to enjoy" is a measure of a symptom of depression, with the response categories "definitely as much" (0), "not quite so much" (1), "only a little" (2) and "hardly at all" (3).

The three studies analyzed HADS in somewhat different ways. Composite scores reflecting each respondents average score on the single items were calculated for a total *mental distress* score in study 1 and 3 (all 14 items) The reliability coefficients for this scale were $\alpha = 0.84$ in

study 1, and α = 0.84 and 0.85 in study 3. In study 2, the two sub scales *symptoms of anxiety* and *symptoms of depression* were analyzed separately, both with a cut-off ≥ 8 for "caseness" anxiety or depression, and as latent variables with categorical indicators. A sum score between 0-7 on anxiety or depression is regarded as within the “normal” range, a score between 8 and 10 as “mild” symptoms and indicate potential “caseness”, and a score of 11 or higher is regarded as moderate to severe and indicate “caseness” (Zigmond & Snaith, 1983). A cutoff of 8 was chosen because it seems likely that symptoms of anxiety and depression in a working population are mild.

3.8 Individual characteristics

The personality trait neuroticism, often labeled negative affectivity, may play a role in tolerance to shift work (Saksvik, Bjorvatn, Hetland, Sandal, & Pallesen, 2011 for a review). Neuroticism and negative affectivity have been shown to influence the perception of psychological and social work environment (e.g. Paterniti, Niedhammer, Lang, & Consoli, 2002) and to be associated with anxious and depressive symptoms[25)]. Negative affectivity may therefore influence associations between psychological and social work factors and mental health and distress by being a mediator or confounder (Parkes, 1990; Spector, Zapf, Chen, & Frese, 2000). Neuroticism was measured by six items from the Eysenck Personality Questionnaire (EPQ) (Eysenck, 1958). The items were rated on a four-point scale ranging from "almost never" (1), "quite seldom" (2), "quite almost" (3), and "almost always" (4). A composite score reflecting the respondents’ average score on the single items was calculated. Reliability coefficient of neuroticism was α=.68 in study 1.

3.9 Confounders

Sex, age, and education level were included in all analyses in study1. Sex, age, married/cohabiting, children living at home, and baseline symptoms of anxiety and depression were included in analyses of study 2. Sex, age, and baseline distress were included in the analyses of paper 3.

4. Statistical analyses

Analyses were conducted with IBM SPSS statistics 21.0 (IBM, Armonk, NY, USA) and Mplus version 7.11 (Muthén & Muthén, 2010).

4.1 Non-response

Study 3 estimated the extent to which selection based on the studied variables may have occurred. Multivariate binary logistic regression analysis (GZLMs) was conducted to estimate the odds of being a responder at baseline as opposed to not responding at baseline based on sex and age group. Information in terms of sex and age of all invited employees was provided by the companies prior to the survey.

In study 2 and 3 attrition analyses were conducted to assess drop-out characteristics after the first wave. Bivariate binary logistic regression analyses were conducted to identify psychological and social work factors associated with responding at both time points as opposed to responding only at baseline. All subjects that participated at baseline and at follow-up were included in these analyses.

4.2 Analyses of variance

Differences in work content between the various shift schedules studied were assessed by conducting multivariate analyses of variance (MANOVA) in all three studies. MANOVA is relevant when comparing group differences on several correlated variables.
Univariate Analysis of Co-Variance was conducted to assess differences in mental distress and neuroticism between the various shift schedules in study 1. Significant main effects of differences between the paired shift schedules were further examined by discriminant analysis (Field, 2005) in all studies. Discriminant analysis identifies one or more "*variates"* that differentiate the groups. The higher the correlation coefficient between the work factor and the "variate" (discriminant function), the more the work factor differentiates the shift-schedule groups on that "variate".

In study 2, interactions between shift schedules and work exposures were assessed by conducting two-way analyses of variance. All psychological and social work factors were dichotomized by each factors observed mean before being analyzed.

4.3 Regression analyses

In study 2, bivariate binary *logistic* regression analyses assessed direct effects of rotating shift work and night work on "caseness" symptoms of anxiety and depression, whereas *linear* regression analyses assessed effects of swing-shift work and job type in paper 3.
Simple and multiple linear regression analyses were conducted to assess direct effects of psychological and social work factors on worker mental distress in study 1 and 3. Study 1 also included neuroticism as a potential confounder. Study 3 added exposures to noise and cold as predictors of mental distress, as well as examining reverse effects - baseline mental distress as predictor of follow-up work factors - by linear regression analyses.
Interaction effects between shift schedules, job type and psychological, social and physical work factors on mental distress were modeled in Mplus using a robust maximum likelihood estimator (MLR) together with the XWITH command (27). All psychological and social work factors as well as mental distress were modeled as latent variables operationalized by the items corresponding to each factor (raw data). Exposure to cold and noise were modeled as observed variables by each single item.

4.5 Cross-lagged models

To determine associations between work factors and symptoms of anxiety and depression, all psychological and social work factors included in study 2 were analyzed by structural equation modeling with latent factors. The different causal assumptions that were tested against each other are illustrated in figure 2.

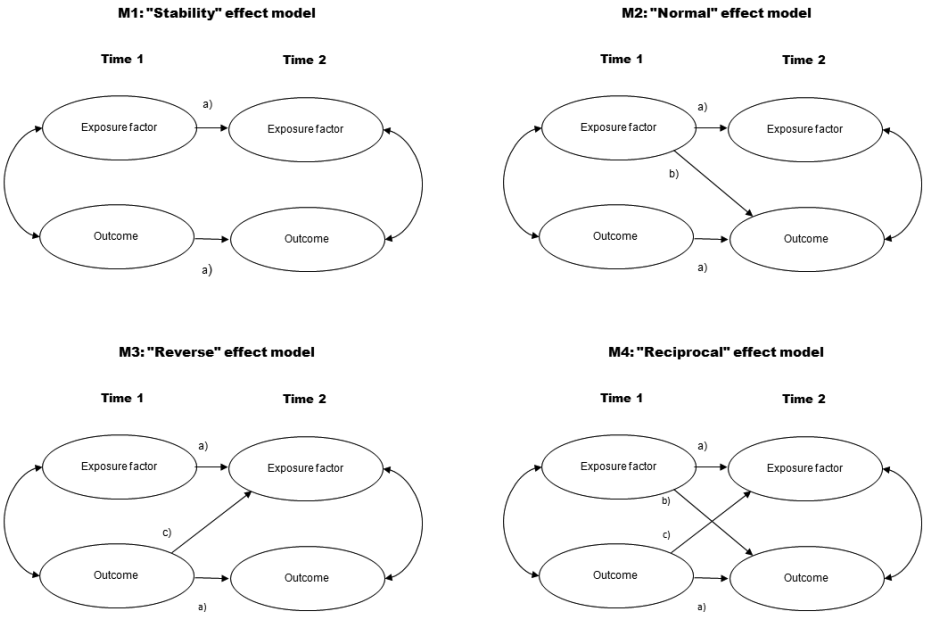

Figure 2. Cross-lagged models of relationships between psychological/social work factors and symptoms of anxiety and symptoms of depression**.** a) "Stability" effects paths; b) "normal" effect paths; c) "reversed" effect paths

It should be noted that prospective studies cannot prove the presence of causality. However, full panel designs allow the comparison of statistical fit of different models based on competing causal assumptions. Regressing follow-up symptoms of anxiety on baseline work exposures when adjusting for the stability across time for both exposure and outcome (Lagged effect), may support a notion of causal influence from work exposure to health. However, there may also be reverse effects. By comparing models of "normal" effects, with models of "reverse" effects and with models of "reciprocal" effects we gain insight into which model explains the associations best (de Lange, et al., 2003).

All work factors and symptoms of anxiety and depression were modeled as latent variables operationalized by the items corresponding to each factor (raw data). Because of categorical observed and skewed items a robust weighted least-squares estimator (WLSMV) was used (Muthén & Muthén, 2010). Cross-lagged models were tested against each other using the robust χ^2 difference test by the DIFFTEST option for the WLSMV estimator. Four models

were tested: (M1) a stability model, regressing both work factors and anxiety or depression at follow-up on baseline measures of themselves, (M2) a normal model, consisting of the stability model along with a causal path from baseline work factors to follow-up anxiety or depression, (M3) a reverse causality model, consisting of the stability model along with a causal path from baseline anxiety or depression to follow-up work factors, and (M4) a reciprocal causality model, consisting of the stability model along with the normal and the reversed causal paths. In all models residual variance of exposure and outcome were allowed to correlate on each time point. These are nested models allowing statistical comparison to evaluate whether adding paths to a model improves model fit. Model 1 is nested in model 2 and model 3, and model 1, model 2 and model 3 is nested in model 4. Model fit was assessed by the root mean square of approximation (RMSEA), the comparative fit index (CFI) and the Tucker-Lewis index (TLI). For all models factor loadings were constrained to be identical at baseline and follow-up for all exposure factors and outcomes in order to ensure measurement invariance. Measurement invariance implies that repeated measurements of a construct should reflect the same construct at every measurement occasion.

4.6 Handling of missing values

In study 1, missing values on the items measuring psychological and social work factors, neuroticism, and mental distress were imputed using multiple imputation under the normal model based on the Marcov Chain Monte Carlo (MCMC) method as recommended by Schafer and Graham (2002). A total of ten datasets were simulated. The imputations were performed separately for each shift schedule group in order to preserve possible interactions between the various shifts. This method is considered appropriate under the assumption that data are missing at random. Multiple imputation procedures take the error variance between each simulated data set into account, and preserve important characteristics of the data set.

In study 3 missing data were handled in different ways depending on the statistical analytical tool employed. Non-response, attrition and direct effects of shift work, job type, psychological, social, and physical work factors on mental distress were estimated in SPSS. Missing data were handled by an inclusion criterion of 75% response of the items corresponding to each scale. Then, list-wise deletion was employed. Interaction effects of shift work, job type, psychological, social and physical work factors on worker mental

distress were modeled in MPLUS, using a robust maximum likelihood estimator (MLR). Here, missing data were handled by Full Information Maximum likelihood (FIML) (Enders, 2010). Similar to MI, FIML utilizes all observed data under the Missing at random assumption (MAR). But, unlike MI it does not require the generation of imputed datasets prior to the analysis. Missing data properties are estimated when running the model and missingness information is derived from the formulated model.

4. RESULTS

Paper I

Berthelsen M, Pallesen S, Bjorvatn B, Knardahl K. Shift schedules, work factors, and mental health among onshore and offshore workers in the Norwegian Petroleum Industry. Industrial health, 2015;53:280-292.

OBJECTIVES: The purpose of the present study was to answer the following research questions: (1) Do workers in different shift schedules differ in mental distress? (2) Do workers in different shift schedules differ in neuroticism? (3) Do shift schedules differ in psychosocial work exposures? (4) Do psychosocial work exposures contribute to mental distress among onshore- and offshore workers? (5) Does neuroticism confound the association between work exposures and mental distress?
METHODS: The study is cross-sectional. Self-reported mental distress, psychological and social work factors, and neuroticism were measured concomitantly with one questionnaire. Participants were recruited from five companies. A total of 1471 subjects out of 2628 invited employees completed the survey (response rate 56%). Both onshore and offshore workers from operator and contractor companies were recruited. Data were gathered from 2010 to 2011. In return for participating, the companies received written reports as well as oral presentations of results as a tool for organizational development and as an aid for monitoring their work environment. To elucidate potential mental health effects of disruption of circadian rhythm offshore permanent-daytime (14 days) was compared with offshore permanent-night shift (14 days), and offshore swing shift (7 nights / 7days) was compared with offshore permanent-night shifts. Hence, the comparisons were made between shift workers with zero, seven or 14 nights. Potential mental-health effects of disruption of circadian rhythms, sleep deprivation, and challenges to private life may were elucidated by comparing onshore permanent-day work with rotating-shift work (day, evening and night).
Psychological and social work factors were measured by the General Nordic Questionnaire for Psychological and Social Factors at Work (QPS_{Nordic}), mental distress was measured by the Hospital Anxiety and Depression Scale (HADS) and neuroticism was measured by a short version of Eysenck Personality Questionnaire (EPQ).

Univariate Analyses of Co-Variance were conducted to estimate differences in mental distress, and neuroticism between the various shift schedules. Multivariate Analysis of Co-Variance was conducted to estimate differences in psychological and social work exposures between shift schedules. Simple and multiple linear regression analyses with block design were conducted to estimate effects of psychological and social work exposures on mental distress. Analyses were adjusted for sex, age and education level (Model 1), and additionally adjusted for neuroticism (Model 2).

RESULTS: The results showed 1) No differences in mental distress between workers in different shift schedules, 2) Revolving-shift workers reported higher neuroticism compared to day workers, 3) Swing-shift workers and revolving-shift workers reported lower job control compared to permanent-night and -day workers, 4) *Onshore workers*: Model 1, simple regressions: Job control and support from co-worker and superior were associated with lower mental distress. Job demands and role conflict were associated with higher mental distress. Model 1, multiple regressions: Job control was associated with lower mental distress. Model 2, simple regressions: Role conflict was associated with higher mental distress. Model 2, multiple regression: There were no statistical significant association between the work exposures and mental distress. *Offshore workers*: Model 1, simple regressions: Job control, role clarity, support from co-worker and superior, fair and empowering leadership were associated with lower mental distress. Job demands and role conflict were associated with higher mental distress. Model 1 multiple regression: Job control, role clarity, and fair and empowering leadership were associated with lower mental distress. Model 2, simple regressions: Job control, role clarity, support from co-workers and superior, and fair and empowering leadership were associated with lower mental distress. Job demands was associated with higher mental distress. Model 2, multiple regression: Role clarity, and support from co-workers and superior were associated with lower mental distress, whereas job demands was associated with higher mental distress. 5) Neuroticism influenced the relationship between psychosocial work factors and mental distress.

CONCLUSIONS: The present study did not find differences in mental distress between workers in different shift schedules. Workers in both onshore and offshore settings working a shift schedule that requires multiple changes in circadian rhythm, reported lower levels of job control than day workers and permanent-night workers, indicating that job characteristics may be important to take into account when determining health effects of shift work in future studies. Job demands seem to be a risk factor of mental distress in offshore settings, whereas

job control, role clarity and fair and empowering leadership seems to be protective of mental distress.

Paper 2

Berthelsen M, Pallesen S, Magerøy M, Tyssen R, Bjorvatn B, Moen BE, Knardahl S. Effects of psychological and social factors in shift work on symptoms of anxiety and depression in nurses: a one-year follow-up. Journal of Occupational and Environmental Medicine 2015;57(10):1127-1137.

OBJECTIVES: The aims of the present study were to elucidate 1) prospective effects of shift work on nurses' mental distress (symptoms of anxiety and depression), 2) differences in psychological and social work factors between different shift schedules, 3) the moderating role of psychological and social work factors on effects of shift schedules on mental distress, and 4) cross-lagged associations between psychological and social work factors and mental distress.

METHODS: The study design was prospective, with a one year follow-up period. A total of 2059 nurses participated at baseline (38.1%), and 1582 nurses completed wave 2 of the survey (76.8%). The current study analyzed data from nurses in four shift schedules: 1) permanent day shift, 2) permanent night shift, 3) two-shift, rotating between daytime and evening time, and 4) three-shift, rotating between daytime, evening time, and nights. To study effects of night work and effects of rotating shift work, the four shift schedules were dichotomized as follows: 1) Night work, comprised permanent night shift and three-shift as one category, and permanent daytime and two-shift as one category. 2) Rotating shift work, comprised two-shift and three-shift as one category, and permanent daytime and permanent night work as one category.

Psychological and social work factors were measured by the General Nordic Questionnaire for Psychological and Social Factors at Work (QPS_{Nordic}), and the Swedish Demand-Control-Support Questionnaire (DCSQ). Mental distress was measured by the Hospital Anxiety and Depression Scale (HADS). The HADS was analyzed as composite scores, dichotomized "caseness" categories with a cut off of <=8 on the anxiety scale and depression scale, and as latent factors.

Associations between demographic factors and shift work and "caseness" anxiety and depression were analyzed by binary logistic regression analyses. Differences in psychological and social work factors between rotating-shift workers and permanent-shift workers, and

between night workers and non-night workers were tested by multivariate analyses of variance. Interaction effects between night work, rotating-shift work, and psychological and social work factors on symptoms of anxiety and depression were estimated by two-way analyses of variance. Cross-lagged effects between psychological and social work factors and symptoms of anxiety and depression were estimated by structural equation modeling with latent factors.

RESULTS: Shift work was not associated with "caseness" anxiety or depression. Nurses working nights reported significantly higher levels of role clarity and job demands, and lower levels of decision authority at baseline and follow-up compared to non-night workers. Nurses working rotating shifts reported higher levels of job demands (baseline and follow-up), role conflict and skill discretion (follow-up), lower levels of role clarity (baseline), and lower levels of decision authority (baseline and follow-up) compared with permanent-shift workers. Effects of shift work on mental distress were not moderated by psychological and social work factors. Symptoms of anxiety and symptoms of depression predicted role clarity, role conflict, fair leadership and social support. Job demands predicted symptoms of depression.
CONCLUSIONS: The current study did not find poor mental-health effects of working nights or rotating-shifts. Differences in perceived working conditions between shift types were demonstrated. Although no moderating effects of working conditions on nurses' mental health were demonstrated in the current study, we cannot conclude that differences in work conditions did not buffer effects of shift work on mental health. Anxiety and depression seem to predict workers experience and appraisal of working conditions. However, prospective studies with multiple measurement points are needed to elucidate potential mutual relationships between work factors and mental distress.

Paper 3

Berthelsen M, Pallesen S, Bjorvatn B, Knardahl S. Effects of offshore swing-shift and psychological, social, and physical working conditions on mental distress – a prospective study.

OBJECTIVES: The current study aimed to elucidate prospective direct effects, and interaction effects of characteristics of shift work, job type, psychological, social, and physical work exposures (normal and reverse effects) on offshore workers' mental distress.
METHODS: At baseline 1772 of 3258 (54.3%) invited workers completed a questionnaire, and 945 of 2399 (39.4%) invited responded at follow-up. Non-response and attrition analyses included all invited employees. For analyses pertaining to the research questions, only offshore workers responding at both time points were included (n=531).
To determine effects of shift work the current study compared swing-shift workers with permanent-day workers.
Psychological and social work factors were measured by the General Nordic Questionnaire for Psychological and Social Factors at Work (QPS_{Nordic}). Mental distress was measured by the Hospital Anxiety and Depression Scale (HADS).
Linear regression analyses were conducted to estimate effects of shift work, job type, psychological, social and physical work exposures on mental distress. Interaction effects between shift work, job type, psychological, social, and physical work exposures on mental distress were estimated by liner regression analyses with latent variables (psychological and social work factors and mental distress). Analyses were adjusted for sex and age (Model 1), baseline mental distress (Model 2, table 3), and baseline work exposure (Model 2, table 4).
RESULTS: Swing-shift work and job type were not associated with mental distress one year later. Quantitative demands, role clarity, role conflict, positive challenges, decision control, control over work intensity, support from supervisor, support from co-worker, fair leadership, and exposure to cold and noise were associated with follow-up mental distress. Adjusted for baseline mental distress, only *exposure to noise* predicted mental distress. When all work exposures were entered into a multiple model, only quantitative demands was associated with mental distress one year later. No statistical significant associations were obtained when adjusting for baseline mental distress. *Reverse associations* were found between mental distress and quantitative demands, learning demands, role clarity, role conflict, positive

challenges, decision control, control over work intensity, support from supervisor, support from co-worker, empowering leadership, fair leadership, and noise. Controlled for baseline work factors, *learning demands* and *fair leadership* were predicted by mental distress. Effects of shift work or job type on mental distress were not moderated by psychological, social and physical work factors.

CONCLUSIONS: The current study did not find mental health effects of working swing-shift during a one-year period. The type of work conducted was not related to mental health problems. Prospective associations between psychological, social and physical work exposures and mental distress were demonstrated. Exposure to noise seems to predict mental distress. Mental distress seems to predict workers perception of learning demands and fair leadership. No moderating effects of working conditions on offshore workers mental health were demonstrated.

5. DISCUSSION

5.1 Effects of shift schedules on mental distress

The current studies neither found concurrent nor prospective effects of shift schedules on workers' mental distress. An obvious explanation for the lack of effects may be the constrained variance of the outcome variable mental distress. The prevalence of caseness anxiety (<=8) ranged from 10.2 to 19.2 percent, and the prevalence of caseness depression (<=8) ranged from 8.4 to 17.7 percent in the current studies. To study low frequent phenomena reliably, large sample sizes are needed. Thus, the sample size of onshore workers in paper 1 and offshore workers in paper 2 may be too small.

Few studies have examined associations between shift work and mental distress among offshore workers. Consequently, the basis for comparison of results regarding offshore shift schedules is weak. However, Ljoså and colleagues (2011) found that offshore workers in shift schedules including night work showed increased risk of mental distress (HCL-5) compared to day workers offshore, but adjusted for psychological and social work factors the association was no longer statistical significant. Parkes (1999) reported similar results. Thus, the evidence for an association between shift schedules and mental distress in offshore settings are inconclusive. The current findings contrast findings from studies of nurses. A cross-sectional study of nurses in Turkey showed that night workers reported higher levels of anxiety, but no difference in levels of depression compared to nurses working daytime (Selvi,et al., (2010). Poorer sleep quality and mental health were also reported by nurses working rotating-shift workers compared to nurses working daytime in Taiwan (Lin, et al., 2012). However, a Danish prospective study of nurses found that shift workers reported *better* mental health than day workers (Nabe-Nielsen, et al., 2011). There is some evidence, although weak, of a slowly increase in mental health problems during a ten-year period among men working nights. A British study showed that men working nights for more than 4 years had increased risk of symptoms of anxiety and depression compared to men who never had worked nights (Bara & Arber, 2009). Results from a longitudinal study in the Netherlands showed similar results (Driesen, et al., 2011). Despite some indications of a relationship between shift work and mental health problems, the evidence is not clear.
The mixed results of associations between shift work and mental health have been attributed to selection effects, where the healthy worker effect is the most central (Knutsson, 2004). A

few studies have examined mental health effects of entering or leaving shift work. A longitudinal study in USA following non-shift workers who transitioned from non-shift work indicated that the development of symptoms of anxiety and depression depended on the degree of sleep-reactivity (Kalmbach, et al., 2015). Furthermore, a Dutch study indicated that depressed workers have an increased risk of changing from shift work to day work or from shift work to sickness absence (Driesen, et al., 2011). Whether the choice of changing shift schedule may be attributed to problems concerning the specific shift schedule or to a consequence of being depressed remains uncertain. One study indicated that changing from night work to daytime work may decrease symptoms of anxiety and depression (Thun, et al., 2014). Thus, it is possible that workers who change their work schedule because of health problems may be overrepresented among day workers in the current studies. Some of them may have changed due to distress from working shifts. Thus, mental health differences between shifts may have been obscured. However, only respondents working the same shift schedule at baseline and follow-up were included in the two prospective studies. Change in mental distress was not detected during the one year follow-up. However, it is possible that mental health problems may have occurred prior to baseline. Finally, it is a possibility that shift work per see is not as important for mental distress as assumed. Rather, it might be the ways shift schedules are organized; balancing work periods with free periods, facilitating appropriate sleep environments, allowing influence over own shift schedule or rota, and facilitating work-family balance, that are important for mental health.

A problem in shift work research has been to compare results across studies. This is mainly due to the complex nature of "shift work". Shift schedules may vary in number of consecutive nights, time of start and end of shift, number of hours per shift, the length of the work period, free periods, and forward-or backward shift rotation. Consequently, it is difficult to determine which aspects of the shift schedules in the current studies, and the aforementioned studies, that actually contribute to the health effect in question, or the lack of such effects. If it is the number of consecutive nights that is important for mental health, the current sample of offshore night- and swing-shift workers working 7 or 14 consecutive nights, should be appropriate to address the question. However, offshore workers are a highly selected group with tolerance for shift work. Also they have four weeks of recovery time after a two-week shift, hence their total work exposure may be too low. If the rotation between day, evening and nights is important for mental health, the current sample of nurses should be more appropriate to address the question. The majority of the nurses worked 3-shift, rotating

between day, evenings, and nights. Furthermore, about 60 per cent had been working shift for less than five years, thus, exposure histories were relatively short. However, the specific rotation schedule included only two to four nights a month, thus the rotation was mostly between day work and evening work. Even though the amount of night work was low, workers may be sleep deprived by rotating from evening to day work, which may affect mental health. Furthermore, due to the multi-facetted nature of "shift work" certain combinations of number of consecutive nights, rotation schedule, and free periods may induce negative health effects whereas others may not. To further complicate the problem, such possible negative health effects may also depend on individual tolerance for shift work, and other work exposures.

5.2 Psychological, social and physical work exposures and mental distress

All three studies demonstrated bivariate associations between *job demands, job control, role clarity, role conflict, support from co-worker and leader*, and *fair leadership* and baseline mental distress (study 1) and follow-up mental distress (study 2 and 3). Study 3 also demonstrated associations between *quantitative demands, positive challenges, decision control, control over work intensity, support from leader, fair leadership, noise, cold* and mental distress at follow-up. Baseline mental distress was associated with 11 out of 12 work factors at follow-up. Thus, we can conclude that psychological and social work exposures are *associated* with mental distress both at the same point in time (study 1) and after one year follow-up (study 2 and 3).

Feelings of distress or dejection may affect how we perceive and interpret events. Thus, in theory, one would expect to find evidence of both work-to-distress associations and distress-to-work associations. Study 2 and 3 examined whether psychological and social work exposures were associated with a *change* in mental distress one year later and vice versa, independent of baseline associations between work exposures and mental distress (baseline adjustment). Study 2 supported a notion of *distress-to-work* relationships between work exposures and mental distress. Experiencing symptoms of anxiety and depression at baseline predicted an increase (on average) in *role conflict* and a decrease in *role clarity, social support,* and *fair leadership (study 2 and 3)*. Study 3 also supported such a relationship between mental distress and *learning demands, and fair leadership*. The present findings are

partly in line with the findings of de Lange and colleagues (2004) who found support for a reciprocal association model between demand-control-support dimensions and mental distress. *Job demands* predicted follow-up depression in study 2, supporting existing evidence for *work-to distress* relationship between job demands and mental health (Crayon, 1992, 1993; de Lange et al., 2004). Exposure to noise predicted follow-up mental distress among offshore workers in study 3. This finding is supported by previous findings (Folscher et al., 2014; Sjoedin et al., 2012).

Baseline mental distress was associated with a decrease in fair leadership both among nurses and offshore workers. Fair leadership encompasses the perception that immediate superior treat workers fairly, distribute work fairly, and not represent a source of "stress". Workers may very well evaluate their leader as less fair as a consequence of being anxious or depressed. However, there might be that anxious or depressed individuals actually are being treated less fairly e.g. because of lowered work ability. For the same reason depressed or anxious offshore workers may experience short-comings regarding demands to education and training.

One explanation for the lack of work-to distress associations in study 2 and 3 may be that it takes longer for adverse working conditions to affect the mental health of workers, than for mental health problems to affect perception of working conditions. Being depressed may bias the worker to interpret events in a more negative way. Being anxious may direct the workers' attention to potential danger. These are states that will affect perceptions of events in daily life. However, heavy workload, or poor leadership may be endured for a long time before health may be affected. The current studies had a follow-up period of one year, which should be sufficient to detect short term effects, but maybe not long-term effects.

Another explanation is that the current studies *failed* to detect work-to-distress relationships if such relationships exist (type 2 error). This may be due to several factors as extensively discussed in paper 2 and 3. It is possible that (over)adjustment for work exposures and mental distress at baseline (study 3), and both at baseline and follow-up (study 2), may have obscured associations (Achen, 2001; Glymour, Weuve, Berkman, Kawachi, & Robins, 2005). When analyzing data with two measurement points in time, baseline associations may contain important variance regarding the association between exposure and outcome. We do not know what caused mental distress at baseline.

Study 1 and 2 assessed individual contributions of work factors to mental distress by multiple regression models. Multiple regression models may be informative in situations where the contribution of each included predictor to the outcome is additive and not interactive. The demand-control model proposed that combinations of high job demands and low job control may produce distress in workers whereas situations of high job demands and high job control would not. Such interactions may be mediated by other work factors included in the model. The demand-control model has not been tested in the current thesis, neither have interactions between the various work exposures. Instead, the focus has been on elucidating how a comprehensive set of specific work factors relates to mental distress. Thus, the results of the multiple regressions should be interpreted with caution. For instance, *quantitative demands* was the sole predictor of mental distress when controlling for other work exposures in study 3. This does not mean that work exposures that did not reach statistical significance are irrelevant for mental distress. Each work factor included in the current studies represent different constructs/aspects of the work environment that may affect health in different ways. Furthermore, mental health effects of one work factor may be moderated or mediated by another work factor, which have not been a focus in the current studies.

5.3 The potential moderating role of psychological, social and physical work factors on the relationship between shift schedules and mental distress

Although, there were differences in work content between shift types, no differences in mental distress between shift schedules were detected. Thus, there may be simple effects of shift and work factors on mental distress. Workers may be exposed to certain working conditions in various degrees depending on the specific shift schedule and the work tasks performed during specific shifts. Thus, mental health effects of working shift may differ because of attributes of the specific shift schedule (time of day, rotation system etc.), because of the work tasks performed during shifts, and various combinations of the two. Furthermore, the *appraisal* of psychological, social, and physical aspects of working conditions may differ between shifts. Experiencing role conflict or working in a noisy environment may be more mentally challenging to the individual at nights compared to day time. However, the current studies were not able to demonstrate such interactions (study 2 and 3). As discussed in paper 2 and 3, one explanation may be that there were few observations in the upper or lower end of the work-exposure or mental distress scales (McClelland & Judd, 1993). Because one cannot

secure observations across all levels of the predictor variables in survey designs, interaction effects may be difficult to detect (McClelland & Judd, 1993).

All three studies demonstrated differences in perceived psychological and social work exposures between shift schedules. It seems that workers in permanent day- or night shifts experience higher job control, social support (study 1 and 3), and fair and empowering leadership (study 1) compared to workers in rotating shifts. These working conditions are considered to be protecting factors of health (Dallner et al., 2000). A similar trend was observed in study 2, with nurses working permanent shifts exhibiting higher role clarity and skill discretion, and lower job demands and role conflict compared to nurses in rotating shifts. Thus, it seems that working condition of rotating shifts may be more problematic than that of permanent shifts. All three studies demonstrated associations between psychological and social working conditions and mental health. Work content may be perceived differently by workers in different shifts, and certain working conditions may protect or alter negative mental health effects. Apart from the lack of observed differences in mental health between shift schedules, two problems may be of relevance for the failure to detect combined effects. First, adjustment for baseline mental distress obscured predictions from work factors to mental distress. The baseline adjustment may also obscure moderation effects. When performing baseline adjustment, we exclude potential relevant information explained by baseline associations between work exposures and mental distress. The second problem pertains to the direction of associations. The findings of study 2 and 3 suggested that being mentally distressed was more likely to affect how individuals perceived working conditions, than the other way around. Thus, we studied moderation effects based on an assumption that working conditions would affect the mental health of workers, in populations in which such assumptions were not met. This problem points to another problem with designs that only include two measurement points in time; we do not know what produced baseline mental distress. The current studies represent a picture of how working conditions are related to mental health problems within a limited time frame. Exposures before the time of baseline measurement may have affected working conditions, mental health, or both. Events occurring in between the two measurement points may also affect perception of working conditions and health. Thus, we cannot conclude that in general, mental distress is more likely to affect the perception of working conditions than the other way around. We can only suggest plausible explanations for why this was the case in the current studies. The methodological problems of the number of measurements and time lags are addressed in all three papers.

5.4 Strength of associations, and the power to detect them

There is no agreement on what should be considered a small, medium or large association. Cohen proposed that coefficients below 0.2 should be considered small, below 0.5 medium and above 0.5 as strong (Cohen, 1988, 1992). According to these classifications, the magnitude of the associations observed in the current studies may be considered small or medium. It has been argued that large associations cannot be expected when studying highly complex phenomena such as the relationship between psychological and social work factors and anxiety or depression (Zapf, Dorman, & Frese, 1996) because the phenomena of anxiety or depression are multifactorial, influenced by many work- and non-work factors. A correlation up to .30 has been suggested as the maximum size to expect (Semmer, Zapf, & Greif, 1996). Ford and colleagues found the size of lagged effects commonly to be below .10 because of high stability in estimates over time (Ford, et al., 2014). Because the associations observed in the current studies were small, a large sample size is required to detect them reliably. For instance a correlation coefficient of .10 requires a sample size of 783 to be detected reliably at the 0.05 significance level, whereas a coefficient of .07 would requires a sample size of 2379 to be detected at the 0.01 significance level (Field, 2005). The size of the current sample of nurses in paper 2 and offshore workers in paper 1 should be sufficient to detect associations around the size of r=.10, whereas the sample size of onshore workers in paper 1 and offshore workers in paper 2 would not. Thus, the current thesis may have failed to detect relevant associations. Standardized measures of associations are descriptive statistics of the relationship between variables and are informative to study in their own right.

5.5 Reliability and validity of the Hospital Anxiety and Depression Scale

The criticism against the HADS concerns the dimensionality and the sensitivity of the instrument in non-clinical populations (Nowak et al., 2014). The HADS was constructed to provide a rapid measure of generalized anxiety and depression in hospital, outpatient and community settings (Zigmond & Snaith, 1983). The aim was to assess the presence of symptoms of anxiety and depression, not to distinguish between different forms of anxiety and depression (Caci, et al., 2003). The seven depression items were designed to measure the *anhedonia* aspect of depression, whereas the seven anxiety items originally addressed the psychological symptoms of neurosis, not physical symptoms like dizziness or headache

(Zigmond & Snaith, 1983). The content of the anxiety scale was later revised to assess *mood* (objectless fear), *cognition* (worry about possible harmful events occurring to self or others), and *behaviour* (restlessness) (Keedwell and Snaith, 1996). Thus, it is possible that the anxiety dimension has sub-dimensions. A review of studies examining the latent structure of the HADS (Cosco, Doyle, Ward, & McGee, 2012), and a meta-analysis (Norton, Cosco, Doyle, Done, & Sacker, 2013), concluded that the latent structure is unclear (ranging from 1 to 4 sub-dimensions) and therefore should be employed as a general measure of distress only. Few studies have questioned the content validity of the HADS scale, although the dominant focus on anhedonia in the depression sub-scale has been noted: "important components of depression, such as hopelessness, guilt, and low self-esteem are not assessed because the HADS-D focuses mainly on anhedonia" (Mykletun, et al., 2001, p. 543). While the HADS anxiety scale contains items that are concerned with worrying, restlessness, and panic attacks, the HADS depression scale focuses on anhedonic depression, i.e., lack of positive affect.

The current studies considered the HADS as a 1-factor measure of mental distress (study 1 and 3), a two-factor measure of anxiety and depression (study 2), and as case-indicator using a cut off of 8 (study 2). Study 2, found that work exposures seemed to be related to both anxiety and depression in a similar manner, indicating support for a one-factor structure of the HADS.

5.6 Self-report

The data of the current studies were exclusively based on self-report. A general concern is often expressed regarding assessment of both exposures and outcomes with self-report in the same study, and the potential pitfalls of such assessments. The current studies have employed properly defined and validated exposure measures that were constructed in a way that should attenuate reporting bias (Dallner, et al, 2000). Prospective design allowing assessment of exposures and outcome at different points in time should reduce state-related bias. However, the current studies are not unaffected by concerns associated with self-report.

There are many ways in which *recall bias* may lead employees to misrepresent working conditions when asked to report them. Depending on the time interval the individual is asked to report, incomplete memories of complex situations may lead the employee to assume current conditions as representative of the past. Recall may also be biased in situations where

a single salient event in the past may dominate the employees' perception of current working conditions. These recall biases may inflate or deflate associations.

It is a common assumption that associations between self-reported working conditions and health are due to reporting bias. This has lead researchers to engage in various procedures e.g. *control* for personality traits such as neuroticism, or baseline assessment of mental health outcomes, believing that this procedure reflects more *objective* relationships. Another assumption is that employing measures assessed by others than the individual her- or himself, or aggregate data to work-unit-level, make the associations more *objective*. However, as pointed out by Christensen (2014) "when considering possible errors of self-report one should perhaps distinguish between assessment of the general, "objective", work *environment* and factors related to or encompassed by it" (p.109). The current studies do not attempt to measure characteristics of the work *environment* the employees are situated in, but aspects of work in the individuals' perceived reality. Thus, "employees were assumed to interpret and appraise environments and jobs in order to evaluate and align them with personal standards and needs and the outcome of this process is the evaluation of work" (Christensen, 2014, p. 109). This appraisal of work may have psychological consequences, that is, affecting the individual emotionally, cognitively and behaviorally, which in turn may affect the health of workers.

5.7 Strengths of the current thesis

Among the most important contributions of the current studies are the comprehensive coverage of specific shift schedules commonly employed in the offshore and onshore petroleum sector and the health care sector in Norway. Mental health effects of working night work, swing shift, rotating shift and day work, as well as working permanent shift as opposed to rotating shift were studied in three different populations. These features should provide a reasonable ground for assessment of mental health effects of working shift. Prospective surveys have rarely been conducted among offshore workers.

A second contribution of the current thesis is the assessment of *normal* and *reverse* associations between psychological, social and physical work exposures and mental distress in different populations. Cross-sectional (study 1) and prospective (study 2 and 3) associations were demonstrated, as well as reverse associations (study 2 and 3) between work exposures

and mental distress. Relationships were analyzed with various levels of adjustment to address the issue of reporting bias (Pearce, Checkoway, Kriebel, 2007; Podsakoff, MacKenzie, Lie, & Podsakoff, 2003) as well as causal assumptions (Achen, 2001; Glymour, et al., 2005) underlying the relationship between work exposures and mental distress. In study 1, *neuroticism* was included as a measure of trait response that might affect the reporting of both work exposures and mental distress and thus affect associations. In study 3 associations were estimated with and without baseline adjustment of mental distress, and work exposures. Cross-lagged models were estimated in study 2, adjusting for stability over time concerning both work exposures and mental distress. These levels of adjustment represent different methods for studying the relationship between work exposures and mental distress. Hence, the current contributions are to the co-occurrence of the phenomena, the persistence of such relationships, and to predictions of change.

5.8 Limitations of the current thesis

The response rate of onshore and offshore workers was 56 percent at baseline (study 1), and baseline and follow-up response rate of study 3 were 54.3 and 39.4 percent respectively. The response rate among nurses was 38.1 percent at baseline and 76.8 percent at follow-up. Thus, the initial selection may be of special importance in study 2. Non-response (study 3) and attrition analyses (study 2 and 3) were conducted to address the issues of selection bias.

Self-selection is a threat to external validity if those who respond differ from those who do not. Non-response analysis (study 3) indicated that older workers tended to respond at baseline more so compared to the youngest employees. Thus, the results of the current studies of onshore and offshore workers may not be generalized to the younger onshore- and offshore employees. The population of nurses (study2) comprised registered members of the Norwegian Nurses Organization that had completed their education for up to 12 years before the first survey in 2008/2009. Thus, the results from study 2 cannot be assumed to apply to older nurses. It is a possibility that nurses who participated at baseline in the study were healthier than nurses who did not. However, the current study has no such information. Self-selection is a threat to internal validity if it is related to both work exposures and outcome variables. However, the surveys of the current studies assessed a wide range of work exposures and health factors other than those included in the present studies. Thus, there is little reason to suspect that responses are a result of a combination of high levels of both risk

factor in the work environment and high levels of anxiety and depression. Attrition analyses revealed that older onshore and offshore employees tended to respond at follow-up more so than younger employees. Furthermore, higher levels of baseline control over work intensity increased the odds of responding at follow-up, whereas baseline mental distress decreased the odds of responding at follow-up. Thus, power to detect associations between shift schedules, working conditions and mental distress may have been diminished. Attrition analyses among nurses revealed that higher baseline role conflict and job demands decreased the odds of responding at follow-up. Thus, the strength of the associations between those work exposures and symptoms of anxiety and depression may have diminished.

5.9 Implications of the present findings and recommendations for future research

Examining several types of shift schedules in different sectors in Norway, the current thesis did not find evidence for associations between shift work and mental distress. Is seems reasonable to assume that selection mechanisms determine whether workers continue to work shifts or not. However, it might be possible that shift work per see is not as important to mental health problems as assumed. In Norway, working hours are highly regulated by "the Working Environment Act", which was based on recommendations from research. "The working environment act" regulates weekly working hours and types of shift schedules that are allowed in different industries. Some hospitals in Norway allow the employees to propose their own rota, and in that way adjust their working time to the time of the day that suits them best; days, evenings or nights. Such actions may reduce potential health problems caused by working shift. However, we do not have information of whether this is the case for the nurses participating in the current study. Some shift workers may choose to work many consecutive days, evenings or nights in order to have longer periods off work. Working offshore is compensated with high salaries and long free periods compared to working onshore. Such long recovery periods may be sufficient to reduce health problems. However, studies on long-term health effects of shift work are needed.

Each of the work factors examined in the present thesis represents different constructs that may interact and affect mental distress in various ways. Therefore, we consider it important to take many aspects of work environments into account when drawing conclusions on how and why shift work may affect the health of workers. In order to design interventions at the work

place one needs to know the specific problems that need attention. Furthermore, knowledge of interactions between shift schedules and work content on mental distress is lacking.

The study of the reciprocal relationship between work content and mental health problems would benefit from employing longitudinal designs with different follow-up intervals in order to capture both short- and long term effects of work exposures.

Given the complexity of "shift work", it is difficult to compare results in such a way as to conclude on which specific aspect(s) of shift work that caused a specific health effect, or which combination of exposures. The optimal design for studying health effects of shift work would be to follow individuals from their first day as a shift worker to their retirement day. Given the complex interplay between biological, psychological and social mechanisms in developing health problems, assessment of all these factors should be strived for. This may be necessary to gain knowledge on both short-term and long-term health effects of shift work. Such a design will also facilitate the study of mechanisms involved in shift work and health.

5.10 Conclusions

None of the shift schedules studied in the current thesis seems to affect the mental health of workers. However, it cannot be concluded that such effects do not exist. The current thesis has pointed to several methodological challenges of studying mental health effects of shift work. Among these factors is the healthy worker effect. Studies designed in a way that allow the study of selection effects are needed. The current thesis demonstrated normal and reverse associations between psychological, social and physical work factors and mental distress. Among them were role clarity, role conflict, fair leadership and noise that have not been included in previous studies of *reverse* effects regarding mental health problems. Work exposures included in the current thesis that have not been sufficiently researched to be included in systematic reviews need more elucidation. To gain more knowledge of the nature of the relationship between working conditions and mental health problems, longitudinal studies with designs employing different time lags are needed. It seems reasonable that mental health problems may affect the perception of working conditions more promptly than exposure to adverse working conditions to produce mental health problems. The current studies did not find interaction effects between shift work and working conditions, hence knowledge of such relationships are needed.

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Doctoral Theses at The Faculty of Psychology, University of Bergen

1980	Allen, H.M., Dr. philos.	Parent-offspring interactions in willow grouse (Lagopus L. Lagopus).
1981	Myhrer, T., Dr. philos.	Behavioral Studies after selective disruption of hippocampal inputs in albino rats.
1982	Svebak, S., Dr. philos.	The significance of motivation for task-induced tonic physiological changes.
1983	Myhre, G., Dr. philos.	The Biopsychology of behavior in captive Willow ptarmigan.
	Eide, R., Dr. philos.	PSYCHOSOCIAL FACTORS AND INDICES OF HEALTH RISKS. The relationship of psychosocial conditions to subjective complaints, arterial blood pressure, serum cholesterol, serum triglycerides and urinary catecholamines in middle aged populations in Western Norway.
	Værnes, R.J., Dr. philos.	Neuropsychological effects of diving.
1984	Kolstad, A., Dr. philos.	Til diskusjonen om sammenhengen mellom sosiale forhold og psykiske strukturer. En epidemiologisk undersøkelse blant barn og unge.
	Løberg, T., Dr. philos.	Neuropsychological assessment in alcohol dependence.
1985	Hellesnes, T., Dr. philos.	Læring og problemløsning. En studie av den perseptuelle analysens betydning for verbal læring.
	Håland, W., Dr. philos.	Psykoterapi: relasjon, utviklingsprosess og effekt.
1986	Hagtvet, K.A., Dr. philos.	The construct of test anxiety: Conceptual and methodological issues.
	Jellestad, F.K., Dr. philos.	Effects of neuron specific amygdala lesions on fear-motivated behavior in rats.
1987	Aarø, L.E., Dr. philos.	Health behaviour and sosioeconomic Status. A survey among the adult population in Norway.
	Underlid, K., Dr. philos.	Arbeidsløyse i psykososialt perspektiv.
	Laberg, J.C., Dr. philos.	Expectancy and classical conditioning in alcoholics' craving.
	Vollmer, F.C., Dr. philos.	Essays on explanation in psychology.
	Ellertsen, B., Dr. philos.	Migraine and tension headache: Psychophysiology, personality and therapy.
1988	Kaufmann, A., Dr. philos.	Antisosial atferd hos ungdom. En studie av psykologiske determinanter.

	Mykletun, R.J., Dr. philos.	Teacher stress: personality, work-load and health.
	Havik, O.E., Dr. philos.	After the myocardial infarction: A medical and psychological study with special emphasis on perceived illness.
1989	Bråten, S., Dr. philos.	Menneskedyaden. En teoretisk tese om sinnets dialogiske natur med informasjons- og utviklingspsykologiske implikasjoner sammenholdt med utvalgte spedbarnsstudier.
	Wold, B., Dr. psychol.	Lifestyles and physical activity. A theoretical and empirical analysis of socialization among children and adolescents.
1990	Flaten, M.A., Dr. psychol.	The role of habituation and learning in reflex modification.
1991	Alsaker, F.D., Dr. philos.	Global negative self-evaluations in early adolescence.
	Kraft, P., Dr. philos.	AIDS prevention in Norway. Empirical studies on diffusion of knowledge, public opinion, and sexual behaviour.
	Endresen, I.M., Dr. philos.	Psychoimmuniological stress markers in working life.
	Faleide, A.O., Dr. philos.	Asthma and allergy in childhood. Psychosocial and psychotherapeutic problems.
1992	Dalen, K., Dr. philos.	Hemispheric asymmetry and the Dual-Task Paradigm: An experimental approach.
	Bø, I.B., Dr. philos.	Ungdoms sosiale økologi. En undersøkelse av 14-16 åringers sosiale nettverk.
	Nivison, M.E., Dr. philos.	The relationship between noise as an experimental and environmental stressor, physiological changes and psychological factors.
	Torgersen, A.M., Dr. philos.	Genetic and environmental influence on temperamental behaviour. A longitudinal study of twins from infancy to adolescence.
1993	Larsen, S., Dr. philos.	Cultural background and problem drinking.
	Nordhus, I.H., Dr. philos.	Family caregiving. A community psychological study with special emphasis on clinical interventions.
	Thuen, F., Dr. psychol.	Accident-related behaviour among children and young adolescents: Prediction and prevention.
	Solheim, R., Dr. philos.	Spesifikke lærevansker. Diskrepanskriteriet anvendt i seleksjonsmetodikk.
	Johnsen, B.H., Dr. psychol.	Brain assymetry and facial emotional expressions: Conditioning experiments.
1994	Tønnessen, F.E., Dr. philos.	The etiology of Dyslexia.
	Kvale, G., Dr. psychol.	Psychological factors in anticipatory nausea and vomiting in cancer chemotherapy.

	Asbjørnsen, A.E., Dr. psychol.	Structural and dynamic factors in dichotic listening: An interactional model.
	Bru, E., Dr. philos.	The role of psychological factors in neck, shoulder and low back pain among female hospitale staff.
	Braathen, E.T., Dr. psychol.	Prediction of exellence and discontinuation in different types of sport: The significance of motivation and EMG.
	Johannessen, B.F., Dr. philos.	Det flytende kjønnet. Om lederskap, politikk og identitet.
1995	Sam, D.L., Dr. psychol.	Acculturation of young immigrants in Norway: A psychological and socio-cultural adaptation.
	Bjaalid, I.-K., Dr. philos	Component processes in word recognition.
	Martinsen, Ø., Dr. philos.	Cognitive style and insight.
	Nordby, H., Dr. philos.	Processing of auditory deviant events: Mismatch negativity of event-related brain potentials.
	Raaheim, A., Dr. philos.	Health perception and health behaviour, theoretical considerations, empirical studies, and practical implications.
	Seltzer, W.J., Dr.philos.	Studies of Psychocultural Approach to Families in Therapy.
	Brun, W., Dr.philos.	Subjective conceptions of uncertainty and risk.
	Aas, H.N., Dr. psychol.	Alcohol expectancies and socialization: Adolescents learning to drink.
	Bjørkly, S., Dr. psychol.	Diagnosis and prediction of intra-institutional aggressive behaviour in psychotic patients
1996	Anderssen, N., Dr. psychol.	Physical activity of young people in a health perspective: Stability, change and social influences.
	Sandal, Gro Mjeldheim, Dr. psychol.	Coping in extreme environments: The role of personality.
	Strumse, Einar, Dr. philos.	The psychology of aesthetics: explaining visual preferences for agrarian landscapes in Western Norway.
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	Einarsen, Ståle, Dr. psychol.	Bullying and harassment at work: epidemiological and psychosocial aspects.
1997	Knivsberg, Ann-Mari, Dr. philos.	Behavioural abnormalities and childhood psychopathology: Urinary peptide patterns as a potential tool in diagnosis and remediation.
	Eide, Arne H., Dr. philos.	Adolescent drug use in Zimbabwe. Cultural orientation in a global-local perspective and use of psychoactive substances among secondary school students.
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2000 **V**	Hovland, Ole Johan, Dr. philos.	Transforming a self-preserving "alarm" reaction into a self-defeating emotional response: Toward an integrative approach to anxiety as a human phenomenon.
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	Dyregrov, Kari, Dr. philos.	The loss of child by suicide, SIDS, and accidents: Consequences, needs and provisions of help.
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	Haugland, Bente Storm Mowatt Dr. psychol.	Parental alcohol abuse. Family functioning and child adjustment.
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	Mæhle, Magne, Dr. philos.	Re-inventing the child in family therapy: An investigation of the relevance and applicability of theory and research in child development for family therapy involving children.
	Kobbeltvedt, Therese, Dr. psychol.	Risk and feelings: A field approach.
2004 H	Thomsen, Tormod, Dr. psychol.	Localization of attention in the brain.
	Løberg, Else-Marie, Dr. psychol.	Functional laterality and attention modulation in schizophrenia: Effects of clinical variables.
	Kyrkjebø, Jane Mikkelsen, Dr. philos.	Learning to improve: Integrating continuous quality improvement learning into nursing education.
	Laumann, Karin, Dr. psychol.	Restorative and stress-reducing effects of natural environments: Experiencal, behavioural and cardiovascular indices.
	Holgersen, Helge, PhD	Mellom oss - Essay i relasjonell psykoanalyse.
2005 V	Hetland, Hilde, Dr. psychol.	Leading to the extraordinary? Antecedents and outcomes of transformational leadership.
	Iversen, Anette Christine, Dr. philos.	Social differences in health behaviour: the motivational role of perceived control and coping.
2005 H	Mathisen, Gro Ellen, PhD	Climates for creativity and innovation: Definitions, measurement, predictors and consequences.
	Sævi, Tone, Dr. philos.	Seeing disability pedagogically – The lived experience of disability in the pedagogical encounter.
	Wiium, Nora, PhD	Intrapersonal factors, family and school norms: combined and interactive influence on adolescent smoking behaviour.
	Kanagaratnam, Pushpa, PhD	Subjective and objective correlates of Posttraumatic Stress in immigrants/refugees exposed to political violence.
	Larsen, Torill M. B. , PhD	Evaluating principals` and teachers` implementation of Second Step. A case study of four Norwegian primary schools.
	Bancila, Delia, PhD	Psychosocial stress and distress among Romanian adolescents and adults.
2006 V	Hillestad, Torgeir Martin, Dr. philos.	Normalitet og avvik. Forutsetninger for et objektivt psykopatologisk avviksbegrep. En psykologisk, sosial, erkjennelsesteoretisk og teorihistorisk framstilling.

	Nordanger, Dag Øystein, Dr. psychol.	Psychosocial discourses and responses to political violence in post-war Tigray, Ethiopia.
	Rimol, Lars Morten, PhD	Behavioral and fMRI studies of auditory laterality and speech sound processing.
	Krumsvik, Rune Johan, Dr. philos.	ICT in the school. ICT-initiated school development in lower secondary school.
	Norman, Elisabeth, Dr. psychol.	Gut feelings and unconscious thought: An exploration of fringe consiousness in implicit cognition.
	Israel, K Pravin, Dr. psychol.	Parent involvement in the mental health care of children and adolescents. Emperical studies from clinical care setting.
	Glasø, Lars, PhD	Affects and emotional regulation in leader-subordinate relationships.
	Knutsen, Ketil, Dr. philos.	HISTORIER UNGDOM LEVER – En studie av hvordan ungdommer bruker historie for å gjøre livet meningsfullt.
	Matthiesen, Stig Berge, PhD	Bullying at work. Antecedents and outcomes.
2006 H	Gramstad, Arne, PhD	Neuropsychological assessment of cognitive and emotional functioning in patients with epilepsy.
	Bendixen, Mons, PhD	Antisocial behaviour in early adolescence: Methodological and substantive issues.
	Mrumbi, Khalifa Maulid, PhD	Parental illness and loss to HIV/AIDS as experienced by AIDS orphans aged between 12-17 years from Temeke District, Dar es Salaam, Tanzania: A study of the children's psychosocial health and coping responses.
	Hetland, Jørn, Dr. psychol.	The nature of subjective health complaints in adolescence: Dimensionality, stability, and psychosocial predictors
	Kakoko, Deodatus Conatus Vitalis, PhD	Voluntary HIV counselling and testing service uptake among primary school teachers in Mwanza, Tanzania: assessment of socio-demographic, psychosocial and socio-cognitive aspects
	Mykletun, Arnstein, Dr. psychol.	Mortality and work-related disability as long-term consequences of anxiety and depression: Historical cohort designs based on the HUNT-2 study
	Sivertsen, Børge, PhD	Insomnia in older adults. Consequences, assessment and treatment.
2007 V	Singhammer, John, Dr. philos.	Social conditions from before birth to early adulthood – the influence on health and health behaviour
	Janvin, Carmen Ani Cristea, PhD	Cognitive impairment in patients with Parkinson's disease: profiles and implications for prognosis
	Braarud, Hanne Cecilie, Dr.psychol.	Infant regulation of distress: A longitudinal study of transactions between mothers and infants
	Tveito, Torill Helene, PhD	Sick Leave and Subjective Health Complaints

	Magnussen, Liv Heide, PhD	Returning disability pensioners with back pain to work
	Thuen, Elin Marie, Dr.philos.	Learning environment, students' coping styles and emotional and behavioural problems. A study of Norwegian secondary school students.
	Solberg, Ole Asbjørn, PhD	Peacekeeping warriors – A longitudinal study of Norwegian peacekeepers in Kosovo
2007 H	Søreide, Gunn Elisabeth, Dr.philos.	Narrative construction of teacher identity
	Svensen, Erling, PhD	WORK & HEALTH. Cognitive Activation Theory of Stress applied in an organisational setting.
	Øverland, Simon Nygaard, PhD	Mental health and impairment in disability benefits. Studies applying linkages between health surveys and administrative registries.
	Eichele, Tom, PhD	Electrophysiological and Hemodynamic Correlates of Expectancy in Target Processing
	Børhaug, Kjetil, Dr.philos.	Oppseding til demokrati. Ein studie av politisk oppseding i norsk skule.
	Eikeland, Thorleif, Dr.philos.	Om å vokse opp på barnehjem og på sykehus. En undersøkelse av barnehjemsbarns opplevelser på barnehjem sammenholdt med sanatoriebarns beskrivelse av langvarige sykehusopphold – og et forsøk på forklaring.
	Wadel, Carl Cato, Dr.philos.	Medarbeidersamhandling og medarbeiderledelse i en lagbasert organisasjon
	Vinje, Hege Forbech, PhD	Thriving despite adversity: Job engagement and self-care among community nurses
	Noort, Maurits van den, PhD	Working memory capacity and foreign language acquisition
2008 V	Breivik, Kyrre, Dr.psychol.	The Adjustment of Children and Adolescents in Different Post-Divorce Family Structures. A Norwegian Study of Risks and Mechanisms.
	Johnsen, Grethe E., PhD	Memory impairment in patients with posttraumatic stress disorder
	Sætrevik, Bjørn, PhD	Cognitive Control in Auditory Processing
	Carvalhosa, Susana Fonseca, PhD	Prevention of bullying in schools: an ecological model
2008 H	Brønnick, Kolbjørn Selvåg	Attentional dysfunction in dementia associated with Parkinson's disease.
	Posserud, Maj-Britt Rocio	Epidemiology of autism spectrum disorders
	Haug, Ellen	Multilevel correlates of physical activity in the school setting
	Skjerve, Arvid	Assessing mild dementia – a study of brief cognitive tests.

	Kjønniksen, Lise	The association between adolescent experiences in physical activity and leisure time physical activity in adulthood: a ten year longitudinal study
	Gundersen, Hilde	The effects of alcohol and expectancy on brain function
	Omvik, Siri	Insomnia – a night and day problem
2009 V	Molde, Helge	Pathological gambling: prevalence, mechanisms and treatment outcome.
	Foss, Else	Den omsorgsfulle væremåte. En studie av voksnes væremåte i forhold til barn i barnehagen.
	Westrheim, Kariane	Education in a Political Context: A study of Konwledge Processes and Learning Sites in the PKK.
	Wehling, Eike	Cognitive and olfactory changes in aging
	Wangberg, Silje C.	Internet based interventions to support health behaviours: The role of self-efficacy.
	Nielsen, Morten B.	Methodological issues in research on workplace bullying. Operationalisations, measurements and samples.
	Sandu, Anca Larisa	MRI measures of brain volume and cortical complexity in clinical groups and during development.
	Guribye, Eugene	Refugees and mental health interventions
	Sørensen, Lin	Emotional problems in inattentive children – effects on cognitive control functions.
	Tjomsland, Hege E.	Health promotion with teachers. Evaluation of the Norwegian Network of Health Promoting Schools: Quantitative and qualitative analyses of predisposing, reinforcing and enabling conditions related to teacher participation and program sustainability.
	Helleve, Ingrid	Productive interactions in ICT supported communities of learners
2009 H	Skorpen, Aina Øye, Christine	Dagliglivet i en psykiatrisk institusjon: En analyse av miljøterapeutiske praksiser
	Andreassen, Cecilie Schou	WORKAHOLISM – Antecedents and Outcomes
	Stang, Ingun	Being in the same boat: An empowerment intervention in breast cancer self-help groups
	Sequeira, Sarah Dorothee Dos Santos	The effects of background noise on asymmetrical speech perception
	Kleiven, Jo, dr.philos.	The Lillehammer scales: Measuring common motives for vacation and leisure behavior
	Jónsdóttir, Guðrún	Dubito ergo sum? Ni jenter møter naturfaglig kunnskap.
	Hove, Oddbjørn	Mental health disorders in adults with intellectual disabilities - Methods of assessment and prevalence of mental health disorders and problem behaviour
	Wageningen, Heidi Karin van	The role of glutamate on brain function

	Bjørkvik, Jofrid	God nok? Selvaktelse og interpersonlig fungering hos pasienter innen psykisk helsevern: Forholdet til diagnoser, symptomer og behandlingsutbytte
	Andersson, Martin	A study of attention control in children and elderly using a forced-attention dichotic listening paradigm
	Almås, Aslaug Grov	Teachers in the Digital Network Society: Visions and Realities. A study of teachers' experiences with the use of ICT in teaching and learning.
	Ulvik, Marit	Lærerutdanning som danning? Tre stemmer i diskusjonen
2010 V	Skår, Randi	Læringsprosesser i sykepleieres profesjonsutøvelse. En studie av sykepleieres læringserfaringer.
	Roald, Knut	Kvalitetsvurdering som organisasjonslæring mellom skole og skoleeigar
	Lunde, Linn-Heidi	Chronic pain in older adults. Consequences, assessment and treatment.
	Danielsen, Anne Grete	Perceived psychosocial support, students' self-reported academic initiative and perceived life satisfaction
	Hysing, Mari	Mental health in children with chronic illness
	Olsen, Olav Kjellevold	Are good leaders moral leaders? The relationship between effective military operational leadership and morals
	Riese, Hanne	Friendship and learning. Entrepreneurship education through mini-enterprises.
	Holthe, Asle	Evaluating the implementation of the Norwegian guidelines for healthy school meals: A case study involving three secondary schools
H	Hauge, Lars Johan	Environmental antecedents of workplace bullying: A multi-design approach
	Bjørkelo, Brita	Whistleblowing at work: Antecedents and consequences
	Reme, Silje Endresen	Common Complaints – Common Cure? Psychiatric comorbidity and predictors of treatment outcome in low back pain and irritable bowel syndrome
	Helland, Wenche Andersen	Communication difficulties in children identified with psychiatric problems
	Beneventi, Harald	Neuronal correlates of working memory in dyslexia
	Thygesen, Elin	Subjective health and coping in care-dependent old persons living at home
	Aanes, Mette Marthinussen	Poor social relationships as a threat to belongingness needs. Interpersonal stress and subjective health complaints: Mediating and moderating factors.
	Anker, Morten Gustav	Client directed outcome informed couple therapy

	Bull, Torill	Combining employment and child care: The subjective well-being of single women in Scandinavia and in Southern Europe
	Viig, Nina Grieg	Tilrettelegging for læreres deltakelse i helsefremmende arbeid. En kvalitativ og kvantitativ analyse av sammenhengen mellom organisatoriske forhold og læreres deltakelse i utvikling og implementering av Europeisk Nettverk av Helsefremmende Skoler i Norge
	Wolff, Katharina	To know or not to know? Attitudes towards receiving genetic information among patients and the general public.
	Ogden, Terje, dr.philos.	Familiebasert behandling av alvorlige atferdsproblemer blant barn og ungdom. Evaluering og implementering av evidensbaserte behandlingsprogrammer i Norge.
	Solberg, Mona Elin	Self-reported bullying and victimisation at school: Prevalence, overlap and psychosocial adjustment.
2011 V	Bye, Hege Høivik	Self-presentation in job interviews. Individual and cultural differences in applicant self-presentation during job interviews and hiring managers' evaluation
	Notelaers, Guy	Workplace bullying. A risk control perspective.
	Moltu, Christian	Being a therapist in difficult therapeutic impasses. A hermeneutic phenomenological analysis of skilled psychotherapists' experiences, needs, and strategies in difficult therapies ending well.
	Myrseth, Helga	Pathological Gambling - Treatment and Personality Factors
	Schanche, Elisabeth	From self-criticism to self-compassion. An empirical investigation of hypothesized change prosesses in the Affect Phobia Treatment Model of short-term dynamic psychotherapy for patients with Cluster C personality disorders.
	Våpenstad, Eystein Victor, dr.philos.	Det tempererte nærvær. En teoretisk undersøkelse av psykoterapautens subjektivitet i psykoanalyse og psykoanalytisk psykoterapi.
	Haukebø, Kristin	Cognitive, behavioral and neural correlates of dental and intra-oral injection phobia. Results from one treatment and one fMRI study of randomized, controlled design.
	Harris, Anette	Adaptation and health in extreme and isolated environments. From 78°N to 75°S.
	Bjørknes, Ragnhild	Parent Management Training-Oregon Model: intervention effects on maternal practice and child behavior in ethnic minority families
	Mamen, Asgeir	Aspects of using physical training in patients with substance dependence and additional mental distress
	Espevik, Roar	Expert teams: Do shared mental models of team members make a difference
	Haara, Frode Olav	Unveiling teachers' reasons for choosing practical activities in mathematics teaching

2011 H	Hauge, Hans Abraham	How can employee empowerment be made conducive to both employee health and organisation performance? An empirical investigation of a tailor-made approach to organisation learning in a municipal public service organisation.
	Melkevik, Ole Rogstad	Screen-based sedentary behaviours: pastimes for the poor, inactive and overweight? A cross-national survey of children and adolescents in 39 countries.
	Vøllestad, Jon	Mindfulness-based treatment for anxiety disorders. A quantitative review of the evidence, results from a randomized controlled trial, and a qualitative exploration of patient experiences.
	Tolo, Astrid	Hvordan blir lærerkompetanse konstruert? En kvalitativ studie av PPU-studenters kunnskapsutvikling.
	Saus, Evelyn-Rose	Training effectiveness: Situation awareness training in simulators
	Nordgreen, Tine	Internet-based self-help for social anxiety disorder and panic disorder. Factors associated with effect and use of self-help.
	Munkvold, Linda Helen	Oppositional Defiant Disorder: Informant discrepancies, gender differences, co-occuring mental health problems and neurocognitive function.
	Christiansen, Øivin	Når barn plasseres utenfor hjemmet: beslutninger, forløp og relasjoner. Under barnevernets (ved)tak.
	Brunborg, Geir Scott	Conditionability and Reinforcement Sensitivity in Gambling Behaviour
	Hystad, Sigurd William	Measuring Psychological Resiliency: Validation of an Adapted Norwegian Hardiness Scale
2012 V	Roness, Dag	Hvorfor bli lærer? Motivasjon for utdanning og utøving.
	Fjermestad, Krister Westlye	The therapeutic alliance in cognitive behavioural therapy for youth anxiety disorders
	Jenssen, Eirik Sørnes	Tilpasset opplæring i norsk skole: politikeres, skoleledereres og læreres handlingsvalg
	Saksvik-Lehouillier, Ingvild	Shift work tolerance and adaptation to shift work among offshore workers and nurses
	Johansen, Venke Frederike	Når det intime blir offentlig. Om kvinners åpenhet om brystkreft og om markedsføring av brystkreftsaken.
	Herheim, Rune	Pupils collaborating in pairs at a computer in mathematics learning: investigating verbal communication patterns and qualities
	Vie, Tina Løkke	Cognitive appraisal, emotions and subjective health complaints among victims of workplace bullying: A stress-theoretical approach
	Jones, Lise Øen	Effects of reading skills, spelling skills and accompanying efficacy beliefs on participation in education. A study in Norwegian prisons.

2012 H	Danielsen, Yngvild Sørebø	Childhood obesity – characteristics and treatment. Psychological perspectives.
	Horverak, Jøri Gytre	Sense or sensibility in hiring processes. Interviewee and interviewer characteristics as antecedents of immigrant applicants' employment probabilities. An experimental approach.
	Jøsendal, Ola	Development and evaluation of BE smokeFREE, a school-based smoking prevention program
	Osnes, Berge	Temporal and Posterior Frontal Involvement in Auditory Speech Perception
	Drageset, Sigrunn	Psychological distress, coping and social support in the diagnostic and preoperative phase of breast cancer
	Aasland, Merethe Schanke	Destructive leadership: Conceptualization, measurement, prevalence and outcomes
	Bakibinga, Pauline	The experience of job engagement and self-care among Ugandan nurses and midwives
	Skogen, Jens Christoffer	Foetal and early origins of old age health. Linkage between birth records and the old age cohort of the Hordaland Health Study (HUSK)
	Leversen, Ingrid	Adolescents' leisure activity participation and their life satisfaction: The role of demographic characteristics and psychological processes
	Hanss, Daniel	Explaining sustainable consumption: Findings from cross-sectional and intervention approaches
	Rød, Per Arne	Barn i klem mellom foreldrekonflikter og samfunnsmessig beskyttelse
2013 V	Mentzoni, Rune Aune	Structural Characteristics in Gambling
	Knudsen, Ann Kristin	Long-term sickness absence and disability pension award as consequences of common mental disorders. Epidemiological studies using a population-based health survey and official ill health benefit registries.
	Strand, Mari	Emotional information processing in recurrent MDD
	Veseth, Marius	Recovery in bipolar disorder. A reflexive-collaborative exploration of the lived experiences of healing and growth when battling a severe mental illness
	Mæland, Silje	Sick leave for patients with severe subjective health complaints. Challenges in general practice.
	Mjaaland, Thera	At the frontiers of change? Women and girls' pursuit of education in north-western Tigray, Ethiopia
	Odéen, Magnus	Coping at work. The role of knowledge and coping expectancies in health and sick leave.
	Hynninen, Kia Minna Johanna	Anxiety, depression and sleep disturbance in chronic obstructive pulmonary disease (COPD). Associations, prevalence and effect of psychological treatment.

	Flo, Elisabeth	Sleep and health in shift working nurses
	Aasen, Elin Margrethe	From paternalism to patient participation? The older patients undergoing hemodialysis, their next of kin and the nurses: a discursive perspective on perception of patient participation in dialysis units
	Ekornås, Belinda	Emotional and Behavioural Problems in Children: Self-perception, peer relationships, and motor abilities
	Corbin, J. Hope	North-South Partnerships for Health: Key Factors for Partnership Success from the Perspective of the KIWAKKUKI
	Birkeland, Marianne Skogbrott	Development of global self-esteem: The transition from adolescence to adulthood
2013 H	Gianella-Malca, Camila	Challenges in Implementing the Colombian Constitutional Court's Health-Care System Ruling of 2008
	Hovland, Anders	Panic disorder – Treatment outcomes and psychophysiological concomitants
	Mortensen, Øystein	The transition to parenthood – Couple relationships put to the test
	Årdal, Guro	Major Depressive Disorder – a Ten Year Follow-up Study. Inhibition, Information Processing and Health Related Quality of Life
	Johansen, Rino Bandlitz	The impact of military identity on performance in the Norwegian armed forces
	Bøe, Tormod	Socioeconomic Status and Mental Health in Children and Adolescents
2014 V	Nordmo, Ivar	Gjennom nåløyet – studenters læringserfaringer i psykologutdanningen
	Dovran, Anders	Childhood Trauma and Mental Health Problems in Adult Life
	Hegelstad, Wenche ten Velden	Early Detection and Intervention in Psychosis: A Long-Term Perspective
	Urheim, Ragnar	Forståelse av pasientaggresjon og forklaringer på nedgang i voldsrate ved Regional sikkerhetsavdeling, Sandviken sykehus
	Kinn, Liv Grethe	Round-Trips to Work. Qualitative studies of how persons with severe mental illness experience work integration.
	Rød, Anne Marie Kinn	Consequences of social defeat stress for behaviour and sleep. Short-term and long-term assessments in rats.
	Nygård, Merethe	Schizophrenia – Cognitive Function, Brain Abnormalities, and Cannabis Use
	Tjora, Tore	Smoking from adolescence through adulthood: the role of family, friends, depression and socioeconomic status. Predictors of smoking from age 13 to 30 in the "The Norwegian Longitudinal Health Behaviour Study" (NLHB)
	Vangsnes, Vigdis	The Dramaturgy and Didactics of Computer Gaming. A Study of a Medium in the Educational Context of Kindergartens.

	Nordahl, Kristin Berg	Early Father-Child Interaction in a Father-Friendly Context: Gender Differences, Child Outcomes, and Protective Factors related to Fathers' Parenting Behaviors with One-year-olds
2014 H	Sandvik, Asle Makoto	Psychopathy – the heterogenety of the construct
	Skotheim, Siv	Maternal emotional distress and early mother-infant interaction: Psychological, social and nutritional contributions
	Halleland, Helene Barone	Executive Functioning in adult Attention Deficit Hyperactivity Disorder (ADHD). From basic mechanisms to functional outcome.
	Halvorsen, Kirsti Vindal	Partnerskap i lærerutdanning, sett fra et økologisk perspektiv
	Solbue, Vibeke	Dialogen som visker ut kategorier. En studie av hvilke erfaringer innvandrerungdommer og norskfødte med innvandrerforeldre har med videregående skole. Hva forteller ungdommenes erfaringer om videregående skoles håndtering av etniske ulikheter?
	Kvalevaag, Anne Lise	Fathers' mental health and child development. The predictive value of fathers' psychological distress during pregnancy for the social, emotional and behavioural development of their children
	Sandal, Ann Karin	Ungdom og utdanningsval. Om elevar sine opplevingar av val og overgangsprosessar.
	Haug, Thomas	Predictors and moderators of treatment outcome from high- and low-intensity cognitive behavioral therapy for anxiety disorders. Association between patient and process factors, and the outcome from guided self-help, stepped care, and face-to-face cognitive behavioral therapy.
	Sjølie, Hege	Experiences of Members of a Crisis Resolution Home Treatment Team. Personal history, professional role and emotional support in a CRHT team.
	Falkenberg, Liv Eggset	Neuronal underpinnings of healthy and dysfunctional cognitive control
	Mrdalj, Jelena	The early life condition. Importance for sleep, circadian rhythmicity, behaviour and response to later life challenges
	Hesjedal, Elisabeth	Tverrprofesjonelt samarbeid mellom skule og barnevern: Kva kan støtte utsette barn og unge?
2015 V	Hauken, May Aasebø	«*The cancer treatment was only half the work!*» A Mixed-Method Study of Rehabilitation among Young Adult Cancer Survivors
	Ryland, Hilde Katrin	Social functioning and mental health in children: the influence of chronic illness and intellectual function
	Rønsen, Anne Kristin	Vurdering som profesjonskompetanse. Refleksjonsbasert utvikling av læreres kompetanse i formativ vurdering

	Hoff, Helge Andreas	Thinking about Symptoms of Psychopathy in Norway: Content Validation of the Comprehensive Assessment of Psychopathic Personality (CAPP) Model in a Norwegian Setting
	Schmid, Marit Therese	Executive Functioning in recurrent- and first episode Major Depressive Disorder. Longitudinal studies
	Sand, Liv	Body Image Distortion and Eating Disturbances in Children and Adolescents
	Matanda, Dennis Juma	Child physical growth and care practices in Kenya: Evidence from Demographic and Health Surveys
	Amugsi, Dickson Abanimi	Child care practices, resources for care, and nutritional outcomes in Ghana: Findings from Demographic and Health Surveys
	Jakobsen, Hilde	The good beating: Social norms supporting men's partner violence in Tanzania
	Sagoe, Dominic	Nonmedical anabolic-androgenic steroid use: Prevalence, attitudes, and social perception
	Eide, Helene Marie Kjærgård	Narrating the relationship between leadership and learning outcomes. A study of public narratives in the Norwegian educational sector.
2015 H	Wubs, Annegreet Gera	Intimate partner violence among adolescents in South Africa and Tanzania
	Hjelmervik, Helene Susanne	Sex and sex-hormonal effects on brain organization of fronto-parietal networks
	Dahl, Berit Misund	The meaning of professional identity in public health nursing
	Røykenes, Kari	Testangst hos sykepleierstudenter: «Alternativ behandling»
	Bless, Josef Johann	The smartphone as a research tool in psychology. Assessment of language lateralization and training of auditory attention.
	Løvvik, Camilla Margrethe Sigvaldsen	Common mental disorders and work participation – the role of return-to-work expectations
	Lehmann, Stine	Mental Disorders in Foster Children: A Study of Prevalence, Comorbidity, and Risk Factors
	Knapstad, Marit	Psychological factors in long-term sickness absence: the role of shame and social support. Epidemiological studies based on the Health Assets Project.
2016 V	Kvestad, Ingrid	Biological risks and neurodevelopment in young North Indian children
	Sælør, Knut Tore	Hinderløyper, halmstrå og hengende snører. En kvalitativ studie av håp innenfor psykisk helse- og rusfeltet.
	Mellingen, Sonja	Alkoholbruk, partilfredshet og samlivsstatus. Før, inn i, og etter svangerskapet – korrelater eller konsekvenser?
	Thun, Eirunn	Shift work: negative consequences and protective factors

	Hilt, Line Torbjørnsen	The borderlands of educational inclusion. Analyses of inclusion and exclusion processes for minority language students
	Havnen, Audun	Treatment of obsessive-compulsive disorder and the importance of assessing clinical effectiveness
	Slåtten, Hilde	Gay-related name-calling among young adolescents. Exploring the importance of the context.
	Ree, Eline	Staying at work. The role of expectancies and beliefs in health and workplace interventions.
	Morken, Frøydis	Reading and writing processing in dyslexia
2016 H	Løvoll, Helga Synnevåg	Inside the outdoor experience. On the distinction between pleasant and interesting feelings and their implication in the motivational process.
	Hjeltnes, Aslak	Facing social fears: An investigation of mindfulness-based stress reduction for young adults with social anxiety disorder
	Øyeflaten, Irene Larsen	Long-term sick leave and work rehabilitation. Prognostic factors for return to work.
	Henriksen, Roger Ekeberg	Social relationships, stress and infection risk in mother and child
	Johnsen, Iren	«Only a friend» - The bereavement process of young adults who have lost a friend to a traumatic death. A mixed methods study.
	Helle, Siri	Cannabis use in non-affective psychoses: Relationship to age at onset, cognitive functioning and social cognition
	Glambek, Mats	Workplace bullying and expulsion in working life. A representative study addressing prospective associations and explanatory conditions.
	Oanes, Camilla Jensen	Tilbakemelding i terapi. På hvilke måter opplever terapeuter at tilbakemeldingsprosedyrer kan virke inn på terapeutiske praksiser?
	Reknes, Iselin	Exposure to workplace bullying among nurses: Health outcomes and individual coping
	Chimhutu, Victor	Results-Based Financing (RBF) in the health sector of a low-income country. From agenda setting to implementation: The case of Tanzania