

PH.D. THESIS

**ASSOCIATIONS
BETWEEN HEALTH AND
WORK DISABILITY**

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1. SUMMARY

The aim of this thesis is to summarize the results of the PhD-project “Associations between Health and Early Retirement” carried out during the period November 1998 to October 2001 at the National Institute of Occupational Health, Department of Epidemiology and Surveillance, in Copenhagen, Denmark. The overall aim of the project was to determine associations between health and work disability, and to analyze how these associations were affected by factors in the work environment, lifestyle factors, and factors related to the organizational level of the workplace. The project features four longitudinal cohort studies which identify predictors for transition from employment to different work disability outcomes, a review of the literature on employer-based predictors and characteristics for disability and return-to-work, and a series of qualitative research interviews to enhance the understanding of the results generated in the quantitative part of the project. Independently of age, gender and health, the longitudinal cohort studies showed associations between work disability as well as voluntary early retirement, and a number of psychosocial and ergonomic work environment exposures. It was furthermore suggested that variables related to the organizational level of the workplace not only had a predictive value on work disability independently of exposures on the individual level, but also modified the effect of health on work disability. This result was obtained utilizing a unique data set combining individual and organizational level exposures. The performed literature review supports the suggested interaction between levels affecting work disability. It furthermore suggests a positive effect on return-to-work of “modified work”, which is subject for further analysis in the qualitative research interviews.

The overall results suggest implications for future research on work disability and “return-to-work” in terms of adapting a multi-level approach with regards to data and expertise, as well as combining qualitative and quantitative methods.

2. RESUMÉ

Formålet med denne afhandling er at sammenfatte resultaterne fra PhD-projektet ”Sammenhænge mellem Helbred og Arbejdsophør”, udført i perioden fra november 1998 til oktober 2001 ved Arbejds miljøinstituttet, Afdeling for Epidemiologi og Overvågning, København, Danmark. Det overordnede mål med projektet var at identificere dels sammenhænge mellem helbred og arbejdsophør, dels at analysere hvordan disse sammenhænge blev påvirket af henholdsvis faktorer i arbejdsmiljøet, af livsstilsfaktorer og af faktorer som relaterer sig til arbejdspladsens organisatoriske niveau. Projektet omfatter fire longitudinelle kohortestudier som identificerer prædiktorer for overgang fra arbejde til forskellige ophørsformer, et review af litteraturen om helbredsbetaget arbejdsophør og tilbagevenden til arbejde efter sygefravær, samt en serie kvalitative forskningsinterview. Disse blev gennemført med det formål, at øge forståelsen af udstødningsprocessen mellem sygemelding og enten permanent ophør eller tilbagevenden til arbejde, samt af de kvantitativt genererede prædiktorer. De longitudinelle kohortestudier påviste sammenhænge mellem en række psykosociale og ergonomiske eksponeringer og tidligt arbejdsophør. Disse sammenhænge var uafhængige af alder, køn og helbred. Det blev ligeledes påvist, at faktorer i arbejdspladsen overordnede organisationsprincipper dels havde en selvstændig prædikterende effekt på arbejdsophør, dels modificerede effekten af helbred på arbejdsophør, uafhængigt af eksponeringer på individniveau. Dette resultat blev opnået ved hjælp af et unikt datasæt med informationer på både individ- og organisationsniveau. Det gennemførte review af litteraturen bekræftede fundet af interaktion mellem eksponeringer på forskellige niveauer. Litteraturreviewet påpeger ydermere en positiv effekt af ”modified work” i forhold til tilbagevenden til arbejde efter sygefravær. Dette blev uddybet yderligere i den kvalitative interview-undersøgelse.

I relation til fremtidig forskning i helbredsbetaget arbejdsophør og tilbagevenden til arbejde peger resultaterne overordnet på, at det er anbefalelsesværdigt at inddrage information og faglig ekspertise om såvel det individuelle som det organisatoriske niveau, samt at kombinere brug af kvalitative og kvantitative metoder.

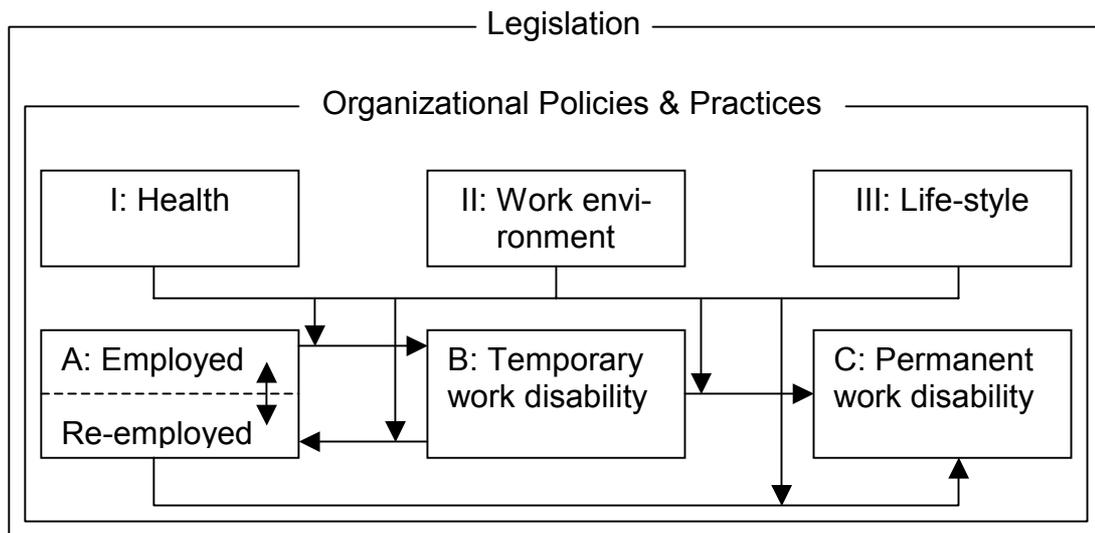
3. AIM AND CONTENTS

This section will state the aim and introduce the contents of this thesis, and briefly present the underlying conceptual framework.

The aim of this thesis is to summarize the results generated from the PhD-project “Associations between Health and Early Retirement”. This project was performed between November 1998 and October 2001 at the National Institute of Occupational Health, Department of Epidemiology and Surveillance, in Copenhagen, Denmark. The overall aim of the project was to determine associations between health and work disability, and analyze how these associations were affected by factors on different levels *e.g.* individual working environment exposures and life-style factors and factors related to the organizational level factors, such as organizational policies and practices (OPPs). These associations should always be interpreted in light of the overall framework constituted by barriers and possibilities in relevant legislation. Work disability was defined primarily through identifying employee transition from a situation of employment to disability retirement or long-term sickness absence. Factors affecting the length of the disability period, *i.e.* return to work (RTW), were also subject to study. The issue of increased voluntary early retirement in the form of early retirement pension, an offer making it possible for every insured Danish employee to retire at 60 at the time of the study instead of normally 65, was also addressed by the project. The project is based mostly on unpublished data from existing files to examine different health parameters' associations of early retirement.

The conceptual framework of the project is shown in figure 1. The three lower boxes show the possible pathways from employment (A) to temporary (B) or permanent (C) work disability. Temporary disability can lead to either permanent disability or RTW. One can also change from one type of employment to another, and remain in employment (A). These pathways are affected by factors in the three upper boxes: health of the individual employee (I), individual level work environment exposures (II) and life style factors (III). They affect mobility between jobs, from employment to temporary or permanent disability, as well as from temporary disability to employment (RTW). These risk factors are furthermore inter-related: work environment exposures can for example affect employee health, which again can determine the type of employment one is capable of engaging in.

Figure 1. Conceptual framework



These associations all take place at the workplace, which again is subject to a specific organizational concept, with for example specific organizational culture, policies and practices. There is a rising awareness of the importance of the organization in relation to employee health, for example in the concept of “healthy employees in healthy organizations” which is promoted by the European Union in The Luxembourg Declaration on Workplace Health Promotion (European Network for Workplace Health Promotion, 1997). The National Institute of Occupational Health and Safety (NIOSH) in the United States also identify “healthy organization characteristics” as a future research priority area (Rosenstock, 1997). Besides this, the overall scene for these causal mechanisms is defined by policy and legislation. For example, if the criteria for receiving disability compensation benefits are tightened, the number of beneficiaries may decrease, and the internal balance between predictors in health status and *e.g.* work environment exposures may be moved.

In the following section 5, the five separate studies conducted during the project will be presented. Section 6 will summarize the overall results of the project, and discuss the methods used and conclusions drawn. Section 7 will discuss the results obtained during the project in relation to the international research in the area. Section 8 contains the overall conclusions of the project, based on the five included studies, as well as the above-mentioned discussion of methods and results.

4. MATERIAL AND METHODS

Three of these papers are based on the Danish Work Environment Cohort Study, DWECS (Borg and Burr, 1997), utilizing the panels interviewed in 1990 and 1995 in prospective cohort studies. DWECS makes it possible to study prevalence and incidence of labor market status outcomes and how they are influenced by health, lifestyle and work environment on a representative sample of the population in Denmark. One of the DWECS based studies features a link of the DWECS '95 cohort to The Statistical Register of Transfer Payments at Statistics Denmark. The three papers based on DWECS are as follows:

Lund and Borg (1999): gives a broad overview of factors associated with job retention.

Lund and Csonka (2001): is the first study comprising individual task level exposures and organizational factors in relation to transition from employment to work disability in terms of retirement or long-term sickness absence.

Lund (2001): addresses factors predicting voluntary early retirement in the form of Early Retirement Pension.

In order to study conditions specific for people with heavy physical work, a prospective cohort study was performed utilizing a cohort of waste collectors and municipal workers, which was established during the CORE research program (Midgaard and Poulsen, 1997).

Lund, Iversen and Poulsen (2001): addresses more specifically the conditions for employees in physically heavy jobs, and how they predict mobility to another job, work disability, unemployment or early retirement pension.

The RTW issue is discussed in a review of the literature performed by:

Krause and Lund (2001): This literature review is published (in press) in a book on the psychology of workplace safety, published by Occupational Health Psychology. In the discussion of this work, interviews performed with former employees in a temporary disability phase will be included.

5. SUMMARY OF PAPERS

This section briefly summarizes the results of the five papers that constitute the basis of this thesis. For each paper, the publication status by October 2001 is presented after the title.

5.1. Lund and Borg (1999). *Work environment and self-rated health as predictors of remaining in work 5 years later among Danish employees 35-59 years of age.* Experimental Aging Research, 25: 429-434

This paper examined factors associated with job retention. In relation to Figure 1, the pathways under study were A (not) to B/C, under influence of risk factors from I, II, and III.

In 1990, a random sample of 1,674 male and 1,646 female employees in Denmark between 35 and 59 years of age were interviewed about health, job satisfaction, and exposures in their psychosocial work environment. The cohort was re-interviewed in 1995 in order to assess their present employment status. Predictors from the 1990 interview for remaining in work in 1995 were identified separately for male and female employees. After controlling for age, very good self-rated health and high skill discretion were found to be independent predictors for remaining in work among male employees. For female employees the predictors were very good self-rated health, high skill discretion, high decision authority, medium level social support and absence of musculoskeletal problems in the knees. Among male employees in the 10% risk group most exposed to the combined risk of all risk factors, remaining in work was 58% compared to 81% in the 10% group least exposed. The corresponding figures for female employees were 46% (most exposed 10%) and 82% (least exposed 10%).

5.2. Lund and Csonka (2001). *Risk factors in health, work environment, work organization and smoking status for work disability among.* Submitted October 2001.

In relation to Figure 1, the pathway under study was A to B. Risk factors were included from I, II, and III and from the organizational level.

This study examined the associations between health, work environment exposures, smoking status and organizational context in 1995 and work disability in

1997. A sample of 3,318 Danish employees was followed for two years. The respondents were interviewed by telephone in 1995, and followed up in The Statistical Register of Transfer Payments in 1997. Health status, work environment exposures, smoking status and organizational context of the workplace were assessed in 1995, and employment status was assessed in 1997. The results of the study indicate that work disability is predicted not only by work environment and smoking status of the individual employee, but also by organizational level factors at the workplace. When suffering from poor mental health, chronic bronchitis or musculoskeletal symptoms in the neck or shoulders at baseline (three diseases related to the bulk of diseases releasing disability retirement pension in Denmark), the two-year incidence of work disability was higher in traditionally organized workplaces than in flexibly organized workplaces. The study suggests a potential for reducing part of the health-related early retirement from work in dimensions related to flexible organization of the workplace.

5.3. Lund (2001). *Risk factors in work environment and health for transition from employment to Early Retirement Pension among Danish employees 50-64 years of age 1995-1997*. Submitted October 2001.

This study focused on the pathway A to C (Figure 1), including risk factors from I, II, and III.

The aim was to identify work environment exposures predicting transition from employment to voluntary early retirement independently of individual employee health. The study featured a questionnaire-based survey among a representative cohort of employees in Denmark 49-64 years of age, with a register-based follow-up 2 years later. At follow-up, 9% of the cohort received Early Retirement Pension. Univariate analysis identified repetitive monotonous work, extreme bending of neck/back, working mainly standing/squatting and work with arms lifted/hands twisted, low decision authority, high job demands, low social support and conflict at work as predictors for Early Retirement Pension. After control for age, gender, smoking and significantly associated health variables, low decision authority and low social support significantly predicted Early Retirement Pension. Work with arms lifted/hands twisted and repetitive monotonous work remained borderline significant through the multivariate modeling. The study suggests a potential for

preventing employees from leaving work by means of voluntary Early Retirement Pension through improving the psychosocial and physical work environment.

5.4. Lund, Iversen and Poulsen (2001). *Work environment factors, health, lifestyle and marital status as predictors of job shift and early retirement in physically heavy occupations*. *American Journal of Industrial Medicine* 40(2): 161-169.

In relation to Figure 1, the pathways A to A/B/C were subject to study, with risk factors from both I, II, and III.

The aim was to assess the rate of people leaving the job as waste collector or municipal worker, to establish how the job was left, and to identify associated risk factors within work environment, health, lifestyle and marital status. A questionnaire-based survey among a cohort of 2,918 waste collectors and municipal workers was performed in 1994, with follow-up 2.5 years later. 25% had left the job at follow-up. Of these, 31% had changed job (associated with low decision authority), 16% were unemployed (associated with low skill discretion, pushing heavy loads and extreme bending of back), 10% received disability retirement pension or were on long-term sick leave (associated with low skill discretion, prevalent diseases, underweight and smoking), and 12% received early retirement pension (associated with extreme bending of back and marital status)

The study suggests a potential for preventing people from leaving physically heavy occupations by improving the physical and psychosocial work environment.

5.5. Krause and Lund (2001). *Return To Work*. In: J. Barling and M. Frone (Eds.) *The psychology of workplace safety*. Washington, DC: American Psychological Association. (in press)

This review focused on the pathways A to B and B to A in Figure 1, addressing risk factors from I, II, and III, as well as factors at the organizational and legislative level.

This study was a review of the literature focusing on workplace factors that are under direct control of the employer and the employees or their representatives, and may influence disability and RTW outcomes. Initially, a short overview of different RTW outcome measures were presented. The study's presentation of the literature distinguished between two lines of empirical research: First, the scientific evidence for an association between workplace factors and RTW or duration

of disability was presented. Second, an evaluation of workplace interventions aimed to facilitate RTW after a work disability occurrence was presented. The chapter did not review the role of behavioral factors and mental health of the individual employee. This was not a comprehensive and systematic review of the literature on RTW, but rather a presentation of an illustrative selection of the most relevant empirical scientific literature on workplace predictors of RTW. Some studies using other outcomes such as absenteeism, job retention, employer change, disability retirement, and unemployment were also cited here, since predictors of these outcomes are conceptually related to predictors of RTW outcomes. The scientific evidence for an association between workplace factors and RTW or duration of disability was established in two ways. First, the scientific literature showed strong associations between job- and employer-related factors and RTW rates and duration of work disability. Second, the evaluation of employer-based RTW programs showed that interventions that include some form of modified work, improve RTW rates consistently by a factor of about two, and cut lost workdays in half. Therefore, it was concluded that RTW programs including modified work are effective and, although based on more limited cost data, they were also feasible.

6. PRESENTATION OF RESULTS

This section summarizes the results obtained through the project (6.1). The relevance and appropriateness of the methods used will be discussed based on the experience generated during the project (6.2). The conclusions of the papers will be discussed in the light of the discussion of methods (6.3).

6.1. Summary of results

One of the aims of the project was to identify factors associated with health related work disability, independently of health. Table 1 presents a summary of the results from the studies that constitute the project.

Studies 1-4 all feature a prospective design, with baseline assessment of predictors and assessment of outcome at or during follow-up. Common findings included an effect independent of health and age, of job skill discretion and job decision authority (Lund and Borg, 1999; Lund, 2001) - also in a cohort consisting of male

blue-collar employees with physically heavy work (Lund, Iversen and Poulsen, 2001).

Table 1. Overview of results

Paper/study	Study characteristics	Outcome	Predictors (effect measure – p<0.05 unless otherwise stated)	Comments
1: Lund & Borg (1999)	Prospective cohort study of 3,320 employees 35-59 years of age. 5 year follow-up	Remaining in work during follow-up (job retention)	<i>Male employees:</i> Very good self-rated health (PPR=1.12) High skill discretion (PPR=1.12) <i>Female employees</i> Very good self-rated health (PPR=2.54) High skill Discretion (PPR=1.12) High decision authority (PPR=1.09) ^{a)} Medium level of social support (PPR=1.15)	Results adjusted for age. ^{a)} Borderline significant (p<0.07)
2: Lund & Csonka (2001)	Prospective cohort study of 3,318 employees. 2 year follow-up	Receiving temporary or permanent disability compensation during last year of follow-up	Poor mental health (OR=3.8) Chronic Bronchitis (OR=1.8) Current smoking (OR=2.0) Work w. arms lifted/hands twisted (OR=2.1) Low degree of employee development in organization (OR=2.2) Low use of supplementary training in organization (OR=2.4)	Results adjusted for age and gender. Comprises data on the individual and organizational level
3: Lund (2001)	Prospective cohort study of 1,201 employees 49-64 years of age. 2-year follow-up.	Early retirement pension	Decision authority (OR=1.85) Social support (OR=1.71) Work w. arms lifted/hands twisted (OR=2.1) ^{b)} Repetitive monotonous work (OR=1.64) ^{b)} Musculoskeletal symptoms lower & upper back/hips (OR=1.55) ^{b)}	Results adjusted for age, gender and smoking status. ^{b)} Borderline significant (p<0.09)
4: Lund, Iversen & Poulsen (2001)	Prospective cohort study of 2,918 waste collectors and municipal workers. 2.5 year follow-up	Job change ^{c)} Unemployment Disability pension/long-term sick leave Early retirement pension	Low decision authority (OR=1.74) Low skill discretion (OR=2.73) Pushing heavy loads (OR=2.03) Extreme bending of the back (OR=2.03) Chronic Bronchitis (OR=3.68) Musculoskeletal symptoms in hips ((OR=2.72) Musculoskeletal symptoms in knees (OR=1.91) Low skill discretion (OR=2.70) Low BMI (OR=3.91) Current smoking (OR=2.31) Extreme bending of the back (OR=6.78) Having a spouse (OR=2.79)	Results adjusted for age and occupational group (waste collector/municipal worker) ^{c)} Only waste collectors
5: Krause & Lund (2001)	Literature review of studies/projects addressing employer based interventions to reduce disability and disability period.	The scientific literature showed strong associations between job- and employer-related factors and RTW rates and duration of work disability. In addition, the evaluation of employer-based RTW programs showed that interventions that include some form of modified work, improved RTW rates consistently by a factor of about two, and cut lost workdays in half. Therefore, it is concluded that RTW programs including modified work are effective and, although based on more limited cost data, they are also feasible.		
6: Qualitative research interviews	Semi-structured interviews with 8 sick-listed employees in the (compensated) sub-acute/ chronic disability phase	(Lack of) contact with and support from the employer was of vital importance for the employee's experience of disability. Successful replacement was not always a result of the formal rehabilitation program of the employer. RTW was not necessarily the optimal outcome for the individual employee.		

Social support was found to predict transition to (voluntary) Early Retirement Pension (Lund, 2001), and showed an inverse u-shaped association with job retention for female employees (Lund and Borg, 1999).

Among the mechanical exposures in the work environment, extreme bending of the back and work with arms lifted/hands twisted proved consistent as predictors for work disability and Early Retirement Pension (Lund and Csonka, 2001; Lund, 2001; Lund, Iversen and Poulsen, 2001). For the latter outcome, repetitive monotonous work furthermore proved to have a borderline significant association. With regards to lifestyle factors, tobacco smoking was addressed in studies 1-4. The focus on this specific variable was chosen, as it has proven to be an important independent predictor of sick-leave and disability pension in other studies (*e.g.* Rothenbacher *et al.*, 1997). Current smoking was significantly associated with work disability pension (Lund and Csonka, 2001; Lund, Iversen and Poulsen, 2001), but not with other outcomes under study *i.e.* unemployment, job change and Early Retirement Pension.

Organizational level variables related to flexible organization of the workplace were also suggested to influence work disability independently of health, age, gender, and individual level work environment and life-style exposures (Lund and Csonka, 2001). Furthermore organizational context significantly modified the effect measures of variables measuring mental health and neck/shoulder symptoms. The predictors described above persisted independently of the included health measures. Of the health measures under study, global self-rated health had predictive abilities in relation to job retention. The expected associations between both temporary and permanent work disability and musculoskeletal symptoms - especially in hips and upper extremities - poor mental health, and respiratory symptoms, were confirmed (Lund and Csonka, 2001).

Regarding RTW, the performed review (Krause and Lund, 2001) of the literature suggested a positive effect of different types of modified work *e.g.* length of disability was halved, and those studies addressing feasibility also concluded positively on this issue.

The major finding from the interview study was the positive effect of corporate social support in the sub-acute and chronic disability phase. It was also indicated that corporate will and capability to introduce some form of modified work enhanced the chances if not for RTW, then for finding the optimal solution for em-

ployees too sick to RTW. The results of the qualitative research interviews are summarized in section 6.1.1. below.

6.1.1. *Qualitative research interviews*

The point estimates used in the quantitative analyses of associations between baseline characteristics and disability outcomes at follow-up do not allow insight into the part of the disability process taking place during the phase after initial sick-leave, but before either permanent disability retirement or RTW. In order to enhance the understanding of this, 8 semi-structured research interviews (Kvale, 1997, pp. 129-136) were conducted with employees from two different workplaces. Strategic sampling (Malterud, 1996, pp. 55-56) was used to secure as wide a representation of individual (*i.e.* age, gender, job, disease, exposures) and organizational characteristics (*i.e.* OPPs towards disability and rehabilitation) as possible. This section summarizes the major conclusions from this part of the project. The interviews were conducted during the winter of 2001 in the homes of the respondents in all but one case, where the interview was conducted on the premises of the trade union of which the respondent was a member. The interviews were taped, transcribed and analyzed using coding procedures and techniques from grounded theory (Strauss and Corbin, 1990, pp. 96-115).

The three major conclusions were:

1. (Lack of) contact with and support from the employer was of vital importance for the employee's experience of disability.
2. Successful replacement was not always a result of the formal rehabilitation program of the employer.
3. RTW was not necessarily the optimal outcome for the individual employee.

All respondents were still employed with the employer from whom they were sick-listed. However, the degree to, and nature of, the involvement practiced by the two organizations represented by the two different employers, differed significantly. Presence as well as lack of employer involvement and support affected employee perception of the disability situation and expectations to the resulting outcome:

"He (the Foreman) was really good in all this – and the case manager and company health professionals, by the way - they were very supportive and understanding when I went from three shift to dayshift, and later on to part time. Otherwise I think I would have gone straight out back then". Male, 57 years of age.

"They (the employer) have done NOTHING during this – it's like 'if you're too sick to do your job...too bad, then you're out'. It's not what they say, but that's how it feels. They make you feel really SICK, not like a worker who's just sick". Female, 39 years of age

However, the degree of success of the employer support/intervention could not always be interpreted by the nature of the outcome: RTW in previous job could be a criterion of success in one case, whereas permanent withdrawal from work in terms of disability pension was the “right” outcome in the other:

“In the end I wasn’t able to perform a decent piece of work – the body just wouldn’t anymore. I had to be kicked out the door in the morning, so pension was the right thing. But because I had been through the other stuff (job modification) I knew it WAS the right thing”. Male, 52 years of age

“I had tried all kinds of different jobs in the organization – it didn’t work with my shoulder. The case manager has done a good job pushing authorities, and I’m really looking forward to what’s going to take place now” (dismissed, rehabilitation as occupational therapist). Female, 32 years of age

Some respondents had also experienced that the factors promoting job retention and RTW, derived from informal structures of the organization more than from the official OPPs concerned with these matters:

”No, no – the case managers should have absolutely no credit for this...the work they found for me was a drag. I felt like a zombie, not using my skills at all...what happened was, that MY boss spoke to the boss in another department, where it was possible to create a MEANINGFUL job that I was capable of handling with my arms...if they hadn’t done that, I probably wouldn’t have been employed there anymore... ”. Female, 43 years of age

It is conceivable however, that the corporate culture expressed in the behavior of the superiors in this case, was a reflection of the same organizations’ favorable OPPs on employee retention and RTW – and vice versa.

An overall theme in the interviews was a stress of the importance of employer intervention/support. In all the cases where there was no such employer/employee interaction, the employees felt they were passively waiting to be dismissed. In all the cases where the employer intervened in the disability phase after initial sick-leave and before they were disability pensioned, returned to their pre-disease job, or returned to work at a new employer, this did not necessarily enhance RTW. The employer involvement through case management, job modification, or replacement, functioned more as a tool ensuring not only a prolonging of the phase of job retention after onset of initial disease (in some cases this phase was considered prolonged for years), but also that in case of permanent disability retirement, this outcome was experienced as a success even for the permanently disabled employee.

6.2. Discussion of methods

The studies 1-4 (Table 1) applied different measures of health, including global self-rated health (Lund and Borg, 1999), 12-month prevalences of different types of musculoskeletal symptoms, respiratory symptoms and mental health. These were obtained by questionnaire, and feature employee self-assessment on items deriving from previously validated scales. However, it is important to notice, that these measures of health symptoms only constitute an approximation of the diagnoses releasing the compensation for work disability, which is the outcome for these studies.

However, considering the overall aim of the project, the initial choice of methods has proven relevant with a couple of exceptions:

The issue of addressing the importance of the legislative context, in which the mechanism of work related disability takes place, was not performed optimally. This was partly a deliberate choice, and partly a shortcoming in the original planning: In performing the literature review (Krause and Lund, 2001), the authors chose to focus on factors subject immediately to employer change, hereby disregarding literature on *e.g.* the importance of economic incentives in the process of work disability and RTW. This will be discussed further in section 7.

It also turned out that the interviews performed only indirectly illuminated the importance of the barriers and possibilities imposed by legislation. An unexpected result of this part of the project was the finding of corporate social support as an important factor during the compensated disability phase. In this respect, the combination of qualitative and quantitative methods has proven useful: such a “secondary risk factor” would not be captured in the point estimates obtained in the quantitative prospective cohort studies.

Overall, the associations between predictors in health, work environment, life style factors, and organizational variables were conducted using high quality cohort data in prospective designs, and the applied strategy of analysis generated results relevant to the aim of the project. The linkage of individual level work environment and lifestyle factors with organizational level variables is to the author’s knowledge unique at present.

6.3. Discussion of conclusions

In this section, the partial conclusions from the individual studies are discussed. A conclusion of the project as a whole is presented in section 8.

Keeping the above-mentioned reservations in mind, the conclusions drawn from the individual studies seem valid. In relation to Lund and Borg (1999), one could argue, that adjusting for both musculoskeletal symptoms and global self-rated health is potential over-adjustment. Nevertheless, this will only lead to underestimation of the effects of the work environment exposures found to predict enhanced job retention: skill discretion, decision authority and social support.

With regards to Lund, Iversen and Poulsen (2001), one should notice the relatively short follow-up period (2.5 years) in relation to the assessment of health effects. A longer follow-up period could allow more health problems to develop, and the effects of health could therefore be underestimated in this study. Another problem the study does not account for is job selection – one does not seek employment in this type of job, if one suffers from or is disposed towards *e.g.* respiratory or musculoskeletal disorders (Koskela 1982; Koskela *et al.*, 1983; Baillargeon *et al.*, 1999). In addition, both exposure at baseline and outcome at follow-up were based on employee self-report. This could cause "common method variance" and the related positive bias (Spector 1987; Williams *et al.*, 1989). However, the data collected at follow-up exclusively concerned employment status – no data on health, work environment or any other exposures were collected. As employment status is considered a fairly objective measure, "common method variance" should not affect the results of this study. Another problem related to this issue, is the one of the subjective component related to self-reported decision authority, skill discretion and decision latitude in studies as the present with a narrow range of job titles. This is known to dilute the results especially in studies with self-reported outcomes. However, again, due to the relatively objective measure of the outcome, this problem is also considered a minor one in this study.

Lund and Csonka (2001) avoid the problem of "common method variance", as outcome is register based. However, due to the use of very conservative criteria for inclusion of variables in the modeling leading to the final model, it is possible that modifiers of the effect measures of the included health measures among the individual level work environment variables are overlooked. These variables could again possibly have affected the effect measures of the organizational vari-

ables. The effect of the organizational context is not in question, but the size of this effect should be approached with slight caution. Hence, future investigations on data comprising both the individual and the organizational level should consider a less conservative level of significance.

7. DISCUSSION OF RESULTS

In this section, selected results will be discussed in the light of relevant research published in the scientific literature. With regards to Lund, Iversen and Poulsen (2001), this paper includes an updated discussion of the results compared to other studies and will not be discussed further here. Instead focus will be on relating the part of the project addressing the structural framework constituted by organizational dimensions and legislation to some important studies in this area. Key studies for this discussion are summarized in Table 2. This table lists studies that investigated the association of individual and organizational level employer characteristics with duration of disability. Only a few and relatively recent studies have identified global measures of organizational level characteristics. Some of these studies focus on dimensions related to the policy level of the company, and are therefore potentially subject to employer change, *e.g.* safety policy or company culture. Others focus on organizational characteristics of a less changeable and more descriptive nature such as company size and firm ownership. Regarding the latter, disability seems to be prolonged if the company is private vs. public (Infante-Rivard and Lortie, 1996; Galizzi and Boden, 1996; Cheadle *et al.*, 1994). This finding was not confirmed in the study by Lund and Csonka (2001). The studies mentioned control for a number of important potential confounders, the two latter also for type of industry and occupation. It seems that the effect of firm ownership is not explained due to firm ownership being a proxy for specific job types with related specific exposures.

In the study by Galizzi and Boden (1996) of time to first RTW among 188,965 employees, the effect of employer size smaller than 50 employees vs. more than 1000 was related to length of disability period: for employees with periods of disability less than 30 days, time to first RTW is longer if the employer is small, whereas the opposite is the case if the disability period exceeds 30 days: small employer size shortens time to first RTW. Generally, the positive effects on RTW

measures of large employer size can be related to the large employers' better opportunities of replacing a disabled employee in the (larger) organization. Lund and Csonka (2001) did not find significant associations between employer size and employee disability.

Other studies address measures related to company policies, practices and culture (Amick III *et al.*, 2000; Habeck *et al.*, 1991). Amick III *et al.* (2000) studied RTW among 197 workers treated with carpal tunnel surgery. Disability is shortened in companies comprising a workplace culture emphasizing an interpersonal and value-focused environment. This furthermore establishes the predictive abilities on RTW of worker training programs in safe job practices, a company policy aiming at reducing the biomechanical workload (*i.e.* heavy lifting and repetitive movements), and policies and practices stressing early intervention, communication and co-ordination in disability case management along with a proactive RTW policy (*i.e.* education and accommodation assistance to employees returning to work after disability). The effects of these measures are independent of employee age, gender, and symptom severity. The study of Habeck *et al.* (1991), presents unadjusted effects of organizational level variables related to the scales suggested by Amick III *et al.* (2000): safety monitoring and training, employee assistance programs, and RTW programs are all related to whether the firms under study have a high or a low rate of closed disability compensation claims cases. There appears to be some evidence supporting the association between OPPs and work disability, as found by Lund and Csonka (2001). However, Lund and Csonka (2001) is the only study addressing OPPs including the effects of work site exposures occurring on the individual level. The neglect of most previous research to include the underlying and possibly confounding causal mechanisms for disability can dilute the effect of the organizational variables. In order to address both the organizational level and individual task level exposures, studies need to include not only data on both the individual and organizational level, as in Lund and Csonka (2001), but also expertise from multiple disciplines in order to estimate the independent effects of variables on the different levels and the interactions between them.

One key element in preventing health symptoms resulting in work disability and also to facilitate RTW is employer provision of modified work of some sort. The review by Krause and Lund (2001) suggests effectiveness of such employer-based

modified work programs. The best quality studies (ranking 4 or higher) reported at least a doubling of RTW rates and/or the number of days worked when modified work programs were offered to injured workers (Baldwin *et al.*, 1996; Bernacki *et al.*, 2000; Bloch and Prins, 2001; Butler *et al.*, 1995; Høgelund, 2000; Loisel *et al.*, 1994; Loisel *et al.*, 1996). Bloch and Prins (2001) report on six prospective studies of highest methodological quality (ranking 5) with two-year follow-ups conducted as part of a cross-national study in Denmark, Germany, Israel, The Netherlands, Sweden, and the USA. They summarize the main predictors of RTW as follows:

"Viewing all national cohorts together, four factors appear to be especially important. Higher perceived work ability and lower pain intensity at the outset were important predictors of RTW at both one and two years, while advancing age and greater physical job demands operated against work resumption. Among interventions, work place accommodations appeared to be the most successful intervention across countries."

Medical interventions and a host of other factors evaluated simultaneously did not make much of a difference in any of these studies. It follows from these studies that modified work programs are able to considerably improve RTW rates by a factor between 2 and 22. Clearly, this result indicates a very significant potential for disability prevention through adaptation of the working environment to the needs of the injured employee. The qualitative research interviews conducted as part of this PhD-project support the findings in the literature review.

With regards to the role of legislation as yet another structure potentially affecting the associations between health and work disability, the discussion is based on the results of the review by Krause and Lund (2001). It is conceivable that retirement and RTW decisions of the injured worker can be influenced by the provision of job security, disability insurance, child-care facilities, health care plans, or other benefits (Sim 1999; Zeitner *et al.*, 1987). Little research has been done to assess the effect of such programs. The extant literature instead focuses on the level of wage replacement benefits from state-mandated workers' compensation, unemployment, or social disability insurance (Weil 2001). However, newer research suggests that interaction effects may in part explain the inconclusiveness of previ-

ous research (Bloch and Prins, 2001; Høgelund, 2000). The above-mentioned Work Incapacity and Reintegration Project (Bloch and Prins, 2001) compared the effectiveness of different RTW interventions used by social security systems and health care providers in the six participating countries. The association between wage replacement benefits and duration of disability was dependent on the degree of job security. The combination of extensive benefits with strong job protection predicted early RTW, while weak job protection combined with extensive benefits did not improve RTW. Shorter disability periods were seen for low levels of job protection combined with low levels of benefits, but mainly for new employees. Another high quality cross-national study (Høgelund, 2000) found no association between RTW and economic incentives, whereas provision of modified tasks and subsidized work had a positive effect on work resumption.

A population-based prospective study of Finnish men has shown that disability retirement is strongly influenced by the number of family members who are working, and who are unemployed (Krause *et al.*, 1997), hereby suggesting an effect of economic incentives. Results are ambiguous on this issue, and future research needs to examine how injured workers weigh the pros and cons of work disability and RTW at different levels of job security, wage replacement rates, and a range of economic and other needs of the family unit (Dembe 2001). An employer may exert an influence on this decision making process by providing benefits that assist the injured worker to balance the needs for recovery, economic security, and maintaining active occupational and recreational roles, as suggested by the research interviews conducted during this project.

Table 2. Company organizational structures and work disability

Study population	Design	Outcome	Predictors, improvement factor	Comments
Bernacki et al. (2000) Compares no. of lost workday cases, no. of lost workdays and no. of days with restricted duty before and during an early RTW program introduced at a large urban medical center in Baltimore, US. Average no. of employees in the pre-program period (1989-1992) was 16,802 (range 16,212-17,136), and 21,175 (range 17,771-28,518) in the intervention period (1993-1999).	Longitudinal cohort study. The early RTW program consisted of five elements: I. Process management team (case management coordinator, insurance company, employees and managers, safety/management representative) working with supervisors on task/work modification. II. Job analysis, identifying physical demands and alternative assignments. III. Development of alternative work assignments (e.g. restrictions in lifting, standing, walking, sitting; a modified version of pre-injury job, reduction of hrs in pre-injury job, combination of tasks prescribed by treating physician. All alternative work ends with the workers full release to original job. IV. Elimination of occupational hazards identified in job analysis (2), e.g. re-design of workplace, tools, tasks; minimizing mechanical, chemical and ergonomic exposures. V. Continued education/information about the RTW program to employees, supervisors, medical personnel and human resources professionals.	No. of lost workday cases, no. of lost workdays and no. of days with restricted duty were based on register data from the Occupational Injury Clinic Database and the Occupational Safety and Health Administration (OSHA). The latter furthermore supplied data on work-related injuries and illnesses coded according to ICD-9.	No. of lost workday cases was 1,330 in 1989-92 and 1,488 after the intervention. The rate decreased from 19.8 to 10/1000 employees (rate ratio = 1.98) The no. of lost workdays dropped from 26.3 to 12.0/100 employees (rate ratio = 2.2). The use of restricted workdays increased from 0.63 to 13.4/100 employees (rate ratio = 21.3). The no. of non-lost workday cases remained stable pre- and during intervention. When an industrial hygienist assisted the employee and supervisor making job accommodation, the accommodation rate increased 54%: of 160 workers, who were found immediately non-re-employable and potentially subjects to long-term sickness/permanent disability, 90 were accommodated after the intervention of the industrial hygienist.	Positive effect of program incorporating continued education of employees and supervisors and work accommodation, e.g. modified work. Positive effects of introducing expertise (industrial hygienist) in the phase where the performed job analysis is transcribed into work modification. The overall effect is not to be doubted, but the estimates for the effect should be interpreted with caution, due to the lack of information on differences between the two groups of employees in the two periods compared. The group of employees under study increased by 26% from pre- to during intervention, and differences in e.g. gender, age and education could possibly influence the rates of lost workday cases, no. of lost workdays and no. of days with restricted duty.
Habeck et al. (1991) A sample of 124 Michigan firms where sampled from two groups (high and low claims rate) based on the no. of workers compensation cases closed in 1986. The source population was all Michigan employers, who closed a Workers' Compensation (WC) case in 1986 (N=19,250). These companies were stratified by industry, using 2-digit SIC coding. Four industries were selected because of their size and diversity and because they represented the extremes of high and low claims rate industries in Michigan: food production, fabricated metals, transportation equipment, manufacturing and health care services. This cohort	Cross sectional cohort study, with baseline assessment of measures related to organizational factors and company policy: A company representative filled out a questionnaire consisting of 73 items covering four major areas: I. characteristics of the organization, work force, personnel and WC factors (30 items) II. frequency of company behaviors related to safety and prevention, climate and culture and disability management and prevention (30 items) III. employer attitudes (10 items) IV. policy issues (3 open ended items) The study addressed the effect of these measures on the rate of closed disability cases. A Hotelling T2 test was used in order to test for differences in organizational factors between the high-	The outcome "no. of workers compensation cases closed in 1986" was established using data on Workers' Compensation obtained through files from the Bureau of Worker's Disability Compensation.	The study showed a high variability of claims rates within specific industries. A very small minority (6.2%) of employers accounted for a majority of the claims (56.5%). The following factors were related to organizational practices contributed to explaining differences between high and low claim companies (relative risk (RR), p-value): Safety monitoring of employees (0.86, p=0.01), safety training of employees (0.81, p<0.00), company leaders pay attention to safe behaviors (0.88, p=0.01), information/ communication flows up-down and down-up in organization (0.90, p=0.03), employee involvement in decision making (0.83, p<0.00), profit sharing (0.68, p<0.00), light duty/modified work (0.80, p<0.00), employee assistance program (0.80, p=0.02), RTW program (0.69, p<0.00), wellness/fitness program (0.63, p<0.00) and employee health screening (0.78, p<0.00).	This study shows an association between company policy measures potentially set to employer change (e.g. safety monitoring/training, communication, employee involvement, profit sharing, light duty/modified work, employee assistance program, RTW program, wellness/fitness program, employee health screening) and the rate of WC benefit claims. Potential confounders such as industry and company size are taken into account in the sampling, but not controlled for in the analysis.

Table 2 (cont I). Company organizational structures and work disability

Study population	Design	Outcome	Predictors, improvement factor	Comments
of work sites consisted of 284 firms. A response rate of 43.7% was obtained, securing a sample of 124 work sites.	and low claim rate groups. Additional univariate tests investigated differences between the groups on specific items. A multiple discriminant analysis was performed to identify the major contributing variables for the expected difference.			
Bloch & Prins (2001) Six national prospective cohorts were established (n=327-565, response rates ranging from 76.4-89.4% from baseline to last follow-up). Five cohorts were drawn from national registers, one was on a voluntary basis. All subjects were aged 18-59 years, received sickness benefit continuously for at least 3 months, were completely work incapacitated from first day of absence, reported sick with low back diagnosis (ICD-9: 721, 722 & 724), and had no back surgery in the year before sick leave. The participating countries were Denmark (DK), Germany (D), Israel (IS), the Netherlands (NL), Sweden (S) and USA (US)	Three measurement points were used: T1; a.s.a.p. after 3 months of work incapacity (baseline), T2; 1 year after first day of work incapacity, and T3; 2 years after onset of work incapacity. Data collection varied from country to country, covering face-to-face interviews, telephone interviews, postal questionnaires and files from social security and health care administration. Exposures were classified as interventions (actions in response to a specific situation of an individual) and incentives/disincentives (system wide characteristics affecting the individual). 26 of these were established, covering training & education, work accommodations, incentives (e.g. wage subsidies), assessment of work capacity/incapacity and services (e.g. job search). Background variables included socio-demographic characteristics, work characteristics (including work environment exposures), health status indicators and perceived health.	Outcome, RTW was defined as working/not working at T2 and T3 using information of doing paid work, receipt of benefit, participation in a rehabilitation program, and death. Various methods of analysis were applied. This table focuses on selected results regarding vocational interventions from a multivariate analysis of RTW at T2 and T3.	The following vocational interventions predicted RTW independently of baseline factors (socio-demographic characteristics, work characteristics including work environment exposures, health status indicators, work ability, and perceived health) at T2 and T3. Only statistically significant OR's are provided separately for each country: T2: work accommodations (DK=21.77; IS=20.95; NL=2.46), and therapeutic work resumption (= job training with compensation) (NL=5.66; US=3.86), job training/education (DK=0.19), employee motivators/incentives (DK=0.48; IS=0.26), case management/-assessment (DK=0.40; D= 0.32; IS=1.90; US=0.54), job counseling, -search, -placement (NL=0.44), and assessment for disability benefit (IS=0.29; NL=0.25; S=0.002). T3: work accommodations (DK=6.71; IS=9.39; NL=12.56), employee motivators (DK=0.27; D=71.10; NL=0.18), case management/assessment (NL=0.53), contact with colleagues/employer (D=19.10), assessment for disability benefit (DK=0.0005; IS=0.31; NL=0.42; S=0.22; US=0.47), and medical intervention (US=2.48).	The study is unique in featuring a prospective cohort study comprising data from six countries. It furthermore incorporates information on several levels, ranging from the level of the individual employee, over work place factors, including work environment, to the framework constituted by legislation in the social and labor market areas. It is necessary to note, that data was derived from different sources in the different countries. This can cause bias in the results. However, the findings of the beneficial effects of especially work accommodation and therapeutic work resumption are stratified by country, and are therefore not questionable in this sense. The inclusion of self perceived work ability in the analyses introduces potential over adjustment.
Høgelund (2000) Two sub-cohorts from: I. The Netherlands (NL). Entry criteria: age 18-59 years old, received sickness benefit continuously for 3 months, completely work incapacitated from first day of absence, reported sick with low back diagnoses (ICD-9: 721, 722 & 724), and no back surgery in the year before sick leave. 528 persons fulfilled the criteria (study population) 370 participated in the final follow-up (response rate = 70.1%). II. Denmark (DK): Entry criteria: living in one of the biggest mu-	Longitudinal cohort study of two cohorts of long-term sick-listed (90-120 days - chronic phase) due to low back pain. Follow-up at three points in time: T1 approx. 5.5 months (DK)/ 4 months (NL) after the first day of sick-listing. Baseline. T2 approx. 13 months after first day of sick-listing. T3 approx. 25 months after first day of sick-listing. Phone interviews (DK) and a combination of phone interviews/ mailed surveys (NL) were used collect data on the employees: I. Health condition (no. of weeks sick-listed the year before present sick-leave, no. of sickness spells the year before present sick-leave, pain intensity, mental	Based on interview data, the following outcomes were investigated: I. Time before first RTW (no. of months three months after first day of work incapacity until resumption of full- or part time, subsidized or unsubsidized work. II. Labor market retention following RTW (months worked divided by months between RTW and end of study period). "Work" includes full- or part time, subsidized or unsubsidized work.	Time to first RTW was significantly prolonged by high pain intensity (1.12, p<0.00), low work ability (1.25, p<0.00), current smoking (1.003, p=0.05), high physical job demands (1.378, p<0.00), dismissal (2.15, p<0.00), relatively few years employed since age 20 (3.22, p<0.00) rehabilitation inquiry performed (1.67, p<0.00), high age (1.03, p<0.00), foreign ethnic background (2.92, p<0.00) and primary education (secondary; 0.58, p=0.01, tertiary; 0.37, p<0.001). Threat of dismissal was insignificant (p>0.05). Full retention compared to low after first RTW was predicted by: no limitations in vitality (1.02, p=0.01), no comorbidity (3.64, p<0.00), high work ability (1.42, p=0.00), subsidized work (2.58, p=0.01),	The study is unique in its use of a two country cohort comprising predictors related to the health and work environment of the individual, company policy and institutional factors related to the labor market. The differences in selection of the two study cohorts could introduce bias: the Dutch cohort consists of employees from the private sector only, the Danish of both private and public - the Dutch cohort does not include small companies, the Danish does - the Dutch only includes employers subscribing

Table 2 (cont II). Company organizational structures and work disability

Study population	Design	Outcome	Predictors, improvement factor	Comments
<p>municipalities, age 18-59, wage earner before sick leave, received sickness benefit continuously for 14-17 weeks, completely work incapacitated from first day of absence, reported sick with low back diagnoses (ICD-9: 721, 722 & 724), and no back surgery in the year before sick leave. 668 persons fulfilled the criteria, 441 persons responded to the final follow-up (response rate = 66.0%). The Dutch cohort was identified from the administrative bodies of the Dutch social security administration for private sector employees only. The Danish cohort was identified from a national register of current sickness benefit cases including both private and public employees. The cohort was followed for two years (1995-1997) from onset of work incapacity.</p>	<p>health, general health, social functioning, vitality, permanent co-morbidity of diagnosis not related to back pain causing sick-leave, self-rated work ability, coping, smoking II. Employment opportunities: company size, branch, occupation, psychological job demands, job control, job strain, threatened by dismissal, dismissal, company lay-offs preceding year, weekly working hours, duration of last employment, no. of jobs/year since age 20, years employed/years since age 20, inquiry of possibility for vocational rehabilitation, participation in general education, work capacity test. III. Psychological and social costs of disability (6 items on attitudes towards work and sick leave and two indexes on social support. IV. Exit conditions: Replacement rate (difference between sickness compensation and previous wage), no. of medical checks during sick leave, income from other household members relative to previous income, income from other sources relative to previous income. Background variables: sex, age, spouse, children, and education.</p>	<p>It should be noted, that in order to be able to calculate employment degree as described above, only people who returned to work at least two months before the end of the study period were included in the analyses of retention after first RTW. This limits the study population to 332 Dutch and 245 Danish persons. Retention after first RTW was investigated using a model comparing a low employment degree (0-0.66) to full employment (1) and a model comparing low to mid employment (0.67-0.99).</p>	<p>low physical job demands (2.00, p=0.01), high seniority (3-9 years: 2.28, p=0.05; 10+ years: 2.31, p=0.05) and disagreement to the statement "people report sick too easily" (2.05, p=0.05). Medium retention compared to a low retention was predicted by short time to first RTW (1.18, p<0.00), high work ability (1.29, p=0.01), modified work (2.37, p=0.01), low job strain (2.64, p=0.01), and having had less than three jobs before sick leave (3.24, p<0.00). Changed working hours (p>0.05), work place adaptation (p>0.05), and replacement rate (p=0.822) were insignificant in relation to retention after first RTW.</p>	<p>to Arbodienst, who's services focus on developing prevention and re-integration in company policies. The question of bias is however not crucial, as most results are presented on the basis of a pooling of the two sub-cohorts. However, Arbodienst is furthermore likely to be related not only to the outcome RTW through offering services related to re-integration, but also to exposures in the work environment through offering services related to prevention. It can therefore introduce confounding of the results, as it is not controlled for in the study.</p>

8. CONCLUDING REMARKS

Besides the identification of work environment exposures that predict work disability independently of employee health, there are two major experiences of this project that should be highlighted and kept in mind in terms of future research:

The combination of quantitative and qualitative methods proved useful in several ways: it was possible to identify what could be called a "secondary risk factor", meaning a factor that is not caught in the quantitative point estimates of exposure and outcome. The research interviews performed gave a clear picture of the importance of employer social support in the sub-acute/chronic phase of disability. This is well in line with findings in a recent study of 433 low back pain workers'

compensation claimants performed by Krause *et al.* (2001), where low supervisory support are associated with about 20% lower RTW rates during all disability phases (Krause *et al.*, 2001). Moreover, it was also useful in clarifying the more specific contents of organizational level factors influencing disability and RTW. Based on this it is recommended to include qualitative methods both in *de novo* search of new risk factors and in the (needed) further development of measures of organizational culture, policies and practices.

Based mainly on the study by Lund and Csonka (2001), but also on the conclusions of the review by Krause and Lund (2001), it seems recommendable in the design of future research to recognize and address the multi-factorial nature of the processes of disability and RTW. Lund and Csonka (2001), and the reviewed studies by Bloch and Prins (2001) and Høgelund (2000) provide evidence for an interaction between the individual employee, the organization (-al culture, policies and practices), and the legislation defining the overall structure in accordance with the conceptual framework suggested in Figure 1 presented earlier. The measures suggested by Lund and Csonka (2001) functioned not only as predictors of work disability independently of individual health symptoms and work environment exposures, but furthermore affected the effect measures of certain health variables, suggesting a potential “buffer-effect” within OPPs for preventing symptoms into developing into work disability. With regards to the legislative dimension, the work by Bloch and Prins (2001), and Høgelund (2000) reviewed by Krause and Lund (2001) indicate a similar interaction between the individual and legislative level.

Based on this, it seems appropriate to conclude that future research addressing work disability and RTW should include data and expertise on both individual task level exposures when assessing the effects of organizational variables – and vice versa.

The question of interaction with the legislative level is not illuminated optimally in this project – the best studies encompassing this dimension are the previously mentioned studies by Bloch and Prins (2001) and Høgelund (2000), as both feature comparable, cross national cohorts ideal for studying the effect of the legislative context. It is also worth noticing that the only study in this project addressing interaction between the individual and organizational level is Lund and

Csonka (2001). With this in mind, the results still clearly suggest an overall potential within especially the psychosocial but also mechanic dimensions of the individual level work environment exposures for reducing not only disability retirement and long-term sickness absence, but also voluntary retirement before the official age of retirement. Lund and Borg (1999), Lund, Iversen and Poulsen (2001), and Lund (2001) all point to a number of work environment exposures that predict disability retirement, absence and early retirement independently of various health symptoms. Minor differences between the indicators of the different outcomes are detected, which is useful when planning interventions against the different types of (disability) retirement.

While most current research on work disability and RTW has focused on the elements related to the individual employees health and work environment exposures, future research also needs to address which modes of interactions between employer and employee and other stakeholders are most conducive for preventing work disability and promoting RTW outcomes. The results of this project clearly indicates, that the investigation of such process variables will require interdisciplinary research utilizing both qualitative and quantitative methods and a conceptual model integrating several theories from different research disciplines.

9. REFERENCES

Amick III BC, Habeck RV, Hunt A, Fossel AH, Chapin A, Keller RB, Katz JN. 2000. Measuring the impact of organizational behaviors on work disability prevention and management. *J Occup Rehab* 10(1): 21-38.

Baillargeon J, Wilkinson GS. 1999. Characteristics of the Healthy Survivor Effect among male and female Hanford workers. *Am J Ind Med* 35: 343-347

Baldwin ML, Johnson WG, Butler RJ. 1996. The error of using returns-to-work to measure the outcomes of health care. *Am J Ind Med* 29(6): 632-41.

Bernacki EJ, Guidera JA, Schaefer JA, Tsai S. 2000. A facilitated early return to work program at a large urban medical center. *J Occup Environ Med* 42(12): 1172-7.

- Bloch FS, Prins R, Ed. 2001. Who returns to work and why? A six-country study on work incapacity and reintegration. New Brunswick, New Jersey, Transaction Publishers.
- Borg V, Burr H, Ed. 1997. Danske Lønmodtageres Arbejdsmiljø og Helbred 1990-95 (The Work Environment and Health of Danish Employees 1990-95). Copenhagen: National Institute of Occupational Health
- Butler RJ, Johnson WG, Baldwin ML. 1995. Managing work disability: why first return to work is not a measure of success. *Indus Labor Rel Rev* 48(3): 452-469.
- Cheadle A, Franklin G, Wolfhagen C, Savarino J, Liu PY, Salley C, Weaver M. 1994. Factors influencing the duration of work-related disability: a population-based study of Washington State workers' compensation. *Am J Public Health* 84(2): 190-6.
- Dembe A. 2001. The social consequences of occupational injuries and illnesses. *Am J Ind Med* 40: 403-417.
- European Network for Workplace Health Promotion. 1997. The Luxembourg Declaration on Workplace Health Promotion in the European Union. Dortmund: Federal Institute for Occupational Safety and Health.
- Galizzi M, Boden LI. 1996: What are the most important factors shaping return to work? Evidence from Wisconsin. Cambridge, MA, Workers' Compensation Research Institute.
- Habeck RV, Leahy MJ, Hunt HA, Chan F. 1991. Employer factors related to workers' compensation claims and disability management. *Rehab Counsel Bull* 34(3): 210-226.
- Høgelund J. 2000. Bringing the sick back to work: labor market reintegration of the long-term sicklisted in the Netherlands and Denmark. Danish National Institute of Social Research. Copenhagen, Roskilde University. 258.
- Infante-Rivard C, Lortie M. 1996. Prognostic factors for return to work after a first compensated episode of back pain. *Occup Environ Med* 53(7): 488-94.
- Krause N, Dasinegr NK, Deegan LJ, Rudolph L, Brand RJ. 2001. Psychosocial job factors and return-to-work after compensated low back injury: a disability phase-specific analysis. *Am J Ind Med* 40: 374-392.
- Krause N, Lund T. 2001. Return to Work. In: J. Barling and M. Frone (Eds.) *The psychology of workplace safety*. Washington, DC: American Psychological Association. (in press)

- Kvale S. 1997. Interview. En introduktion til det kvalitative forskningsinterview. København, Hans Reitzels Forlag.
- Loisel P, Durand P, Abenham L, Gosselin L, Simard R, Turcotte J, Esdaile JM. 1994. Management of occupational back pain: the Sherbrooke model. Results of a pilot and feasibility study. *Occup Environ Med* 51(9): 597-602.
- Loisel P, Durand P, Gosselin L, Simard R, Turcotte J. 1996. La clinique des maux de dos. Un modele de prise en charge, en prevention de la chronicite. Montreal, Quebec, Centre hopitalier universitaire de Sherbrooke.
- Lund T. 2001. Risk factors in work environment and health for transition from employment to Early Retirement Pension among Danish employees 50-64 years of age 1995-1997. Submitted October 2001.
- Lund T, Borg V. 1999. Work environment and self-rated health as predictors of remaining in work 5 years later among Danish employees 35-59 years of age. *Experimental Aging Research* 25: 429-434.
- Lund T, Csonka A. 2001. Risk factors in health, work environment, smoking status and organizational context for work disability. Submitted October 2001.
- Lund T, Iversen L, Poulsen, KB. 2001. Work environment factors, health, lifestyle and marital status as predictors of job shift and early retirement in physically heavy occupations. *American Journal of Industrial Medicine* 40(2): 161-169.
- Malterud K. 1996. Kvalitative metoder i medisinsk forskning. En innføring. Aurskog, Tano Aschehoug 1996.
- Midtgård U, Poulsen OM. 1997. Occupational safety and health in waste collection and recycling: the CORE research program. *Ann Agric Environ Med* 4(1): 21-26.
- Rosenstock L. 1997. Work organization research at the National Institute for Occupational Safety and Health. *J Occup Health Psychol* 2(1): 7-10.
- Rothenbacher D, Arndt V, Fraisse E, Zschenderlein B, Fliedner TM, Brenner H. 1998. Early retirement due to permanent disability in relation to smoking in workers in the construction industry. *JOEM* 40: 63-68.

- Sim J. 1999. Improving return-to-work strategies in the United States disability programs, with analysis of program practices in Germany and Sweden. *Social Security Bulletin* 59(3): 41-50.
- Spector PE. 1987. Method variance as an artifact in self-reported affect and perceptions of work: myth or significant problem? *J Appl Psychol* 72: 438-443.
- Strauss A, Corbin J. 1990. *Basics of qualitative research. Grounded theory procedures and techniques*. Newbury Park, Sage Publications.
- Weil D. 2001. Valuing the economic consequences of work injury and illness: a comparison of methods and findings. *Am J Ind Med* 40: 418-437.
- Williams LJ, Cote JA, Buckley MR. 1989. Lack of method variance in self-reported affect and perceptions at work: reality or artifact? *J Appl Psychol* 74: 462-468.
- Zeitner IR, Beedon EL. 1987. Long-term disability programs in selected countries. *Social Security Bulletin* 50(9): 8-21.

further research along these lines that would help inform future return-to-work policies. Health status All associations between health indicators at onset and work status after two years were consistently linear: the less pain and the better functional capacity at onset, the higher resumption rates in all cohorts. In summary, the outcomes in terms of work resumption varied widely between the six cohorts. Even though some "baseline variables" were consistently related to resumption rates in all cohorts, these universalities do not account for the crossnational differences: also within socio-demographic subgroups, resumption rates varied considerably between cohorts. The evidence on the association between disability and poverty was recently reviewed in the United Nations' first Flagship Report on Disability and Development The association between disability and poverty has been shown to be stronger when poverty is measured multidimensionally as multiple deprivations compared to when it is measured through income or consumption expenditures. Initiatives on the local, national, and transnational levels addressing the connection between poverty and disability are exceedingly rare.