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## **Externally assessed psychosocial work characteristics**

A methodological approach to explore how work  
characteristics are created, related to self-reports  
and to mental illness

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**Karolinska  
Institutet**

Stockholm 2007

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Published by Karolinska Institutet. Printed by Universitetservice US-AB  
Nanna Svartz väg 4, SE-171 77 Solna, Sweden  
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ISBN 978-91-7357-250-7

## ABSTRACT

The general aim of this thesis was to add knowledge to the area of measurement issues of psychosocial work characteristics and job design by using a more objective methodological approach. Expert assessments were made through direct observations and interviews and are a theory guided non-emotional description that is independent of the specific individuals' social or cultural frame of reference. ARIA work content analysis was used in three different ways in this thesis; as the outcome in a job design study, for validation of self-reports in two studies and as a predictor in an epidemiological study.

The aim of Paper I was to identify factors at the workplace that created good and bad psychosocial work characteristics. Five cases with deteriorated work characteristics over a period of six years were compared with four cases with improved work characteristics. We found differences in managerial and employee strategies between bad and good job cases. In the good job cases, managers had an active strategy with their subordinates, upwards in the organization and outwards in inter-organizational relations. An important characteristic among employees in good job cases was the use of collective strategies.

The aim of Paper II was to explore externally assessed demands and control for both women and men in each of the groups of the Job Demand Control model, which itself was based on self-reported data. Most comparative analyses of the JDC groups showed that external assessments corresponded to self-reports in the expected direction for both women and men. However, in the active job situation, external assessments deviated from self-reports in different directions for women and men. Women had more hindrances and less influence over their work, while the situation was reversed for men. It was concluded that associations between self-reported working conditions and health might be underestimated among women reporting an active job situation.

Paper III investigated whether self-reporting of psychological demands and control at work is as valid for psychologically distressed subjects as for subjects with psychological well-being. Results did not indicate any systematic differences between self-reported and externally assessed working conditions for respondents reporting different levels of psychological distress. It was concluded that over-reporting of work demands or under-reporting of work control is unlikely at the levels of psychological distress studied.

Paper IV studied the relation between externally assessed work characteristics and psychiatric disorders. Lack of instrumental support from colleagues and supervisors assessed as a hindrance to work performance, and deterioration in work characteristics during the past three years were associated with depression.

The ARIA method and theoretical framework used in this thesis are recommended for human resources departments and occupational health services aiming to identifying areas that need to be improved in order to create sustainable jobs.

*Keywords:* psychosocial work characteristics, exposure assessment, over-reporting, psychological well-being, anxiety, depression, work organisation, action strategies, action theory

# SAMMANFATTNING

Avhandlingen syftar till att undersöka hur frågor i arbetsmiljöenkäter fungerar i olika grupper, hur mer objektiva bedömda förhållanden är relaterade till psykisk ohälsa och hur bra och dåliga psykosociala arbetsförhållanden skapas.

För att besvara frågeställningarna i fyra delstudier har en metod för mer objektiva bedömningar av psykosociala arbetsförhållanden används. ARIA Arbetsinnehållsanalys och är ett teoribaserat intervju- och observationsinstrument med en handlingsteoretisk grund som beskriver arbetets innehåll, hinder och möjligheter ur ett externt perspektiv.

I delstudie I undersökte vi faktorer som bidrar till att skapa bra respektive dåliga arbetsförhållanden. Resultatet visade att en ledningsstruktur med samordnare och gruppleadare, enbart ekonomiska mål, en operativ istället för strategisk ledning samt anställda vars strategier präglades av ett personligt ansvarstagande var vanligt i de arbeten som försämrats. I arbeten som förbättrats hade arbetsledarna inte bara ansvar utan också befogenheter, chefer och anställda diskuterade och vägde in kvalitetsaspekter i målen för arbetet. I dessa jobb arbetade aktivt för att förändra bristande förutsättningar för arbetet, ofta gentemot aktörer utanför den egna organisationen. I de förbättrade jobben hade de anställda en kollektiv strategi att som innebar att det var arbetsgruppen som gemensamt avgränsa och genomföra arbetet.

I delstudie II och III undersöktes hur frågor i arbetsmiljöenkäter fungerar i olika grupper. Resultaten från delstudie II visar att kvinnor som beskriver att deras arbete innebär höga krav och samtidigt hög kontroll enligt Krav-kontrollmodellen, s.k. aktiva jobb hade enligt våra externa bedömningar sämre förhållanden än vad de själva rapporterade. Detta gällde inte männen i samma grupp. Det finns alltså en risk att sambandet mellan arbetsförhållanden och ohälsa underskattas bland dessa kvinnor. I delstudie III undersökte vi i vilken mån studier av sambandet mellan psykosociala arbetsförhållanden och psykisk ohälsa överskattas genom att nedstämda individer möjligen överskattar kraven och underskattar sina möjligheter till kontroll i arbetet. Resultatet visar att det inte tycks föreligga sådana felskattningar på grund av nedstämdhet.

Resultaten från delstudie IV tyder på att det inte bara är hur man upplever och värderar sina psykosociala arbetsförhållanden som har betydelse för psykisk ohälsa utan att även mer objektiva bedömningar av arbetsförhållanden påverkar hälsan. De som inte får instrumentellt stöd i arbetet, dvs. hjälp av arbetskamrater och chefer när de behöver för att kunna utföra sina arbetsuppgifter löper en betydligt större risk för att drabbas av depression än de som får sådant stöd. Det är alltså inte bara det sociala klimatet som har betydelse utan även hur arbetet är organiserat. Även försämrade arbetsförhållanden tycks öka risken för depression.

Metoden som används i avhandlingen beskriva arbetsförhållanden för individer på ett mer objektiva, icke känsloladdat sätt. Metoden kan användas av företagshälsovården och företagets personalavdelningar vid kartläggningar för förändringsarbete och i rehabiliteringssammanhang för att skapa hållbara arbetsförhållanden.

*Nyckelord:* psykosociala arbetsförhållanden, exponerings bedömning, överrapportering, nedsatt psykiskt välbefinnande, ångest, depression, arbetsorganisation, handlingsteori.

## LIST OF PUBLICATIONS

This thesis is based on the following papers, which will be referred to in the text by their Roman numerals (I-IV)

- I. Waldenström, K., Härenstam, A. How are good and bad jobs created? Case studies of employee, managerial and organizational factors. *Submitted*
- II. Waldenström, K., Härenstam, A. Does the job demand-control model correspond to externally assessed demands and control for women and men? *Scandinavian Journal of Public Health, in press*
- III. Waldenström, K., Lundberg, I., Waldenström, M. Härenstam, A. and the MOA Research group. Does psychological distress influence reporting of demands and control at work? *Occupational and Environmental Medicine* 2003;60:887-891.
- IV. Waldenström, K., Ahlberg, G., Bergman, P., Forsell, Y., Stoetzer, U., Waldenström, M., and Lundberg, I. Externally assessed psychosocial work characteristics and diagnoses of anxiety and depression. *Occupational and Environmental Medicine, in press*

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## LIST OF ABBREVIATIONS

ARIA	An acronym derived from the Swedish expression for work content analysis - Arbetsinnehållsanalys
CI	Confidence interval
e.g.	for example (exempli gratia)
i.e.	that is (id est)
MOA	Modern work- and living conditions for women and men (research project)
MUSIC	Musculoskeletal Intervention Centre (research project)
n.a.	not applicable
NYK	Nordic Occupational Classification [Nordisk yrkesklassificering]
OR	Odds Ratio
PART	Psykisk hälsa Arbete och Relationer - an acronym derived from the Swedish name for Psychiatric disorders, work and relations (research project)
SCB	Statistics Sweden [Statistiska centralbyrån]

The concepts 'work characteristics' and 'working conditions' are mixed in the text and have an equivalent meaning. The best concept to describe externally assessed conditions used in this thesis is 'characteristics' because 'conditions' includes broader aspects such as social climate and job security which we did not assess externally.

## BACKGROUND

Working life and its conditions are powerful determinants of health, both positively and negatively (Levi 2002). Psychosocial working conditions are of growing interest mainly because the increasing prevalence of mental illness in the working population. Psychiatric disorders and psychological distress constitute an increasing part of the ill health behind sick-leave and early retirement in Sweden and several other countries in the EU (Üstün, Ayuso-Mateos et al. 2004). In occupational health research psychosocial conditions have also been shown to be important for different somatic health outcomes, such as cardiovascular disease (Peter, Siegrist et al. 2002; Kuper and Marmot 2003) and musculoskeletal disorders (Bongers, de Winter et al. 1993; Hoogendoorn, van Poppel et al. 2000).

A feasible and cost-effective method for studying working conditions and their relation to ill-health is the self-administered questionnaire. As a consequence, the vast majority of psychosocial research is based on self-reports. There is an ongoing discussion on what these self-reported methods intend to and actually measure - the appraisal or the actual conditions and if these self-reported measures are reliable in different sub-groups.

It has been shown that persons with a high level of pretension are less satisfied with their work environment than would be expected according to the actual conditions, while persons with a low level of pretension are more satisfied than expected (Björkman and Lundquist 1981). In this debate it has been proposed that more objective measures should be used in assessing the exposure at work (Kasl 1987; Frese and Zapf 1988; Kristensen 1996; Kasl 1998).

Another question is to what extent more objective conditions are related to illness or if it is the appraisal of the situation that is of importance for ill health. In order to reduce potential bias from common method variance when exposure and outcome are based on self-reports the use of more objective data has been suggested (Kasl 1987; Frese and Zapf 1988; Kristensen 1996; Kasl 1998)

Objective measures are only able to identify potential stressors, because they need to be perceived and appraised as stressful in order to become a stressor. Empirically, it is not easy to differentiate the aspects of the stress process; the objective stressor, the stress perception and the appraisal. However, as Frese & Zapf state, it is useful to conceptually keep the different parts of the process clear, even if the empirical work is much messier (Frese and Zapf 1988). They have formulated the importance of more objective measures in psychosocial research:

*'Theory and research is driven by what we want to explain and what we want to do practically. Thus, if one's primary concern is to change people's conception about stress, it is legitimate to rely only on perceptions of stressors. However, if we want stress research to contribute to job design we need an answer on how we can develop work in such a way that there is no long-term psychological damage'* (Frese and Zapf 1988).

Accordingly, there are methodological reasons for using more objective measures and it can be questioned to what extent commonly used questionnaires are reliable for the various sub-groups studied. One question is if questionnaire items developed for men decades ago are relevant for women's work of today? Another question concerns the risk for common method variance in studies using self-reports on both exposure and outcome, especially in studies of psychological well-being.

Proposals for more objective measures have also concerned issues of job design. Through the comprehensive occupational health research of the past decades we know a lot about what characterizes good and bad working conditions. There are several methods for assessing work characteristics that enhance personal development and delimit alienation (for an overview see Kompier (Kompier 2003), but how those conditions are created at the workplace has been less studied. In order to prevent adverse working conditions and promote sustainable working conditions within an organisation we need to know what factors are involved in these processes.

The general aim of this thesis was to add knowledge to the area of measurement issues of psychosocial work characteristics and job design by using a more objective methodological approach.

## **MORE OBJECTIVE MEASURES - EXTERNAL ASSESSMENTS**

In this thesis more objective measures do not mean a description of the truth. A theory-guided non-emotional description has been used that is independent of the specific individuals' social or cultural frame of reference. This is why our research group preferred to label our methodological approach *external*, i.e. the work characteristics as seen from an external point of view.

Frese & Zapf described different conceptualizations of the term objective and subjective used in the literature (1988). They concluded that in the tradition of action regulation theory the concept objective is referred to as not being related to one specific individual's perception whereas subjective is tied to one individual's cognitive and emotional processing (e.g. perceptions and appraisals). Thus, to be unfairly rebuked by a supervisor is a non-material yet objective event. The conceptual trick of discriminating between subjective and more objective is to think of an average person's cognitive and emotional processing. What would an average person's reaction to this be? The average person's stressor is not related to the concrete individual's cognitive and emotional processing (Frese and Zapf 1988).

There are several ways to measure more objective conditions. Each measure is influenced both by method variance and by true variance. Therefore, no method can a priori be assumed superior (Semmer and Zapf 1989). One method is to assign to all workers with the same job title *the average value* of the self-reported levels of the particular stressor. However, individualized work design sets limits to the method of group data used as there might be fewer and fewer cases where people are performing the same tasks. By using crude titles, actual differences between individuals within a group are ignored and the real associations between job characteristics and health

endpoints will be underestimated (Kasl 1987; Frese and Zapf 1988; Kristensen 1996; Kasl 1998; Kasl and Jones 2003). Most occupational titles cover a broad range of specific jobs with different psychosocial working conditions. Furthermore, because occupational titles explain a fair amount of variance in some dimensions (decision latitude) and less in others (psychological demands and supervisor support) this strategy seems appropriate for some dimensions and not for others (Karasek and Theorell 1990; Bultmann, Kant et al. 2001; Ostry, Marion et al. 2001).

Another measure of more objective conditions is *external assessments of job characteristics* and includes several methods: One is assessments of individual jobs by supervisors or worksite observations conducted by trained observers where actual job behaviours and workings are measured in real time. If these assessments of different experts do not refer to the same concept about stress factors but instead apply to their individual concepts, the same measurement problem that affects self-reports is transferred from the worker to the expert (Landsbergis, Theorell et al. 2000).

To overcome these limitations another type of external assessment can be used; *theory-guided observational interviewing*. This is performed at the worksite by an analyst who is trained in the application of the theoretical framework. Theory-guided observational interviewing at the worksite, by trained analysts, is better able to abstract from feelings and appraisals related to the workplace than self-reported questionnaires completed by incumbents engaged in a work situation every day (Greiner, Krause et al. 2004). In theory-guided interviews, analysts are not restricted to obtaining the necessary information by worksite observations only, but can also use self-reports and archival data. The analyst serves as a translator from observations and self-reports to theory and definitions. Only a few theory-guided observational instruments have been developed and validated in epidemiological studies with explicit health outcomes.

Probably the most used theory-guided observational instruments are the VERA and RHIA measures which have been developed in Germany and are based on action regulation theory (Hacker 1982; Volpert 1982). Other comparable measures are ISTA (Semmer, Zapf et al. 1995) TDS (Rau 2004), and WEBA (Schouteten and Benders 2004).

Studies using theory-guided observational instruments have found associations with several outcomes. Externally assessed stressors were associated with work accidents (Laflamme and Friedrich 1993; Greiner, Krause et al. 1998), patient safety (Elfering, Semmer et al. 2006), several health indicators (Leitner and Resch 2005), musculoskeletal disorders and pain (Vingård, Alfredsson et al. 2000; Greiner and Krause 2006), psychosomatic complaints (Greiner, Ragland et al. 1997), well-being (Grebner, Semmer et al. 2005), sickness absence (Greiner, Krause et al. 1998), hypertension (Greiner, Krause et al. 2004; Rau 2004), and coronary heart disease (Bosma, Marmot et al. 1997).

### **VERA and RHIA**

The history behind the method used in this thesis begins in 1990 when our research unit was preparing a study on causes of musculoskeletal pain, the MUSIC/Norrtälje-study. Methods for more objective measures of the psychosocial exposures at work were needed and VERA (Volpert, Oesterreich et al. 1983) and RHIA (Leitner, Volpert et al.

1987) were such methods. VERA identifies person-independent task related cognitive requirements conducive to personal development. RHIA measures strain-inducing task requirements which include work barriers, time pressure, time binding, and monotonous work conditions. VERA and RHIA were designed to assess work characteristics in industrial work and the handbooks and manuals for industrial work had been translated into Swedish by Friedrich and colleagues (Friedrich and Larsson 1990; Friedrich, Larsson et al. 1991)

VERA and RHIA are based on action regulation theory. This theory addresses how humans, by concrete actions, interact with the world around and change it according to their goals. Working conditions, which hinder the achievement of results or require an increased expenditure of energy thus increasing the stress for the worker, are considered as regulation hindrances. In 1970 both Hacker ('Allgemeine Arbeits- und Ingenieurpsychologie') and Volpert ('Sensumotorische Lernen') published the theoretical foundations for action regulation. Later, for example, Frese and Zapf described the theoretical foundations in English (Frese and Zapf 1994).

The theory of action regulation attempts to describe the mental structures of human actions, i.e., goal setting, generation of action plans, performance and evaluation of goal attainment in order to set new goals. Action regulation is a description of actions built into chains, where each action is considered as a part of a comprehensive endeavour to attain a certain goal in hierarchical structures. (Greiner and Leitner 1989). The theory proposes that stress or limitation of human development at work is due to 'partialization of action' i.e. tasks that do not require all steps in the action process and are described as incomplete tasks (Volpert, Oesterreich et al. 1983). Incomplete tasks lack the possibility to develop appropriate methods, try them out and change them. Division of labour generates work tasks that in themselves are worthless. The action regulation theory also maintains that human actions are regulated at different levels depending on what types of mental resources are required. According to action regulation theory, the type of action regulation used in the work is correlated not just to the work tasks, but also to the knowledge, experience, and intentions of the working person. This means that the same work task can mean different cognitive requirements for different people.

## **ARIA**

As our aim was to assess work characteristics in a population-based study, the VERA and the RHIA instruments were adapted to be applicable to all types of occupation. Accordingly, our instrument was slightly simplified in order to be suitable for interviews. The initial version of our instrument, which is a modified version of VERA and RHIA, was used for interviews in the MUSIC-Norrtälje study (Waldenström, Josephson et al. 1998; Vingård, Alfredsson et al. 2000; Wigaeus Tornqvist, Kilbom et al. 2001; Waldenström, Theorell et al. 2002). ARIA was revised and further developed in the MOA study where we had the opportunity to make observations of the work activities at the workplace. According to the experience of a third study, the MOA-follow-up the instrument was revised to include a more thorough examination of work goals. Some years ago our method was given the name ARIA, which is an acronym derived from the Swedish expression for work content analysis.

Besides the simplification and the adaptation to all types of occupation there is a difference between VERA/RHIA and ARIA. The ARIA instrument is not person independent as are VERA/RHIA, but is independent of both emotion and individual frames of reference regarding work characteristics. In ARIA each individual is studied, not only the work tasks per se. The assessments are related to personal knowledge and experience. The differences between ARIA and VERA and RHIA are further described in the Method section.

Assessing the work characteristics of an employee raises the question of what is to be assessed, i.e. what is expected to be included in the work assignment of each employee? Work seems to become increasingly regulated in some sectors of working life (Giertz 2000) and less regulated in others (Sandberg and Targama 1998). The result of the latter is that the employees' understanding of the job – the work assignment – becomes more significant with regard to what the work will entail. As a consequence, organizational goals and resources do not solely predetermine the work content. The work content is shaped in a complex process of interactions between the employees' own experience of the job, personal competence and by how they relate to their work as well as by colleagues, organisational factors and leadership.

If we are to understand actions at work, we should thus study the employee, the organization, and the existing objectives and actions. It is meaningful to differentiate between an assigned task and how it is understood and performed by the employee. An action is an interactive process between the individual's anticipation about the outcome of an action in the specific situation and the results of this action. People develop goals when they create tasks and when they perform tasks formulated by others (Hackman 1970; Hacker 1982; Frese and Zapf 1994). The assigned task is thus the starting point for work actions and the task is the interface between the employee and the organization. According to action theory human actions are rational and deliberate, based on goals and evaluations of the consequences of the action (Leitner, Volpert et al. 1987; Frese and Zapf 1994).

The action theoretical approach is a theoretical perspective which includes several theoretical traditions. This research approach studies the way people act according to their beliefs in order to achieve the best overall outcome and is used in several disciplines (Edling and Stern 2003). This thesis is a part of the sociological or social psychological tradition where obstacles to action and room for action are studied. In this field the differentiation between subjective and objective room for action is of interest (Aronsson and Berglind 1990). A study guided by an action theory perspective, involves analysing how hindrances and possibilities in the organization interplay with what the individual perceives is possible both among employees and their managers.

### **How are good work characteristics created?**

What people do at work depends on what is possible to do in order to gain the best outcome with the given prerequisites. If we can identify the perceived goals, action strategies among employees and managers, and describe the given conditions in the organisation we will be able to identify why people are doing what they are doing at

work and possibly better understand why jobs become good or bad. It will probably be preferable to use an external perspective for assessing the conditions and strategies used to produce these conditions because this information is probably valid for several employees at the workplace, whether they like it or not.

- 1) *This thesis will explore what employee and managerial strategies and what organizational and employee conditions are involved in the creation of sustainable and adverse working conditions assessed externally.*

## **SELF-REPORTED MEASURES**

The most commonly used method for assessing psychosocial work characteristics in occupational health research is the Job Demand Control (JDC) model developed by Karasek in 1979 (Karasek 1979). One of the main thoughts with the JDC model is that neither high demands nor low control alone are the source of ill health. It is rather the interaction of high demands and low control that is harmful to health, personal development and productivity in the organisation. The JDC model posits that the high-strain situation (high demands/low control) is associated with a high risk of poor health, while active (high demands/high control) and passive (low demands/low control) work is associated with an average risk of poor health, and low-strain (low demands/high control) work is associated with better-than-average health status (Karasek and Theorell 1990).

The JDC model is based on stress theory. The model implies that high job demands in combination with low job control are strain inducing and cause stress reactions. Stress theory has dominated the occupational health research on work-related causes to psychological ill health. Stress theory originate from Selye's research on physiological processes (Selye [1936] 1976). The physiological processes of stress increase somatic problems. The psychological processes (perceptions, appraisals, coping strategies and personal prerequisites) were initially described by Lazarus in 1966 (Lazarus and Folkman 1984): A person estimates the threat and the possibility to manage the situation. If the situation is perceived as threatening the next step is to find coping strategies; either in terms of avoidance or changing the situation or by changing the levels of expectation or re-evaluating the threat by defence mechanisms such as denial of the threat. The stress process as well as the coping strategies may influence self reports of the stressors. As a consequence, a common interpretation problem in psychosocial work environment research is whether negative working conditions are correctly reported, over reported or denied (Theorell and Hasselhorn, 2005)

Stress theory and action theory are two scientific approaches to the study of how humans interact with their environment. In both theories the environment interacts with the person and affects long-term personality evolution. Stress inhibits learning and learning inhibits stress (Volpert, Oesterreich et al. 1983; Karasek and Theorell 1990). The reaction of psychological strain (fatigue, anxiety, depression and physical illness) occurs when the psychological demands of the job are high and the worker's decision latitude in the task is low (the strain hypothesis). When the control of the job is instead high and psychological demands are also high but not overwhelming, learning and

growth are the predicted behavioural outcomes (the active learning hypothesis) (Karasek and Theorell 1990).

The JDC aims to measure more objective work characteristics but as the data are self-reported in questionnaires these instruments inevitably measure the job characteristics as perceived by the worker (Karasek and Theorell 1990). Observational interviews have been recommended in the validation of self-reported measures by contrasting the two measures (Semmer, Zapf et al. 1996).

Studies that compare self-reports and expert assessments show in general that the concordance between self-reports and expert ratings is higher for decision latitude than for job demands (for an overview see (Theorell and Hasselhorn 2005)). Theorell and Hasselhorn found higher correlations of demands among blue-collar workers than among white-collar workers. Blue-collar workers rated their decision latitude systematically higher than did the experts (Theorell and Hasselhorn 2005). There is less knowledge about the concordance between expert assessments and self-reports for the interaction of these dimensions, i.e. high strain, active, low strain and passive jobs.

As already stated, self-reports are a valuable tool in occupational health research and these measures need to be reliable for all sub-groups studied. In this thesis, two issues concerning sub-groups are raised. The first concerns gender differences. Occupational health research using the JDC model has been better in explaining causes of ill-health among men than among women and there have been suggestions that it is domestic responsibility that causes ill health among women rather than working conditions. A second factor that has been discussed is distorted reporting, e.g. due to the personality, mood or health status of respondents.

### **Valid for women's work?**

There is an unresolved issue why research results differ between men and women and why findings for women are sometimes different from those expected. In a review of 20 years of empirical research, van der Doef and Maes (van der Doef and Maes 1999) state that in a relatively large number of female samples, no support was found for the strain hypothesis, whereas in male or mixed-gender samples, high strain was associated with decreased general and job-related well-being. Several studies have found that among women, illness or sick leave is as common in active jobs as in high-strain jobs (Vahtera, Pentti et al. 1996; van der Doef and Maes 1999; Krantz and Östergren 2002; Vikenmark and Andersson 2002; Eaker, Sullivan et al. 2004; Lidwall and Marklund 2006). In a ten-year prospective cohort study, coronary heart disease was found to be more common among women reporting an active rather than a high-strain work situation (Eaker, Sullivan et al. 2004). Several explanations for these findings have been suggested. A recurrent explanation is that unpaid work among women is an important factor for these different health outcomes but little attention has been paid to whether there are differences in the work characteristics among women compared to men not captured by the JDC model.

- 2) *This thesis will explore to what extent the JDC model reflects more objective measures of demand and control equally well among men and women by comparing externally assessed individual work characteristics in the four groups of the model, i.e. high strain, active, low strain and passive jobs. A specific question is to explore why health conditions among women with active jobs have been shown to be as bad as among women in high strain jobs in some earlier studies.*

### **Valid for distressed?**

Despite less consistent results for women, there is considerable evidence that self-reported high demands, low control and low social support are related to psychological distress (van der Doef and Maes 1999). One problem with self-reports of environmental conditions by questionnaire might be the triviality trap (Kasl 1987). The triviality trap exists if the outcome distorts the exposure measures in epidemiological studies, resulting in an overestimated relation between exposure and outcome. Workers with poor psychological well-being might report more job stress than workers with good health at the same objective exposure levels. It is known from cognitive psychology that recollection of material is more efficient when it is congruent with current mood (Bower 1981; Jorm and Henderson 1992). Several studies have controlled for possible over-reporting in cross-sectional studies when only self-reported data on psychosocial factors at work are available, by adjusting for negative affectivity (Watson, Pennebaker et al. 1987). However, controlling for affectivity may in fact reduce true variance due to that negative affective persons holds more adverse jobs (Spector, Zapf et al. 2000). Still, distressed people may report less favourable demands and control conditions than those with normal mood and introduce bias in self-reported work characteristics.

- 3) *This thesis will address the issue of possible distorted reporting by comparing comprehensive observations of individual work characteristics with self-reported psychological demands and job control among those with and without self-reported psychological distress*

### **PSYCHOLOGICAL ILLNESS**

Psychological distress as described above is a self-reported indicator of lowered psychological well-being. More objective measures of mental illness as the outcome are clinically assessed depression and anxiety. Depression and anxiety are two common disorders and the risk of suffering from an affective syndrome once or more during a lifetime is more than 20 per cent among men and 40 per cent among women according to Swedish surveys (Ottosson 2004).

A limited number of studies have investigated work characteristics in relation to diagnoses of depression or anxiety. Three of these studies were longitudinal (Bromet, Dew et al. 1988; Wang 2005; Ylipaavalniemi, Kivimäki et al. 2005). They are all based on self-reported working conditions. These studies support the importance of social support from supervisors and co-workers as an important aspect for preventing mental

illness. Bromet and colleagues also found that high demands increased odds ratio for depression (Bromet, Dew et al. 1988).

There are problems of subjective measures even with longitudinal designs. One is that we do not know much about the time course of cause and effect. There are different exposure time models, for an overview see Frese & Zapf, 1988. One of them is the adjustment model. The adjustment model can be described within Lazarus' theory (Lazarus 1966): One develops coping strategies toward the stressors (e.g. denial or help seeking) which reduce ill-health. In this case, external assessments are able to identify remaining stressors, regardless of how they are coped with.

- 4) *This thesis will examine if psychosocial work characteristics were related to diagnoses of depression and anxiety in a study where work characteristics were externally assessed in a face to face interview.*

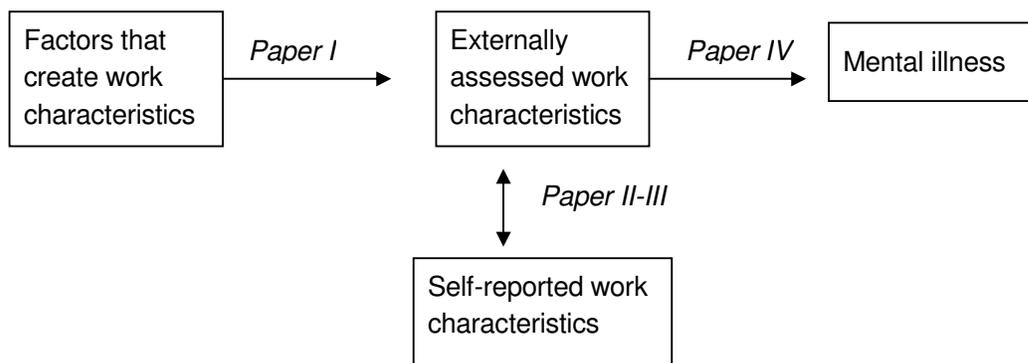
## AIMS

The overall aim of this thesis was to study how externally assessed psychosocial work characteristics were created and related to self-reports and to mental illness.

The specific aims were -

- I. to identify conditions and strategies at the workplace that create good and bad work characteristics
- II. to explore externally assessed demands and control for women and men in different groups of the JDC model, which itself was based on self-reported data.
- III. to investigate whether self-reports of psychological demands and control at work are as valid for psychologically distressed subjects as for subjects with psychological well-being.
- IV. to investigate if psychosocial work characteristics were related to diagnoses of depression and anxiety in a study where psychiatric diagnoses were obtained in a face to face interview and where work characteristics were externally assessed.

**Figure 1.** The different parts of the empirical investigations in this thesis and how they are related.



## MATERIALS AND METHODS

Papers II and III are based on data from the MOA Study. Paper I is based on the MOA study follow-up, while paper IV is based on data from the PART Study. The data were collected during 1995-2003 (1995-1997 for Paper II and III, 1998-2003 for Paper IV and 1995-2003 for Paper I).

A list of papers published from the MOA Study and the PART Study can be found on the website [www.phs.ki.se/occupmed/research/publications.htm](http://www.phs.ki.se/occupmed/research/publications.htm).

### THE MOA STUDY

MOA is an acronym in Swedish for 'Modern work and living conditions for women and men'.

The MOA Study was a multidisciplinary study aimed at developing methods for epidemiological studies. The design of the main study was cross-sectional, with data being collected between 1995 and 1997 in five Swedish counties. The study group was selected so as to obtain large variation in working conditions. Factors assessed in the workplace included organizational, social and psychological conditions, physical workload, and the chemical and physical environment.

The study group was selected by means of a stepwise selection process using current statistics and reports relating to different branches of the Swedish labour market, and to conditions within different occupations (Härenstam, Ahlberg et al. 1999; Härenstam, Karlqvist et al. 2003). The selection process followed three steps:

1. Selection of occupational groups fulfilling at least one of the following criteria: groups typical of the majority of the Swedish labour force; groups utilizing new forms of organization or production; groups with either extremely good or extremely poor health.
2. Selection of worksites to achieve variation in employers (private or public), size and geographical location (urban or rural).
3. Selection of individuals for variation in work tasks, work position, qualification levels and terms of employment.

A gender perspective was central to the study and whenever possible females and males with the same occupation and work site were chosen. Efforts were made to match genders for similar positions at each workplace. We succeeded in pair-wise matching two-thirds of the sample by gender, type of work (working with people, things, or data, according to Kohn and Schooler (Kohn and Schooler 1983)), and qualification level (according to socioeconomic categories), including the 62 men and women who were also matched in terms of workplace. The study group was comparable to a population-based sample (SCB [Statistics Sweden] 1996) according to the distribution of socioeconomic groups and types of occupations (Härenstam, Karlqvist et al. 2003).

The requirements of the final selection was an even distribution of men and women and an even distribution in age, level of education and type of work between females

and males. Of approximately 8 000 employees at 80 worksites, 102 women and 101 men were selected and went on to participate in the study. The sample covered 85 occupational titles.

The MOA Study received financial support from the Swedish National Institute of Public Health, the Swedish Council for Work Life Research, Stockholm and Örebro County Councils, the Swedish Council of Research, and the National Institute for Working Life.

### **The MOA Study follow-up**

In 2002-2003 a follow-up of the MOA Study was conducted. For each subject the follow-up was about 5-7 years after the initial data collection. A strategic sample of 18 employees and their managers was selected from the MOA project study group. These employees had worked in the same organization for a period of approximately six years but not necessarily with the same tasks. The sample was designed to reflect various general work activities, according to the Things, Data, People taxonomy (Kohn & Schooler 1983), qualification levels, and types of organizations and activities (Giertz, 2000; Härenstam et al, 2005). This sample was made up of 10 men and 8 women in various life phases. Out of these 18 employees, 9 were chosen that had either clearly deteriorated and adverse psychosocial working conditions or improved and good conditions according to a second job analysis in comparison to the first one at baseline. The selection was made to enhance comparison of two categories of cases with clearly different work situations in order to identify differentiating patterns. The nine excluded cases showed less clear changes in working conditions over time. The nine selected employees worked in nine different organisations. The sample includes both public and private organisations within different types of operation such as public prosecution office, hospital clinic, elderly care home, child care, transportation, retail trade, manufacturing industries, public administration and computer consultants.

### **THE PART STUDY**

PART is an acronym derived from the Swedish name for psychiatric disorders, work and relations. The PART Study is a population-based study of mental health in Stockholm County. The first data collection was made in 1998-2000. The study population includes 19 742 randomly selected Swedish citizens 20-64 years of age residing in Stockholm County. The study population was asked to complete a questionnaire containing questions on potential risk indicators for psychiatric disorder as well as scales to measure well-being, depression and anxiety. A total of 10 441 returned the questionnaire. Thus the response rate was 53% (58% among women and 48% among men). Participation was higher in the oldest age-group among both men and women. An analysis of the effects of non-response in the first phase showed that male sex, young age, low income, low education, living alone, immigrated from non-Nordic countries as well as previous admissions to hospital due to psychiatric diagnoses were associated with lower participation rates. However, the associations between potential determinants of psychiatric disorder and the psychiatric disorders as assessed

by odds ratios were remarkably similar among participants and in the entire material (Lundberg, Damstrom Thakker et al. 2005).

A second questionnaire was sent in 2001-2003 with basically the same questions as in the first questionnaire. This time 84% responded, which corresponded to 8 613 individuals. The attrition was associated with the same conditions as in the first phase (Bergman, Lundberg et al. Manuscript).

In conjunction with our second questionnaire participants were selected for an interview. Four hundred and forty-four individuals were selected because of low well-being, defined as  $\leq 10$  points in the WHO (Ten) Well-being index, and 437 were selected because of high well-being defined as  $> 10$  points in the same index. In the first phase of this study we found that this limit was associated with an increased risk of psychiatric disorder (Forsell 2004).

## **SUBJECTS**

The subjects in Paper II and III comprised the MOA Study sample, while the subjects in Paper I comprised a smaller sample, selected for the follow-up. Subjects in Paper IV were those who were interviewed in the second phase of the PART Study.

### *Paper I*

Out of 18 employees, two groups with clearly different work situations were selected for an in-depth analysis in order to enhance the opportunities to see differentiating patterns. The analysis was based on 9 cases. The employee and his/her organization, and a manager were considered a case. Five cases were assessed as bad job cases, all the employees were women. Four cases were assessed as good job cases, three employees were men and one was a women.

### *Paper II-III*

Paper II and Paper III were based on subjects from the MOA Study. The mean age among women was 38 years (range 20-61), and among men 39 (range 19-62). Their occupations covered 85 different job titles from the three-digit Nordic occupational classification (NYK), with 62 job titles among women and 63 job titles among men.

The study in Paper II was based on 91 men and 94 women who had answered all questions in the JDC model questionnaire.

The study in Paper III was based on 195 women and men who had answered on all the questions concerning control and 190 women and men who had answered all the questions concerning demands.

### *Paper IV*

Among the 881 subjects participating in the interview (selection described above), 672 (431 women and 241 men) were employed or self-employed at the time of the interview and had been employed or self-employed for more than two years before the interview. Data from these subjects were used in the analysis. This selection of subjects was done in order to exclude those who had been exposed to the work conditions for only a short time.

## **ETHICAL APPROVAL**

The studies in Paper II-III (Dnr 95-336), Paper IV (Dnr 96-260 och 01-218) and Paper I (Dnr 00-215) were approved by the ethical committee of Karolinska Institutet as being in accordance with ethical standards.

## **ASSESSMENT METHODS**

The thesis includes analysis with quantitative (II-IV) as well as qualitative (I) methods. Paper I was a qualitative longitudinal case study and Paper IV was a case-control study with longitudinal components. Papers II and III were methodological studies comparing two types of measurement.

### **Work content analysis - ARIA**

The common denominator for all the four papers is the ARIA method. ARIA was used for assessment of work characteristics in comparison to self-reported measures of demands and control (Paper II-III), as the exposure (Paper IV), and as the outcome (Paper I).

#### *ARIA compared to VERA and RHIA*

ARIA is as described above based on the VERA (Volpert, Oesterreich et al. 1983) and the RHIA (Leitner, Volpert et al. 1987) instruments. In comparison to these protocols ARIA was modified to be applicable to all kinds of occupation and slightly simplified. ARIA should cover our need to be able to assess all types of occupations, while VERA and RHIA initially aimed to assess only industrial work. Accordingly, the dimensions have been somewhat changed.

The VERA instrument includes 10 levels of cognitive requirement which cover the cognitive requirements and the degrees of freedom for own planning of work tasks. VERA is quite finely calibrated at lower levels, which suited assessments of industrial work in 1970-80 but it did not suit a broad range of occupations in the late 1990's which were the target group for our analysis. Therefore, we returned to the action regulation theory of three main levels originally described by Hacker (Volpert, Oesterreich et al. 1983; Frese and Zapf 1994).

Degree of freedom in planning work tasks is included in the ten levels of cognitive requirement in the VERA instrument. We decided to separate the assessment of complexity of the tasks from the possibility to influence how to perform the work. This was done because even if a task is very complex, there might still be some scope for deciding how to perform the task or which tasks that have to be performed. Frese and Zapf, referring to Semmer, pointed out that jobs with high complexity and low control are particularly stressful, mainly because they lead to overload and responsibility (Frese and Zapf 1994) (Semmer 1984). Theoretically, control can be considered as the number of decision possibilities, complexity representing the number of decision necessities.

ARIA aims to assess the situation specific possibility to influence one's own conditions at work. Specific questions covering this aspect were developed. The aspects to assess cover control in and over the work, from a daily to a more long-term perspective, individually or collectively, are built on the concepts described by Aronsson (Aronsson 1989). After data collection in the MOA study the assessments of these aspects were transformed to a four-graded scale. This made it possible to compare them to the control dimension in the self-reported JDC model. We constructed a specific dimension to cover influence. The levels are quite comparable to other scales, such as the Procedural Degrees of Freedom Scale, TDS (Rau 2004).

RHIA differentiates between regulation obstacles, regulation uncertainty and overtaxing regulations (Greiner and Leitner 1989). These aspects are covered by ARIA but are somewhat restructured. Regulation obstacles such as interruptions or organizational constraints make action regulation more difficult – if not impossible. In ARIA these obstacles are assessed in the hindrances dimension, mainly in terms of lack of resources. Regulation uncertainty refers to uncertainties about how to reach the goal and include stressors such as lack of appropriate feedback, role conflicts and role ambiguity. In ARIA these aspects are assessed in the hindrances dimension, either in terms of lack of support from colleagues or superiors or in terms of unclear goals and work tasks. In the case of overtaxing regulation the speed and intensity of the regulation is the major problem. Typical examples are time pressure and requirement to concentrate - monotony. In ARIA, time pressure is assessed as well as required conformance to schedule, sometimes called time binding. Monotony is not a single aspect in ARIA but is covered by the dimension of cognitive requirements. Hindrances such as physical environmental factors are not assessed in ARIA because it aims to focus on psychosocial aspects.

Beside some differences in the dimensions studied, another important difference is that VERA and RHIA assess work tasks that imply that the worker is fully trained for the tasks. This is due to the fact that the assessment of the work tasks studied is independent of who is conducting them. Our aim was to assess not just the work tasks per se but the work characteristics given the specific individual with his or her specific knowledge and experience. This takes into account that the same work task can imply different cognitive requirements for different people. We aimed to study the specific worker in his or her position. This is because our purpose was to assess the actual work-worker relationship and its possible health related consequences. If only the work tasks per se is studied, one can not draw conclusions to what extent the work tasks are adjusted to the single employee.

#### *ARIA Procedure*

In Paper IV the data were collected by interviews with the participants at the research institution. In Paper I-III the data collection was a combination of observations at the workplaces and interviews both with the employee and with the employer. The observers had the unique opportunity to become familiar with the organization by means of interviews with representatives of the work organizations. Each studied person was usually observed at the workplace for one day of work by one of four trained observers who conducted the job analyses. The duration of this observation

depended on the variety and complexity of the work tasks involved. At several workplaces more than one person was studied. Thus, the observers visited most workplaces for more than one day. Accordingly the observers had information concerning the basic conditions of the observed job from supervisors and colleagues, as well as from the jobholders themselves. Interviews with the employees were conducted to gain information about work tasks and conditions that were not observable, to exclude assessing behaviour rather than conditions (Greiner, Krause et al. 2004; Leitner and Resch 2005) and to assess conditions that did not arise on the observation day. The observers were trained to ask the subject to be concrete and provide examples of situations related to the work characteristic that was to be assessed. The observers had frequent meetings to discuss experiences, difficulties estimating, and individual scores. This strategy was designed to minimize the differences in assessment criteria when applied to different types of occupations.

### *Studied dimensions*

To define what **work tasks** were included in the work assignment, each subject's work assignment was divided into different tasks and the relative proportion of time spent on each task was defined.

The components of each work task were classified according to their **cognitive requirements** into three categories: creativity or solving new problems, active use of occupational skills, and routine work or low cognitive requirements. At the routine level, actions are regulated more or less unconsciously and automatically; at the active knowledge level, actions are regulated consciously through established rules and knowledge; and at the creativity level the characteristic process is problem solving or planning new processes. According to action regulation theory all levels should be present in order to promote learning and development.

The participants were asked to describe what skills were needed to execute the task, i.e., 'When was problem solving and planning needed?' With this information it was possible to calculate the percentage of working time spent at each mental regulation level.

Several aspects of the **possibility of influencing one's work characteristics** were considered during data collection (e.g. what, how, where, and when to conduct specific work tasks). To achieve a variable that would be comparable from one type of occupation to another, the possibility of exerting influence was categorized into four levels (none, low, some, high). The lowest level did not allow the subject to choose between work tasks or how, where, and when they should be executed; schedule, breaks, and pace were set and the work was fixed not only in time but also place. The second level was much like the first, but the subject had the opportunity to exchange some work tasks with workmates or to change the order of some work tasks. The third level meant the authority to choose between work tasks and to make decisions as to how and when the work tasks should be done (at least during part of the day). At the highest level of influence regarding what to do, i.e., which work tasks would be included in the work assignment; the subject had long-term, but not always short-term control. In the PART study (Paper IV) the possibility of influencing one's work characteristics in a long-term perspective was considered. It was assessed to what extent one had influence over which work tasks were to be included in the work assignment (what to do) and to what extent one had influence over how to conduct the

tasks, (how to do it). Both these aspects were assessed in three levels; by my own, collectively, and other decides.

The quantitative demands in work were described by *time pressure*. If the work tasks could not be unattended for more or even fewer than agreed pauses, and this was not compensated with less hectic periods, the work was considered to entail high time pressure.

Qualitative demands were described by the *hindrances* dimension. When assessing hindrances, the observers followed a checklist covering several aspects of rules and resources and decided whether some of these aspects were present. The studied aspects were: unclear goals or work tasks; insufficient resources in terms of equipment, housing, and personnel; lack of support from supervisors or workmates necessary for job performance; work tasks unadjusted either to the subject's competence or to hindrances outside the work organization. The criteria for assessing hindrances were obvious loss of quality, considerable delay resulting in overtime work, work without breaks, and work executed with an apparent risk of accident or illness. It is necessary to have criteria that cover different ways to cope with hindrances, other than simply adding overtime. In some jobs it is impossible to extend work through overtime; instead you may intensify or lower the quality of work. The hindrances were considered to be severe if these criteria affected the performance of the work tasks for more than half of the workday, or work cycle. Disturbances, strain, or sources of irritation that not fulfil the criteria were not considered to be hindrances.

Subjects were asked to describe consequences of different action alternatives, e.g., 'What happens if you don't finish before you go home?' Accordingly, as in the studies by Leitner and Resh (Greiner, Krause et al. 2004; Leitner and Resch 2005), the observers had to look and ask for concrete realizations at the workplace for each of the theoretically-defined categories of hindrances to task performance. Furthermore, the observers had to verify that the hindrance was not a part of the task, verifying that there were no other ways of dealing with the problem (e.g., lowering the quality to still acceptable levels). The criteria for each category of the studied variables guided the final assessment.

Variable constructions of each dimension differ somewhat in each paper (Table 1). This is due to the aims of the different papers. In Paper II externally assessed measures were compared to self-reports. High and low demands and control respectively in these self-reported measures were defined according to the median, which is a common way to classify the JDC groups. The externally assessed variables have a stricter definition because we aimed to minimize the risk of misclassification because of uncertainty around the median. One example is the scale of possibilities to influence ones own conditions. The scale has four steps (1-4). Instead of using 1-2 compared to 3-4 we used the fourth level in Paper II. In Paper II the aim was also to identify rather high skill requirement and for both empirical and theoretical reasons the 10 per cent limit was chosen. In Paper III the purpose was to compare an index with creativity and influence to the self reported control index. Therefore, a scale with as normal a distribution as possible was created. In Paper I and in Paper IV the imbalance of cognitive requirement was used. These variables did not need to be comparable to self-reported values but rather follow the theoretical foundation of imbalance.

**Table 1.** Variable construction and cut-off points for the ARIA dimensions.

	I	II	III	IV
<b>Cognitive requirements</b> (mental demands)	High or low imbalance*	≥10% creativity	creativity in four levels	High or low imbalance*
<b>Possibilities to influence</b>	None, small	High	None, small, some, high	Decision on what/how Own, collectively, other
<b>Hindrances</b>	Some or severe (any type)	Severe (any type)	None, some, severe (any type)	Some or severe - goals & resources - lack of support
<b>Time pressure</b>	High	High	Low, moderate, high	Low, moderate, high
<b>Required conformance to schedules</b>	High	-	-	Low, moderate, high

\* (= high creativity combined with no routine, or no creativity combined with more than 50% routine work)

Frequencies of each dimension studied are presented in Table 2. Paper IV is based on a different sample than Paper I-III but the figures in the two samples were very similar.

**Table 2.** Frequencies (%) of the ARIA dimensions in the two samples.

		MOA (Paper II-III)			PART (Paper IV)		
		Men (101)	Women (102)	All (203)	Men (241)	Women (431)	All (672)
<b>Cognitive requirements</b>	low imbalance	15	13	14	11	9	10
	high imbalance	10	20	15	12	12	12
<b>Possibility to influence</b>	high	19	13	16	-	-	-
	Decision on what to do, own	-	-	-	19	13	15
<b>Required conformance to schedule</b>	high	21	19	20	18	19	18
<b>Time pressure</b>	high	27	35	31	15	24	21
<b>Hindrances</b>	any type (severe)	21	34	26	-	-	-
	-goals & resources (some or severe)	-	-	-	28	34	32
	-support from colleagues & supervisors (some or severe)	-	-	-	10	14	13

In Paper IV a variable measuring *deteriorated work characteristics* was created in order to study if negative changes in the ARIA dimensions during the study period affected mental ill-health.

## Job Demand Control Model

Perceptions of work characteristics according to the JDC model were obtained from a short Swedish version of the job content questionnaire, the DCQ, which was introduced in 1988 (Karasek and Theorell 1990; Theorell 1996; Landsbergis, Theorell et al. 2000). The Swedish version included five items concerning job demands (the demand dimension), four items concerning skill discretion, and two items concerning decision

authority (the control dimension). Four response categories for each question were available. In the MOA sample a reliability coefficient of the items (Chronbach's Alpha) was .761 for demands and .755 for control and can be considered as acceptable.

### Comparisons of externally assessed and self-reported conditions

The ARIA dimensions intended to capture demand-control conditions have been compared to the same dimensions in the JDC model by factor analysis of replies to the Swedish version of the Job Contents Questionnaire. The results showed that the dimensions of ARIA, on a group level, varied as expected with the comparable self-reported constructs in the JDC model (Waldenström, Theorell et al. 2002).

As self-reported job *demands* include words and phrases such as 'have to work very fast,' 'hard,' 'excessive work,' 'enough time to perform work tasks,' and 'conflicting demands,' external assessment of time pressure and hindrances were used as indicators of work demands. One dimension of *control*—authority over decision making—was measured by self-reported 'influence on how to perform work' and 'influence on what to do at work.' The corresponding external assessment of possibilities of influencing one's work characteristics was used in the analysis. The second dimension of control was skill discretion. Self-reported words and phrases indicating skill discretion were 'learn new things,' 'skill is required,' and 'creativity is required'. The corresponding assessment was the externally assessed amount of time engaged in creative work tasks.

In Paper II the analysis was to explore whether self-reports corresponds equally well to external assessments in all four groups of the JDC-model; the high strain, active, low strain and passive group. This means that there should be a high level of control (creativity and influence) according to the external assessments in the active and in the low strain group and there should be high demands (time pressure and hindrances) in the high strain and in the active group. The median was used as a cut-off point to reflect a commonly used method of dichotomizing demand and control. Index values of  $\geq 14$  were defined as high demands and index values of  $\geq 19$  were defined as high control.

In Paper III the index of self-reported demands was compared to an index measuring externally assessed demands consisting of time pressure and hindrances (Table 3). The index of self-reported control was compared to an index measuring externally assessed control consisting of the amount of creativity in work tasks and possibility of having influence (Table 3). The two items of demand correlated (Gamma) moderately (.474). The two items of control showed a moderate correlation (.576).

**Table 3** Min-max, median, mean and number of cases in Paper III.

	min-max	median	mean	n
Self-reported index of demands (5 items)	6-20	13	13.2	190
Self-reported index of control (8 items)	10-24	18	17.9	195
Externally assessed index of demands	6-18	12	12.4	203
Externally assessed index of control	7-28	14	16.2	203

## **Psychological distress**

In Paper III a group defined as psychologically distressed was compared with a non-distressed group. The subgroup of psychological distressed was identified by the General Health Questionnaire (GHQ-12) which measures psychiatric symptoms (Goldberg 1978; Lindsay 1994). Each response alternative contributes 1-4 points from each question to a summary index. The 12 items of the GHQ-12 were dichotomised and summed up. Among 202 subjects the mean value was 20.9, the median 20 and the range 14-39. Three or more symptoms were taken to indicate psychological distress. Eleven per cent of the men and twenty-one per cent of the women had three or more symptoms and were regarded as psychologically distressed.

## **Depression and anxiety**

The outcome measures in Paper IV were depressive and anxiety syndromes according to DSM-IV. Diagnoses were made using the SCAN (Wing, Babor et al. 1990) interview and assessed by a psychiatrist. The depressive disorders included Major Depression, Dysthymia, Mixed Anxiety Depression and Minor Depression. Anxiety disorders included, Agoraphobia, Social phobia, Specific phobia, Panic syndrome with agoraphobia, Panic syndrome and General Anxiety syndrome (APA 1994). Among the 672 subjects, 51 (14%) were diagnosed with depressive disorders, 103 (24%) were given anxiety diagnoses, and 236 (36%) individuals reported symptoms or psychological distress at baseline. There is a high prevalence of co-morbidity for depressive and anxiety disorders (Flint 2005). However, the two outcomes were studied separately in order to elucidate different risk factors.

## **Other factors considered**

In Paper IV, five potential confounders were included in the analysis; sex, age, self-reported financial difficulties, negative life events and self-reported symptoms of depression, anxiety or psychological distress.

Changed work characteristics may affect self-reports of current work characteristics if the changing conditions alter the worker's frame of reference or if the employee does not perceive the changed conditions. In order to measure changing conditions, *job expansion* over the past year was externally assessed in Paper II. Job expansion was defined as work tasks becoming more mentally demanding (more creative or less routine work tasks), more tasks being added or new tasks replacing old ones, by for example change in position.

In Paper II, *gender segregation* was measured both in the occupation and in the organisation, and *demands in private life* were considered taking into account responsibility for children and demanding domestic responsibilities.

## METHODS OF ANALYSIS

### Quantitative analysis

In Paper II the Pearson Chi-square test was used to determine whether differences (and similarities) in externally assessed work characteristics between the JDC groups were present among women and men, respectively. Because the relatively small sample was divided into several groups (2 × 4 - women and men in four different JDC groups) Fisher's exact test was applied with 99% confidence intervals to assess significant differences between the groups.

To determine whether differential misclassification was present in Paper III, psychologically distressed subjects were compared to subjects with less than three symptoms concerning the relation between self-reported and externally assessed work characteristics. Since the external data were more ordered than continuous, the non-parametric Spearman rank correlation coefficients ( $r_s$ ) with 95% confidence intervals were calculated.

In Paper IV, logistic regression analyses were performed in four steps: First, analyses of the relationship between each independent variable and the outcome were made. Second, multivariate analysis was performed with all work-related variables, which showed a p-value  $\leq 0.2$  in the first step, included. Third, the same work-related variables were included together with the non-work variables, which showed a p-value  $\leq 0.2$  in bivariate analysis. In a fourth step, symptoms of mental illness at baseline were added to the final model.

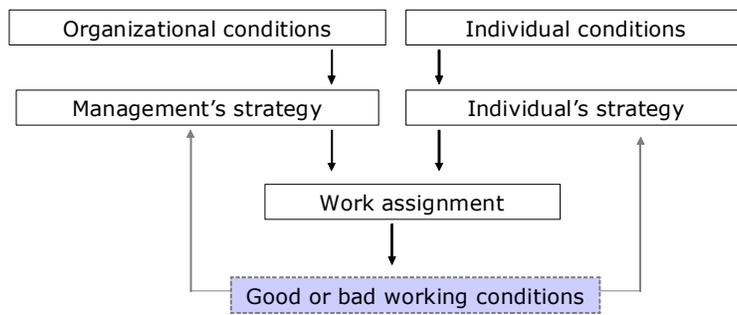
### Qualitative methods

In Paper I a qualitative approach was used to investigate how individual, managerial and organisational factors created good and bad working conditions.

#### *The conceptual model*

In order to describe the pattern of factors at the workplace that created good and bad jobs, the analysis was based on a conceptual model (Figure 2). The assumption behind the model is that employees as well as managers are individuals that act according to their goals and interact with their environment. This is described as action strategies in the model. In order to reveal how employee and managerial scope for action is used, action strategies are separated from employee and organizational conditions. The concepts in the model include *the work assignment* which was equated with the position and comprise factors related to the employee's formal position in the organization. *Employee action strategies* comprise the ways in which employees deal with their situation i.e. according to their assumption of responsibility. *Employee conditions* are individual prerequisites that may affect how the individual deals with the work assignment and includes personal level of education, sex, and age. *The management's action strategy* refers to the way management deals with the organizational prerequisites. *Organizational conditions* comprise ownership, business direction, size, workforce composition (gender distribution etc.), cost-saving imperatives, and the organization of work.

**Figure 2.** Model of how the individual's working conditions are created and also the guiding concept for the study.



### *Data collection*

Data were collected on two occasions (t1 and t2), 5-7 years apart. At t1 a work content analysis according to ARIA was performed of each of the employee's individual working conditions. At t2, the interview with the employee was divided in two parts: Questions were asked regarding what goals guided the employee actions and how he or she understood the scope of action in the job. The aim was to clarify how tasks were formulated by the employee and how they stood in relation to the employer's objectives. At the end of the interview changes in the dimensions of the work content according to ARIA were assessed. At both t1 and t2 the interview with managerial representatives dealt with organisational characteristics. At t2 the informants were also asked about the current goals in the organisation and if there was an imbalance between the organization's objectives and resources and how this affected work characteristics for employees.

### *Qualitative analysis*

The method chosen for data analysis is of a descriptive and explorative nature. It describes conditions and actions. The information about actions was taken from both employee and management interviews at t1 and t2. The classification of conditions and actions was made by the researchers.

The method of parallel case studies was inspired by the Pragmatic Case Study Method (Fishman 1999). In this method the researcher begins with an explicit theoretical or conceptual model. A pragmatic case study uses process indicators as a method to understand how the theoretical model works. The process indicators constituted pre-formulated question areas from the interview, but also factors that came up during the course of the semi-structured interviews. In order to study patterns in the cases, five analytical matrixes were designed, each corresponding to one of the boxes in the conceptual model (Figure 2). Comparisons between the bad and the good job cases in each of these matrixes were made in order to identify clear differences in the employees' and managers' descriptions of conditions and actions. The matrixes aimed to sort and visually support the qualitative analysis of the data and the interpretation.

Out of 18 cases, 9 with clearly different work characteristics between t1 and t2 were chosen for an in-depth analysis. Five cases were classified as having bad jobs. In *the cases with bad jobs* the employees had deteriorated work characteristics based on ARIA dimensions compared to the baseline as well as bad work characteristics at follow-up. Four cases were classified as having good jobs. In *the cases with good jobs* the employees had improved their work characteristics since the baseline study, and they had good work characteristics at follow-up. The categorization of good and bad is of course a simplification of both the results and reality. The cases should more precisely be described as having sustainable versus unsustainable working conditions from a health perspective.

## EMPIRICAL INVESTIGATIONS

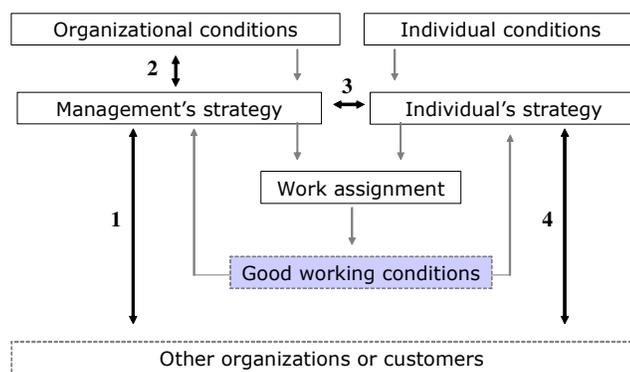
Four empirical investigations have been made in order to answer to each research question.

### HOW ARE GOOD WORKING CONDITIONS CREATED?

The research question in Paper I was: What organizational and employee conditions and what employee and managerial strategies are significant when good and bad jobs are created with regard to mental demands, influence, time pressure, required conformance to schedules, and hindrances?

The results show that employee, managerial and organizational factors seemed to be important in the process of creating working conditions. Two organizational conditions commonly referred to as important to working conditions; organizational changes and increased or streamlined production did not differentiate the good job cases from the bad job cases during the study period. Many of the conditions and strategies that differentiated between the good and bad job cases concerned strategies used by managers and employees. This observation indicated that there was scope for manoeuvre in the organization. According to our analysis, the creation of good jobs was also a matter of how given conditions and prerequisites were used. Managers' strategies *downwards* in the organization with their subordinates, *outwards* in inter-organizational relations and *upwards* in the organization were important in the creation of good jobs.

**Figure 3.** Model of how good jobs are created according to the results. The double arrows have been added to the original model (Fig. 1).



In order to visualize action areas that may be important in creating good jobs, the model designed for the interviews and analysis was supplemented with four links (labelled with bi-directional arrows 1-4 in Figure 3). In good jobs these links show that the management's action strategy incorporated stakeholder factors (1), which comprised both other organizations and customers. The active management strategy clarified agreed routines and through continual dialogue with the client or the other organization

feasible solutions to specific problems were provided. Management enhanced employees' working conditions by having an active strategy upward in the organization (2) and thereby influenced intra-organizational conditions. Performance measurements were used to obtain feedback on performed actions and were a basis to argue for increased resources in dialogue with higher management levels in the organization. In the other direction, higher management levels had a downward dialogue with middle management on the consequences of organizational prerequisites and changes of the same. The strategy of managers in the bad job cases was instead to be operative, to 'roll up their sleeves and jump in.' Unfortunately, this preserved the situation, as no one was working strategically to change conditions.

A third link is that between employees and their immediate bosses (3), where there was a dialogue about objectives and priorities. In both good and bad cases the employees expressed a clear work assignment, but employee and organizational objectives were less well matched in the bad job cases than in the good job cases. The employees in the bad job cases had objectives for their work that did not always coincide with available resources and management's objectives. The employee's objectives were adapted more to the customer's wishes than to the organization's resources. In bad job cases there was a general idea as to how equilibrium between objectives and resources could be achieved, but when management's vision was not concretized in dialogue with the employee, it was left to the employee to bring about that equilibrium. In order to adjust the work to the available resources, management wanted employees to work less carefully. In the good job cases there was no gap between the employee and the organizational objectives. Even if the organization was governed by resources also in the good job cases, the managers emphasized the underlying objective in terms of quality of work; it was not left to the employees to maintain this as it was in bad job cases. Employees in the bad job cases had an explicit commitment to the work and expressed a sense of personal responsibility. They took greater responsibility than was expected of them, which could be due to a strong sense of loyalty to subordinates or third parties. In good jobs the manager ensured that allocation of work was individualized, with respect to both what and how much would be performed. The fourth link (4) may be part of that dialogue. In this way, the employees were strengthened in their approach to customers. Thereby, the management strategy was active and strategic both inside and outside the organization. When it came to individual strategies, the employees in good jobs made use of collective strategies. In sum, shaping good jobs seems to need an organization and management that do not place the responsibilities on the individual employee and thereby undermine collective actions at the workplace.

Factors that create bad and good jobs respectively are summarized in Table 4.

**Table 4.** Factors that create bad and good jobs respectively

Factors that create <i>bad</i> jobs	Factors that create <i>good</i> jobs
<ul style="list-style-type: none"> <li>• <b>Formal goals concern quantity</b>; budget is put ahead of quality: 'Finances in balance...'</li> <li>• <b>Decentralised problem solving</b>, i.e. how to maintain quality with reduced resources</li> <li>• <b>Semiformal management structure</b>; supervision was delegated to 'coordinators' with low authority</li> <li>• <b>Short-term passive strategy for problem solving</b>; 'ad-hoc-solutions' instead of strategic solutions</li> <li>• <b>Vague collective responsibility</b>; 'everyone's' will easily become no one's responsibility</li> <li>• Employee's strategy characterized by <b>personal responsibility</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Financial and quality goals</b> for the business</li> <li>• <b>Performance measurements</b> as feedback</li> <li>• <b>Formal management structure</b></li> <li>• Manager creates viable <b>structural solutions</b> of <b>concrete problems</b> in the work tasks</li> <li>• <b>Management has a strategy</b> how to deal with <b>actors outside</b> the organisation</li> <li>• <b>Individualized allocation of work</b></li> <li>• <b>Clear division of responsibility</b>, who is in charge of what</li> <li>• <b>The team</b> takes common responsibility of delimiting and performing the work</li> </ul>

### ARE SELF-REPORTS RELIABLE FOR DIFFERENT SUB-GROUPS?

The following two papers aim to answer two questions concerning reliability of self-reports in sub-groups; women and men (Paper II) and distressed compared to non-distressed employees (Paper III).

### Does the job demand-control model correspond to externally assessed demands and control for women and men?

The aim in Paper II was to explore externally assessed demands and control for women and men in different groups of the JDC model, which itself was based on self-reported data. The results show that most comparisons between the groups among men and women respectively were in the expected direction, although not always statistically significant. Comparing the results for men and women there was a reversed pattern in the active job situation (Table 5). Women who reported an active job situation had more adverse conditions than men and they were more often employed in an organisation with mostly female staff and in a predominantly female occupation.

One possible explanation of the different patterns between women and men is that men in active jobs worked in organisations where there are opportunities to influence the work situation in order to reduce potential hindrances or to refuse new job tasks. The externally assessed high influence refers to influence over what work tasks were included in a work assignment in the long term. The adverse job conditions for women in active jobs may be a consequence of organisational conditions in a gender segregated labour market. Our results thus support the use of contextual conditions in terms of gender segregated organisations and occupations. Although women had more domestic responsibility than men, there were differences in work characteristics not reflected in self-reports.

The results indicate that the associations between self-reported working conditions and health might be underestimated among women reporting an active job situation. Our findings contribute to the discussion of why the results in some studies show that active jobs among women are as hazardous for health as high strain jobs.

**Table 5.** Externally assessed work characteristics (demands and control) among women and men in self-reported work situations according to the JDC model

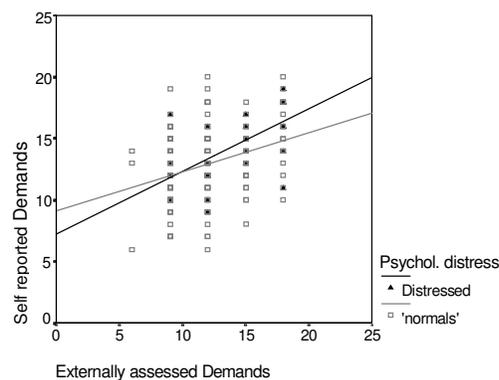
Externally assessed work characteristics		Self-reported work situation			
		HIGH STRAIN	ACTIVE	LOW STRAIN	PASSIVE
Time pressure	Women	41%	56%	16%	20%
	Men	37%	45%	18%	16%
Considerable hindrances	Women	36%	52%	16%	20%
	Men	37%	20%	15%	16%
High influence	Women	0%	22%	37%	3%
	Men	5%	40%	30%	0%
Creativity	Women	32%	52%	58%	7%
	Men	21%	65%	30%	12%

### Does psychological distress influence reporting of demands and control at work?

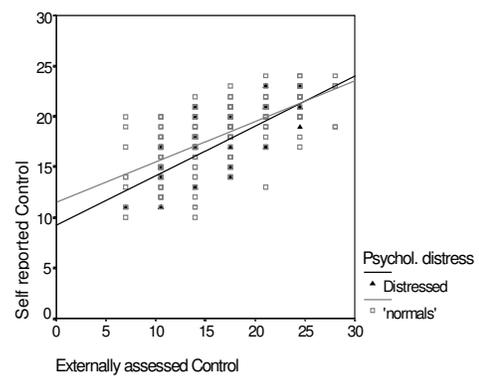
The aim of Paper III was to investigate whether self-reports of psychological demands and control at work are as valid for psychologically distressed subjects as for subjects with psychological well-being or if workers with poor psychological well-being report more job stress than workers with good health at the same objective exposure levels.

The results show that the concordance between self-reported and externally assessed demands (Figure 4) and control (Figure 5) did not differ between psychologically distressed and non-psychologically distressed subjects.

**Figure 4.** Association between externally assessed demands and self-reported demands for subjects with psychological well-being and subjects with psychological distress.



**Figure 5.** Association between externally assessed control and self-reported control for subjects with psychological well-being and subjects with psychological distress.



The correlation (Spearman) between self-reported and externally assessed work characteristics for psychologically distressed subjects was .594 for demands and .721 for control. The correlation coefficient for non-psychologically distressed subjects was .307 for demands and .658 for the control. The correlation coefficients for the two control dimensions separately (skill discretion and decision authority) did not differ from the coefficient for the summary control index.

It can be concluded that self-reports of psychological demands and job control at work are as valid for psychologically distressed subjects (at commonly occurring level of distress) as for subjects with psychological well-being. Accordingly, the risk of over-estimating the association between demands and control at work and psychological distress should be low in studies using the GHQ-12 as the outcome measure.

## **WORK CHARACTERISTICS AND MENTAL ILLNESS**

The aim of Paper IV was to investigate if psychosocial work characteristics were related to diagnoses of depression and anxiety in a study where psychiatric diagnoses were obtained in a face to face interview and where work characteristics were externally assessed.

The results show that hindrances concerning lack of instrumental support from colleagues and supervisors and deterioration in work characteristics during the studied period were related to diagnoses of depression also after adjusting for other potential risk factors outside work, and symptoms of mental illness at baseline. Financial difficulties, severe life events and symptoms of mental illness reported at baseline were also related to depression (Table 6). Separate analyses for the results for each sex were similar but with less precision due to the smaller number of subjects.

Most work characteristics were associated with an increased odds ratio for anxiety in bivariate analysis but did not remain statistically significant when non-work independent variables and symptoms of mental illness at baseline were adjusted for. Symptoms of mental illness at baseline, financial difficulties and being a woman were significantly related to anxiety in the final model (Table 6). When analyses for each sex were conducted the results were similar but with less precision due to the smaller number of subjects.

Lack of support from colleagues and supervisors was defined as a hindrance for satisfactory job performance, and could be an indicator of inappropriate work organization.

The results indicate that not only the emotional appraisal of the situation but also how the work is organized is related to diagnoses of depression.

**Table 6.** Multivariate analyses include variables in work, life and symptoms at t1 resulting in odds ratios showing the risk of having a depressive or anxiety respectively.

	<b>Depression</b>		<b>Anxiety</b>	
	Exposed cases	OR (95% CI)	Exposed cases	OR (95% CI)
Cognitive requirements in balance	36	1	71	1
low imbalance	5	0.4 (0.1-1.7)	15	0.8 (0.3-2.2)
high imbalance	10	1.2 (0.4-3.5)	17	1.2 (0.5-2.9)
Influence on what to do, own	6		11	1
collective	28		48	1.6 (0.6-4.5)
no	17		44	1.4 (0.5-4.3)
Influence on how to do it, own	18	1	34	1
collective	22	1.1 (0.4-2.6)	51	1.1 (0.6-2.5)
no	11	1.2 (0.4-3.6)	18	1.4 (0.5-3.9)
Required conformance to schedule low	13	1	36	
moderate	25	0.9 (0.4-2.3)	47	
high	13	1.0 (0.3-3.5)	20	
Time pressure low	7	1	25	1
moderate	24	2.0 (0.7-5.8)	52	1.6 (0.8-3.4)
high	20	3.3 (0.9-12.4)	26	1.3 (0.5-3.2)
Hindrances goals & resources	20	0.9 (0.4-2.0)	43	1.6 (0.9-3.1)
Hindrances support from colleagues & supervisors	20	<b>6.4 (2.6-15.8)</b>	19	1.5 (0.6-4.0)
Deterioration in work characteristics	27	<b>2.8 (1.3-6.1)</b>	41	1.5 (0.8-2.7)
Financial difficulties	9	<b>5.6 (1.7-18.6)</b>	17	<b>4.9 (1.5-15.7)</b>
Living alone	13		38	1.3 (0.7-2.5)
Life events (last year s-r) 0	12	1	20	1
1-3	31	1.4 (0.6-3.6)	63	1.0 (0.5-1.9)
>4	7	<b>3.7 (1.0-14.2)</b>	18	1.3 (0.4-4.0)
Female sex	36	1.3 (0.6-3.1)	79	<b>2.0 (1.0-4.0)</b>
Symptoms of mental illness at baseline	27	<b>6.6 (3.0-14.7)</b>	63	<b>10.7 (5.7-20.0)</b>

## **DISCUSSION**

The general aim of this thesis was to add knowledge to the area of measurement issues of psychosocial work characteristics and job design by using a more objective methodological approach.

In order to achieve emotional independent assessments we used a theory-based instrument for observations and interviews. The external perspective applies the researchers' theoretical frame of reference to the work characteristics studied. It further involves an interview technique focusing on work practices in order to exclude evaluations, attitudes and rhetoric statements if they could not be described in more concrete terms and exemplified during the interviews. As this perspective is not objective, meaning the truth, but reflects a theory-based assessment of the job made by an external observer and/or interviewer we describe it as an external perspective.

As illustrated in Figure 1, an external perspective was in this thesis used to identify factors involved in the creation of psychosocial work characteristics (Paper I). Secondly, the external perspective was used to explore exposure levels of demands and control among women and men in different groups of the demand-control model to understand why the self-reported exposures are more weakly related to health outcomes among women than among men (Paper II). The external perspective was also used to reflect self-reported measures among those with low psychological well-being in order to investigate to what extent self-reported measures were affected by the reporting person's psychological state (Paper III). Additionally, the external perspective was used to study if more objective measures of work characteristics were related to mental illness (Paper IV). The results of these studies will be discussed, starting with the factors involved in the creation of sustainable and adverse psychosocial work characteristics

### **HOW GOOD WORKING CONDITIONS ARE CREATED**

The study in Paper I was designed to identify factors contributing to sustainable work characteristics that would be valuable to target for those who are involved in job design issues. The results indicate how the management and employee scope of action were used to change working conditions for the better. However, it was not obvious how to separate organisational factors from managerial strategies as several of the organisational factors could be considered as strategies adopted by managers at a higher level in the organisation.

What people do at work is of course highly dependent on the goals they aim to achieve. In bad jobs the formal goals were not applicable in everyday practice and the employees were left with the decision about what to do, how to make priorities with reduced resources. As in a study of flexible work the actual room for action, the decision authority, did not supply the employees with clearly defined conditions and boundaries (Hansson 2004). In our study this type of boundary-less work was valid also in more traditional jobs. In the bad job cases we found a lack of consistence between formal goals in the organisation and operational goals in everyday practice that needs to be clarified in order to be able to create good job conditions. Discrepancy in goals can

have several reasons; the members of the organisation do not agree on the formal goals; formal goals are perceived as unrealistic due to available resources or to other external circumstances (Abrahamsson and Aarum Andersen 2002). In good jobs the managers and the employees had an ongoing discussion of what the formal goals meant in everyday practice. As work always contains contradictions, decisions need to be taken and the presence of instrumental support from managers or colleagues to clearly define operative goals seems to be important in creating good jobs.

According to the results, some suggestions for further research and practice can be made. The results highlight the possible importance of building structures of formalized authority, increasing communication of goals and hindrances in order to improve working conditions for the employees. Middle managers are important in the initiative phase but higher management levels need to support the process. Factors that enhance the middle managers' ability to improve conditions should be further explored. Suggestions for future research are also to replicate the results of conditions and strategies in their relation to work characteristics and health in a quantitative study. The methodology may be useful for human resources departments and occupational health services, who are interested in identifying structures and strategies that should be focused on in order to create sustainable working conditions in the organization and not merely focusing on the individual workers' stress management. The results will hopefully encourage employees and managers to use their authority and create structural solutions of daily problems. If structural solutions are impossible, they should use their authority to redirect the responsibility and problem-solving upwards in the organisations to those who have the authority. Ask who in the organisations owns the problem? Who could do something to create a solution?

## **SELF-REPORTS COMPARED TO EXTERNAL ASSESSMENTS**

Another area where more objective measures are suitable is validation of self-reported measures. The second and third aim of this thesis was to understand how self-reported measures were related to externally assessed demands and control. Questions were raised concerning two different subgroups: Are self-reported demands and control valid for distressed employees and for women's work?

Although there can be a difference in domestic responsibility among men and women in active jobs, our results indicate that there seems to be differences also in working conditions, not reflected in self-reports.

In Paper II we found a rather consistent picture between self-reports and the external assessments among women and men in the different JDC groups, with one exception. Among the group of women who reported their job as active (high demands and high control) the picture was less consistent with the externally assessed demands and control. This indicates a reduced validity of measures of demands and control among women who reported their job as active. Semmer and colleagues argue that observational measures are not necessarily objective and that it can not be concluded that lack of convergence with self-reports automatically invalidates self-reports (Semmer, Grebner et al. 2004). However, our results shed light on why the JDC-model does not explain women's illness as expected, especially women reporting an active job

situation (Vahtera, Pentti et al. 1996; van der Doef and Maes 1999; Krantz and Östergren 2002; Vikenmark and Andersson 2002; Eaker, Sullivan et al. 2004; Lidwall and Marklund 2006).

The results can be interpreted in the light of another multi-method study aimed to disentangle objective and subjective components of job stressors and determine the role of each for hypertension risk (Greiner, Krause et al. 2004). When observer-based stressor level was low, the association between self-reported frequency of stressors and hypertension was high. When the observer-based stressor level was high the association was inverse and the authors conclude that this might indicate denial of stress (Greiner, Krause et al. 2004). This phenomenon could be applicable to our results. A possible explanation is that among women who report an active job situation are those who deny or suppress their adverse conditions.

The different pattern between women and men in the active job situation is that the adverse job conditions for women may be a consequence of organisational conditions in a gender segregated labour market. Due to a rapidly changing organisation with accompanying changes in their work engagement the employees may not perceive their adverse conditions. Job expansion may have increased the responsibility without accompanying increase in decision authority. This may result in an imbalance between responsibility and decision authority. When reporting control, the employee might not have perceived this imbalance if the responsibility has become even greater than before.

Rau used objectively evaluated task requirements to classify jobs in terms of causing high strain, causing low strain, and being conducive to personal development (comparable with an active job) (Rau 2004). In Rau's study objectively evaluated work conditions were related to biological health indicators. Interestingly, no woman was classified as being in an active job situation.

This may be interpreted, as shortcomings regarding working conditions may be visible to an external observer who may have another frame of reference, while the employees get used to, and thereby do not perceive, adverse conditions. Additionally, women who report their job as active rather than high strain may be those who act according to personal responsibility as shown in Paper I. They may internalise problematic conditions in the organisation of work as their own responsibility.

In our study women in the active job situation had high figures in both quantitative and qualitative demands. In a study of health care personnel these two types of demands were described as interacting; the qualitative demands (compared to hindrances) become a burden and difficult to handle because of high quantitative demands (time pressure) (Ahlberg-Hultén, Härenstam et al. 1999). Men in the active job situation have as high figures in quantitative demands as women but less qualitative demands in terms of hindrances.

The JDC model has several advantages in its simplicity and has been able to explain several health outcomes. However, regarding women in the active job situation, one suggestion is to supplement questionnaires with items that better reflect hindrances in terms of insufficient resources and authority needed for job performance. However, this may not be a solution. If the lack of convergence between self-reported and external assessments is a result of denial among women reporting active jobs and they in fact have jobs more comparable to a high strain situation, new questions will not help. Thus,

further research on work characteristics and subjective significance of the questionnaire items among women who report an active job situation is needed.

In Paper III it was found that self-reported measures seem to be valid for distressed employees at the level measured defined as having three or more psychiatric symptoms. Accordingly, the risk of over-estimating the association between demands and control at work and psychological distress should be low in studies using the GHQ-12 as the outcome measure.

Summing up the comparisons between self-reported and external assessments we conclude that despite shortcomings of external data, one advantage with the studies in this thesis is that weaknesses in the external data should be the same for the groups compared (subjects with psychological distress and subjects without but also for all JDC groups). The advantage of the design of our study is that it takes into account both actual changes in working conditions due to a dynamic reciprocal stress process, and over-reporting due to psychological distress. If conditions actually change there will be high concordance, and if there is over-reporting there will be low concordance between self-report and externally assessed working conditions among psychologically distressed subjects. It should also be repeated that externally assessed data are not a substitute for self-reports, but they give complementary data because self-reports may reflect response styles or the respondent's hypothesis about job stress and strain or personal characteristics such as negative affectivity (Semmer 2003).

## **WORK CHARACTERISTICS AND MENTAL ILLNESS**

Self-reported demands and control do not seem to be distorted by distress as was shown in Paper III. According to this, it could be suggested that more objective measures are not needed in studies of work-related mental illness. However, self-reported measures valid for reduced well-being are not necessarily valid for those with more severe clinical illness such as diagnosed depression and anxiety. Therefore, it was still preferred to use more objective measure to verify results from epidemiological studies using self-reported measures for work-related determinants of more severe illness.

In Paper IV it was found that externally assessed psychosocial work characteristics were related to diagnoses of depression. Paper IV supports results from studies using self-reported data and our results do not indicate a triviality trap regarding psychosocial exposures and severe illness in terms of depression. However, the externally assessed work characteristics were not related to anxiety when confounding factors were considered. The lack of relation between work characteristics and anxiety may have several reasons. It could be related to time of onset. Most of the depressed cases had an onset during the study period while many of the anxiety cases seem to have had an onset before baseline. The lack of relation can also be due to the different anxiety diagnoses included, such as specific phobia not related to work life situations. Or it may be dependent on the choice of independent variables. The ARIA model which was used to assess work characteristics covers psychosocial externally assessed work exposures in terms of job demands, job control and job social support. It does not include conditions such as insecure employment, which may have been associated with anxiety.

Previous research has indicated that both anxiety and depression were highly related to childhood experiences of neglect and abuse, while adversity in adult life (e.g. widowhood and divorce) was only related to the rate of depression (Brown, Harris et al. 1996).

An action theoretical approach used in Paper IV is applicable when studying depression as depression can be compared to a state of dejection. Dejection could be the effect of unsuccessfully striving for goal fulfilment due to lack of support as our results showed. Deteriorated conditions were also related to depression and can be considered as a loss and therefore affect mental health.

Although expected, some of the studied dimensions did not relate to the two outcomes studied. We hypothesized that imbalance in cognitive requirements could contribute to adding knowledge about causes of psychological ill health. It did not and this could be due to the possibility that other factors were more important or due to measurement weakness. In many jobs, cognitive requirement on a higher level is a result of hindrances in work organization which require problem solving. This type of problem solving is probably rather frustrating than health promoting. A second hypothesis was that authority over decisions would be a risk factor, but this was not confirmed.

As in many other studies we found that social support is a risk factor for depression. In our study social support was measured as an obstacle, comparable to a lack of instrumental support in order to attain the work goal. Other types of support have been defined in terms of social climate or emotional support. Social support according to the Swedish version of the JDC-Support model is formulated in expressions such as: ‘calm and pleasant atmosphere; solidarity, my work-mate stands by me, understands if I have a bad day, be in agreement with superiors and work-mates.’ As it is not possible to externally assess this aspect, this was not considered in our study. However, social climate probably affects or is affected by instrumental support. In Paper IV we measured the instrumental support and can thereby state the risk for unsuitable organisational structures, regardless of the work climate. This should be a target for preventive actions inside organisations. As externally assessed work characteristics were related to depression and confirm studies based on self-reports that social support at work seems to be an important factor for mental health it can be concluded that self-reports are reliable in epidemiological studies of mental illness.

## **METHODOLOGICAL CONSIDERATIONS**

### **Validity and reliability of work characteristics**

External assessment through observation is not necessarily more accurate than self-reported measures, but is more objective in that the subject’s cognitive and emotional processing is excluded from the assessment. Thus, there should be less measurement bias relating to individual psychological and behavioural conditions (Frese and Zapf 1988; Kasl 1998). The criteria for the external measurements were established by the researchers and were the same for all participants. Self-reports have a larger span of significance because each respondent can make a judgment as to what a question refers to. Therefore, assessments from the two perspectives differ in the specificity of the

exposure. External assessments most likely suffer from too little differentiation due to low observability, but approaches using observational and self-report measures in parallel may overcome the limitation of each approach and allow analysis of the interplay between individual and work factors (Semmer, Zapf et al. 1996; Hurrell, Nelson et al. 1998). External assessments and self-reports have partly different theoretical roots, and were thus intended to measure partly different aspects of the same dimension. However, the assessment of work characteristics is based on action regulation theory which in a way uses stress theoretical concepts in terms of identifying stressors such as hindrances to goal fulfilment. Action regulation theory also identifies cognitive requirements and planning, in order to supply the worker with learning possibilities and control in order to handle possible difficulties and deficiencies in the work process. This is comparable to the JDC model.

To be able to draw scientific conclusions from studies using such measures, they need to be valid and reliable. Some reliability and validity tests have been made within this thesis, other have been made earlier.

The ARIA dimensions have been compared to the JDC model by factor analysis which is yet another type of construct validity testing. This was done in the MUSIC/Norräljestudy and the results showed that the constructs of ARIA vary as expected with comparable constructs in the JDC model, assessed by self-reports (Waldenström, Theorell et al. 2002).

In Paper II and Paper III the validity of the two measures was tested by examination of the degree of convergence or divergence with the two tests that were presumed to measure the same construct. ARIA was compared with measures assessed with self-reports and the results indicate that divergences between the two measures are in line with suspected shortcomings of the questionnaire items among active women. In Paper III, the two measures co-varied which indicated a concordant description of work characteristics. The validity of the measures used have been tested in several ways. In the MOA-study the levels of cognitive requirements were computed for each of the four observers. There were differences between the observers, but these differences were in an expected way found to be related to differences in the qualification level of the occupations studied for each observer. This can be regarded as the ability of the assessment to discriminate between groups which are known to be different.

Content validity is usually determined by a panel of experts who examine the relationship between test objectives and test items or by knowledge of the normal practice used. ARIA has been referred to as a valuable tool for assessing the work situation among occupational health practitioners, mainly due to the additional perspective, not only based on employees' appraisal and values.

In Paper IV data were collected by an interview with the limitation of being dependent on the individual description of the conditions studied. However, the assessment was based on the information from the participants, their concrete examples from the work situation and the researchers' common theoretical frame of reference concerning the aspect of work characteristics to be assessed. Also, the same frame of reference was used for all occupations. Therefore, the interview should be less subjective than questionnaire replies.

Interrater reliability and validity of external assessment have not been measured systematically for all dimensions. As the dimension for cognitive requirement was considered by the interviewers to be the most complex dimension, interrater reliability was computed for this dimension in the MUSIC Norrtälje study: The correlation between the assessment at the interview (7 interviewers) and the second assessment based on the recorded interview was between .75 and .82 for the three levels of cognitive requirements (Waldenström, Josephson et al. 1998).

Additionally, similar correlations to self-assessments for each observer would be an indication of reliability in the external assessments. Working with Paper III, the associations between self-reported and externally assessed demands (as in Figures 1 and 2) were computed but not reported and were very similar for the different observers. As regards control, the results were also similar for all observers.

According to this, ARIA has been tested for validity in several ways but there are some measures of reliability that should be used in the future, for example the question concerning interrater reliability of the dimensions other than cognitive requirements. The best reliability estimation would be a double analysis (Greiner and Leitner 1989), i.e. two investigators observe and interview one worker each, workers who have identical work tasks. This solution has practical restrictions as few employees have the same type of work assignment in today's work life. The inter-rater reliability could instead be measured by comparing two assessments of the same worker.

### **Qualitative analysis**

The validity of the categorisation of strategies and conditions found in Paper I can of course be questioned but the procedure used probably strengthens the validity. On the basis of the transcribed interview information, the researcher made the classification in the tables. This classification was authenticated by the co-researcher based on a summary of the interview material. The pragmatic case study method (Fishman 1999) enhances structure when categorizing the qualitative data.

### **Collecting data at different levels**

An interesting experience from Paper I was that the goals guiding the employees work in the bad job cases were not unclear to the employees, which we expected. Instead, they set their own goals, independent of or because of the goals set by the organisation. This causes a mismatch between actual goals for the work carried out in the organisation and the resources adjusted to the organisation's goal set by the managerial level. This lack of concordance between different goals is probably easier to reveal if data are collected from both the employer and employees.

The importance of collecting data at different levels has also become apparent when comparing the results from the two samples used in this thesis. Unclear goals and tasks were more often identified in the MOA study where information were collected both from visits to the employees' workplaces during work and from interviews with the managers (or organizational representatives) compared to the PART study (Paper IV) where information was collected by interviews with the employees at the research unit.

It can be concluded that a combination of different sources of information (individual and organisational) generates a more person-independent picture of how the work is organized. A possible mismatch between the two perspectives; the individual and the organisational level became apparent.

### **The samples**

In the MOA study one might expect a healthier sample with better working conditions than in the general population because the workplaces and subjects had accepted extensive participation in the research project. However, when the MOA study group (Paper II, II and III) was compared to a population-based sample neither self-reported working conditions nor psychological distress or demographic aspects seemed to deviate from corresponding conditions in a general, employed, sample (Härenstam, Karlqvist et al. 2003). Our conclusion is that the sample studied is similar to a representative sample from the general employed population.

A healthier sample was possible also in the PART study (Paper IV) but extensive non-response analyses from phase I of the PART study (Lundberg, Damstrom Thakker et al. 2005) as well as phase II (Bergman, Lundberg et al. Manuscript) do not indicate serious bias. There did not seem to be any strong selection regarding the interviews in the second phase.

The analyses and results in Paper I are based on a small sample, but the nine cases are based on interviews with eighteen people on two occasions, i.e. 36 interviews and visits to workplaces. One could question if the cases are representative of working life. We do not state that the results apply to anything else than the cases studied, but as they cover a variety of organizations, ownership structures, and occupations, it is not unreasonable to presume that the results may be used as a basis for discussions about interventions at many other workplaces.

### **Gender perspective**

The gender perspective was an explicit question in Paper II. The aim was to explore current measurements of women's working conditions. The analysis was made for men and women separately. The results showed that the JDC model seems to reflect externally assessed demands and control, except for women in active jobs. In Paper II a broad sample of employees in various occupations and work organisations were studied and efforts were made to match men and women. Therefore this sample is less gender segregated concerning working conditions than the overall population of Sweden and possibly that of many other countries. Our results would therefore apply to an ordinary gender-segregated population, but the differences between men and women in the active job situation would probably be even more pronounced in a more representative sample.

In Paper I the issue of gender was a result rather than a main target for analysis. The bad job cases constituted women employees, often in female dominated organisations. In Paper II women in active jobs were more often employed in occupations and

organisations mainly staffed by women. Together this indicates that women's work deserves more attention in research. When self-reports are used we should be conscious that questionnaire items may be less valid for assessing the job situation in female-dominated organisations and occupations. Additionally, the demands and resources in these jobs may be less obvious and therefore hard to assess by the employee. In order to reduce hindrances and improve decision authority and in a female-dominated occupation or organisation an external methodological approach could be used to identify the actual prerequisites and strategies in the specific organisation.

In Paper I bad jobs were found in female-dominated organisations and in occupations predominantly staffed by women, and the employees studied were women. This has not been highlighted in the paper for a specific reason: gender segregation is not easily changed. Other structural factors and the strategies used by these women and their managers are probably easier to change in a short term perspective. If successful, the gender segregation may probably be less if the conditions are improved. Thus, the choice not to highlight the gender perspective was made for pedagogic reasons, rather than for scientific reasons.

In Paper III we compared distressed to non-distressed employees. Men and women were not analysed separately as the number of subjects were limited and as we did not hypothesise that psychological distress should affect reporting in different ways for men and women.

Analyses in Paper IV were conducted and presented in the paper for men and women together since there were few men with the diagnoses. Sex, however, was always included as an independent variable in the analysis, as both depression and anxiety are more common among women than men (Horwath and Weissman 2002). In order to check different risk patterns between men and women separate analyses showed almost the same results although with less precision.

## **EXTERNAL ASSESSMENTS – ADVANTAGES AND DISADVANTAGES**

The major disadvantage of observational methods is the great amount of time and resources that needs to be invested, both in training and time for data collection. To improve external assessments there are a number of points of special importance (Semmer, Grebner et al. 2004). First, there is a need for extensive training of observers. The observers will to some degree be dependent on information given by employees. It is of extreme importance that they learn to use that information, but not in the sense of simply taking it at face value, but rather as a piece of information that they use in making their own judgement. They need to be trained in a technique which aims to find further evidence for or against a conclusion (Semmer, Grebner et al. 2004). As the method is quite time consuming and thereby expensive, self-reported measures should first be excluded as a relevant alternative.

Despite the questioning of self-reports in some groups, external assessments will usually coincide with self-reported descriptions of a persons work characteristics. However, it is valuable to gain knowledge about the exceptions.

If researchers and occupational health practitioners want detailed analyses of potential causes of stress factors for intervention purposes, observational interviews with an external perspective provide a basis for job redesign strategies to create sustainable jobs (Landsbergis, Theorell et al. 2000). The action theory perspective used in Paper I involves analysing how hindrances and possibilities in the organization interplay with what the individual perceives is possible both among employees and their managers (Leitner, Volpert et al. 1987; Aronsson and Berglind 1990; Frese and Zapf 1994). This perspective will increase the possibility to gain knowledge about what people in the organisation, employees and managers, actually do, not what they say they want to do and is therefore a valuable tool for evaluation of organisational changes. The exposure assessments with an ARIA analysis are based on action regulation theory. Such analysis will identify working conditions that hinder the achievement of results or require an increased expenditure of energy, which increases the stress for the worker, and are considered as regulation hindrances.

There are researchers who argue that the perceptions of the environmental condition are the relevant independent variables for study. They consider the causal pathway to health outcome works only through these perceptions and suggest that one does not need to concern oneself with the objective conditions (Perrewé and Zellars 1999). However, if we want to improve conditions at the work place that probably increase the risk of several people becoming ill, then the more objective perspective is to be preferred. If we want to take preventive actions it is better to focus on the stressors rather than the stress reaction (Kasl 1998; Frese and Zapf 1999).

In occupational health practice and human resource management a more objective method can be used in several situations:

- To identify areas that need to be changed in the organizing of work in order to achieve a better match between resources and demands. Such a method could address issues such as staffing or authority for different positions.
- A non emotional evaluation of the effects of an intervention, comparing work characteristics at t2 compared to t1 (as in Paper I).
- To gain in-depth knowledge of the work characteristics in a sub-group whose answers in a questionnaire survey do not indicate obvious target areas for interventions.
- To identify possible underlying non-emotional causes of a conflict.
- When legal questions arise, more objective assessments of working conditions are preferable.
- In rehabilitation cases external assessments of adverse conditions have been shown to enhance decisions regarding necessary adjustment as they can not be dismissed as the emotional evaluation of sick employees.
- To change non-functional work-related feelings. If an employee feels personally responsible for 'everything' (as in bad jobs in Paper I) the external perspective can elucidate the actual responsibility, especially if information is collected both from the employee and the manager level. This information can generate a re-evaluation of the personal responsibility or can help to redirect the responsibility to the managerial level where there is the authority to change the expectations and responsibility.

ARIA has been developed through research-projects (MUSIC, MOA, and the MOA-Follow-up) and by collecting experiences from work health practitioners. A user's guide has been published (Waldenström 2006). This manual aims to support the use of external assessments and increase validity and reliability among users in occupational health practice and human resource management. Our experience of using an external perspective is that discussions in a group of users are of great importance in order to maintain the theoretical frame of reference and to be able to disregard the personal appraisal of the person studied. Therefore, discussions with other users in a network probably increase the quality.

Of course, methods such as ARIA have their shortcomings but should provide a substantial advantage in terms of reducing the influence of the subjects' emotional reactions in their responses and in reducing the variation of the researchers' assessments. Therefore, although objective measures are time consuming and thereby expensive, they are worth the trouble when self-reports can be questioned.

## CONCLUSIONS AND IMPLICATIONS FOR RESEARCH AND PRACTICE

The external perspective contributes to knowledge about methodological issues in research and target areas for job design and intervention. The perspective examines and assesses psychosocial work characteristics beyond emotions and personal frames of reference. In this thesis externally assessed psychosocial work characteristics have been used to explore how work characteristics are created, related to self-reports and to mental illness.

The results contribute to knowledge about *methodological issues in research*:

- Relations between working conditions and health outcomes may be underestimated among women in the self-reported active job situation according to the JDC model. External assessments deviated from self-reports in different directions for women and men. According to external assessments work characteristics among women in the active job situation seem to be more comparable to a high strain situation.
- Self-reported measures of demands and control are as reliable for distressed as for non-distressed employees. Over-reporting of work demands or under-reporting of work control is unlikely when three or more symptoms according to GHQ-12 are taken to indicate psychological distress.
- Studies of social support as a risk factor for mental illness are confirmed using more objective measures.

An external person's theory-guided assessment of the working conditions is probably a valuable tool for *human resource management* and *occupational health practitioners* who aim to identify areas that need to be improved in order to create sustainable jobs. In this thesis some possible target areas for interventions have been identified:

- There were differences in organisational prerequisites and managerial and employee strategies between bad job cases and good job cases. In cases with improved conditions there was a formal management structure, both quantitative and qualitative aspects of work goals were discussed and managers acted to change insufficient prerequisites often outside the organisation. The employees acted collectively to delimit and carry out the work tasks. These factors seem to be important in order to improve working conditions.
- As lack of instrumental social support as a hindrance to work performance is a strong risk factor at work for depression, it is of importance to identify what type of support is needed at the workplace and to build structures for such support.

It should be concluded that external assessment is a complement to subjective measures, not a substitute. This conclusion is made for two reasons; external assessments are time consuming and thereby expensive and sometimes unnecessary. Second, people's individual appraisals of their work are an important source of information.

## ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to all those who, during the work with this thesis, have been patient with me, encouraging, generous, polite, funny, interested, intelligent and supportive in different ways. In particular, I would like to thank:

All participants in the studies, who with enormous patience explained again and again different parts of their work until I thought that I understood what was going on out there.

*Annika Härenstam*, my main supervisor, was an outstanding project leader for the MOA research study group with her energy, generosity and trust. As a supervisor she gave me the opportunity to try by myself, but was only a call away if needed. When I felt despair she was always encouraging and enthusiastic which gave me the strength to move on. It has been a pleasure to work with you and you have become a friend. Hopefully we will continue to collaborate.

*Ingvar Lundberg*, my co-supervisor, who I persuaded to take on this role. I promised that you would not be any further involved in my studies but somehow you became highly involved and I am happy about that. It has been a pleasure to have access to your competence in epidemiological science. I have felt completely safe in the regression jungle with your guidance.

*Måns Waldenström*, my co-author, who introduced me to the external perspective and who has played an important role in increasing my knowledge about external assessments.

The MOA Research group', especially *Gun Johansson, Anna Rydbeck, Lennart Bodin, Catarina Jansson, Lena Karlqvist, Monica Karlqvist, Ola Leijon, Gun Nise, Patrik Schéele, Hanna Westberg* and *Pelle Wiklund*, for co-operation and support in an open-minded multi-disciplinary research project.

My co-authors; *Gunnel Ahlberg*, for valuable comments on Paper IV and Paper I and for inviting me to be involved in the further education of work health practitioners. The latter has enriched my work. *Peter Bergman* and *Ulrich Stoetzer*, for the huge task of data collection in the PART study and for valuable comments on Paper IV and *Yvonne Forsell* who shared her knowledge about psychiatry and epidemiology.

Department of Occupational and Environmental Health at Stockholm County Council, Swedish Council for Work Life and Social Research (FAS), the board of postgraduate education at KI and division of Occupational Medicine at the Department of Public Health Sciences at KI who gave financial support.

*Gunmaria Löfberg, Nils Plato, Magnus Svartengren* and *Ann-Marie Windahl* and all PhD students, at the division of Occupational Medicine for various support.

Interviewers and organisers of the PART-study, including *Eija Airaksinen*, my fellow postgraduate for our lunches at MF. Thanks to *Magnus Alderling*, *Lennart Hallsten* and *Tomas Hemmingsson* in the PART-A group for comments on Paper IV.

Members of the 'Orgdok' group at the National Institute for Working Life, *Erik Berntsson*, *Malin Bolin*, *Chatrine Höckerting*, *Tina Kankkunen*, *Staffan Marklund* and *John Ylander*, for interesting seminars on organisational issues and for support with Paper I.

*Eva Bejerot* for valuable comments on Paper I, *Michael Allvin* for co-operation in the MOA-pilot study and *Steve Wicks* for checking my English.

The MUSIC Norrtälje research group from whom I learned a lot, especially about data collection. Thanks to *Malin Josephson* for inspiration and continuous work- and friendship.

The ARIA network of occupational health practitioners who shared their experiences of using the external perspective in real life.

*Håkan Andersson*, *Maria Elb*, *Inga-Lill Pettersson* and *Irene Tjernberg* at the Occupational and Environmental Health department who know what to do when I do not. All other work mates at the department, who came, went or stayed during all these years - it has been great to know you all!

All present and former inhabitants in 'the Tower' from whom I receive daily support in whatever is needed, including concern, candy and 'latest news', *Teresia Nyman*, *Eva Bernmark*, *Wim Grooten*, *Ola Leijon*, *Marie Mulder* and *Christina Wictorin* - I will miss you!

My mother *Ulla* and my father *Tore* who seldom tells me what to do, but was very resolute and told me not to give up when my patience failed with my driving lessons many years ago. This experience has been incredibly useful when struggling to receive a research licence - now I will be the driving researcher.

In my case, the work and private life interface has not been very clear. *Måns* is highly involved in this thesis, initially as a very important colleague and later on as my husband. As I am the expert I am able, from a non-emotional external perspective and according to all the criteria available, to assess that he is the best husband that one ever can have - you give me what I need!

But there are also two more important persons in my life: My beloved daughters *Hanna* and *Hedda* who have been impressively patient with a sometimes absent-minded mother - I love you!

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