Psychosocial Work Conditions – Cardiovascular Disease, Perceptions and Reactive Behaviour

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To all my friends and family <3

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ABSTRACT

The overall aims of this thesis were to improve our understanding of (1) associations between adverse psychosocial work conditions and less explored cardiovascular outcomes, and (2) workers' perceptions and reactive behaviour when exposed to such conditions. Psychosocial job environment was evaluated with the job demand-control and effort-reward imbalance models. In the former construct, demand captures psychological work load, while control measures the employee's influence over work tasks. Conceptually, effort is similar to job demand in measuring work intensity, while reward measures salary, esteem from colleagues and management, and job security. Examined subjects were drawn from three cohorts: randomly selected residents from Greater Gothenburg, patients with new onset acute coronary syndrome from the West county of Sweden and Swedish male construction workers.

Results in paper I illustrated that a combination of high demands-low control, commonly referred to as high strain, and imbalance between effort and reward was related to adverse values in intermediate cardiovascular heart disease risk factors, foremost blood pressure and blood lipids. Surprisingly, findings in paper II showed that work conditions characterized by high demands-high control were more strongly associated to increased ischemic stroke, than high strain. Furthermore, high strained and effort-reward imbalanced jobs predicted job mobility in a general population sample (Paper III) and were related to delayed return to work and fear-avoidance perceptions towards the workplace, among patients with new onset acute coronary syndrome (Paper IV). Fear-avoidance attributions, in turn, mediated the relationship between poor psychosocial conditions and expected work resumption. The results partly concur with previous evidence on links between psychosocial job factors and cardiovascular outcomes. The results also indicate that workers are not passive receptors to impairing job conditions, but both react to and actively try to improve or avoid detrimental work environment, and consequently protect their health.

In the gender stratified analyses (paper I, III, IV) notable differences were detected, as psychosocial job dimensions were not related to blood pressure, job mobility, expected return to work or fear-avoidance attributions among women. These differences could be due to a gender segregated labour market or lack of precision in reflecting female dominated work cultures. Further explanations might be that for women, private life stressors, e.g. child care or household work, deflate relationships between the psychosocial factors and outcomes used in this thesis.

Keywords: Psychosocial job conditions, cardiovascular disease, gender segregation
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SAMMANFATTNING PÅ SVENSKA

På grund av teknisk utveckling har det under flera decennier pågått en förändring av arbetsförhållanden, där arbetsmarknaden inte längre domineras av industriarbete, utan allt mer består av arbeten som utmärks av kunskapsprocessande eller kund- och vårdkontakter. Detta har därmed inneburit ett skifte, från ett dominerande fokus på fysiska riskfaktorer, till ett allt växande behov av att utreda psykosociala faktorers betydelse för arbetsrelaterade ohälsa. Dålig psykosocial arbetsmiljö har kopplats till många olika typer av ohälsotillstånd, såsom kardiovaskulär hjärtsjukdom, depression och muskeloskeletala besvär. Det övergripande syftet med den här avhandlingen var att undersöka samband mellan psykosocial arbetsmiljö och kardiovaskulära sjukdomar, men även hur dåliga psyksociala arbetsförhållanden kan uppfattas av individen och leda till reaktiva beteenden.

Psykosociala arbetsförhållanden har i den här avhandlingen har utvärderats med de två, i det här sammanhanget, vanligaste och mest vetenskapligt utvärderade modellerna. Den ena modellen kallas *krav-kontroll modellen*, där kombinationen höga krav och låg kontroll anses som särskilt skadligt för hälsan. Den andra modellen *ansträngning-belönings modellen* utvärderar hur mycket ansträngning individen lägger ner på sitt arbete i relation till hur stor belöning som erhålls, i form av lön, uppskattning och anställningstrygghet. Delstudierna i den här avhandlingen har utförts på tre olika grupper: slumpmässigt utvalda invånare i Storgöteborg, personer med akut koronarsyndrom i Västra Götalandsregionen och svenska män inom byggbranschen.

Studieresultaten visade att personer som upplevde dåliga psykosociala förhållanden på arbetsplatsen hade sämre värden avseende biologiska riskfaktorer för kardiovaskulär hjärtsjukdom, såsom blodtryck och blodfetter. Något överraskande var att höga krav i kombination med låg kontroll inte var relaterat till högre risk för koronarhjärtsjukdom eller ischemisk stroke. Istället visade sig att höga arbetskrav och hög kontroll, vilket brukar anses som stimulerande, innebar en något ökad risk för ischemisk stroke. Däremot var höga krav-låg kontroll och obalans mellan ansträngning-belöning relaterat till arbetsbyte och försenad återgång till arbetet efter sjukskrivning på grund av koronarhjärtsjukdom. Ytterligare ett fynd var att personer som nyligen drabbats av akut koronarsyndrom och som rapporterade dålig psykosocialmiljö, uppfattade arbetsplatsen som skadlig för hälsan. Denna uppfattning påverkade också tiden för att återgå till sitt arbete efter sjukskrivning.

Flera av resultaten skiljde sig dock avsevärt åt mellan män och kvinnor, då samband mellan dåliga psykosociala arbetsförhållanden och blodtryck, arbetsbyte eller uppfattningen att arbetsplatsen var dålig för hälsan, enbart återfanns bland män. Sådana skillnader kan bero på könssegregation på arbetsmarknaden och att de psykosociala formulär som använts i denna avhandling bättre speglar typiskt manliga arbetsmiljöer. En annan orsak kan vara att kvinnors livssituation innehåller större komplexitet, där kombinationen av både yrkesarbete och hushållsarbete, kan ha större inverkan på hälsa och reaktiva beteenden än hos män.

LIST OF PAPERS

This thesis is based on the following studies, referred to in the text by their Roman numerals.

I. Söderberg, M., Rosengren, A., Hillström, J., Lissner, L., Torén, K. A cross-sectional study of the relationship between job demand-control, effort-reward imbalance and cardiovascular heart disease risk factors. *BMC Public Health 2012, 12:1102*

II. Schiöler, L., Söderberg, M., Rosengren, A., Järvholm, B., Torén, K. Psychosocial work environment and risk of ischemic stroke and coronary heart disease: a prospective longitudinal study of 75236 construction workers. *Submitted for publication*

III. Söderberg, M., Härenstam, A., Rosengren, A., Schiöler, L., Olin, A-C., Lissner, L., Waern, M., Torén, K. Psychosocial work environment, job mobility and gender differences in turnover behaviour: a prospective study among the Swedish general population. *BMC Public Health 2014, 14:605*

IV. Söderberg, M., Rosengren, A., Gustavsson, S., Schiöler, L., Härenstam, A., Torén, K. Fear-avoidance beliefs towards work among acute coronary syndrome survivors - relationships to adverse psychosocial job conditions and mediator effects in expected return to work. *Submitted for publication*

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ABBREVIATIONS

JDC	Job demand-control
ERI	Effort-reward imbalance
RTW	Return to work
CHD	Cardiovascular heart disease
ACS	Acute coronary syndrome
OR	Odds ratio
HR	Hazard ratio
95% CI	95% confidence interval
DBP	Diastolic blood pressure
SBP	Systolic blood pressure
BMI	Body mass index

1 INTRODUCTION

Everyday work implies exposure to a variety of job environment factors, where some have been associated with adverse health outcomes. Traditionally, occupational medicine has focused on physical hazards, e.g. chemical exposure and ergonomics, which reduce employees' health and increase injury risk. However, in the modern labour market an increasing amount of jobs are defined by cognitive and emotional demands. For example, according to official Swedish statistics [1]; about 66% of the Swedish working population perceived their work situation as stressful and 43% that their job was to psychologically demanding. Hence, in recent decades there has been a shift in interest towards impaired health caused by adverse psychosocial. This has been reflected in the amount of studies carried out in this context, illustrating associations between psychosocial characteristics and various ill-health outcomes, such as cardiovascular and coronary heart disease [2-4], mental health disorders [5-8] and musculoskeletal problems [9, 10].

Although there is much evidence on links between psychosocial work conditions and several different health outcomes, the literature has predominantly assessed relationships to cardiovascular heart disease (CHD). The strong focus on CHD is obvious; CHD is the most common single cause of death in many countries worldwide, including Sweden. It is also the most frequent cause for sick-leave and early retirement in Sweden [11]. In 2010 the societal cost for CHD, including treatment and loss of productivity was 61.5 billion Swedish krona (about 8.5 billion US dollars) [12]. Hence, CHD includes both extensive individual suffering and societal consequences.

Studies investigating other cardiovascular conditions related to fatality and long sick-leave spells, such as stroke, are fewer, but have also produced more conflicting results. The lack of such studies is surprising as stroke is the third most common cause of death worldwide [13, 14] and implies both prolonged sick-leave and disability [15], affecting the individual with regard to well-being and weakened economics. Besides individual suffering, stroke is a notably expensive disease. Costs for managing stroke are not limited to the acute hospital phase, but extend throughout life, as remaining mental and physical disabilities are common [16]. In Sweden, home and residential care accounted for 59% of total stroke costs, and indirect costs for productivity losses accounted for another 21%. The high economic burden for stroke is not unique for Sweden, as stroke accounts for approximately 2-4 % of the total health-care expenditures in several European countries, e.g. France, Holland, the UK [17] as well as in the US [18].

Further, despite the amount of proven relationships between poor work conditions and ill-health, few studies investigate how workers themselves perceive adverse psychosocial factors. This lack of research is notable, as it seems unlikely that workers are passive recipients to poor job environment that do not reflect or actively try to improve conditions. Possible reasons for the lack of studies, concerning such mechanisms, are that occupational medicine traditionally has focused on physical problems caused by e.g. chemical or hand-arm vibrations exposure, which might not be immediately noted by the worker, but slowly result in ill-health over time. Psychological distress, caused by poor psychosocial work conditions, is likely to be more imminent in the worker's everyday life, and hence cause thoughts and reactions.

In behavioural science, *perception* is defined as the organization, identification and interpretation of sensory information in order to understand the surroundings. This procedure involves cognitive and emotional responses, which assigns meaning to the perceived context and might result in reactive behaviour [19]. One perceptive process is *attribution* [20]. This cognitive process is used to ascribe properties to objects and situations in order to evaluate causes for specific events. For example, in order to interpret what caused a car crash, the individual might notice that the road was winding, and hence attribute the accident to the road conditions. In a similar fashion, when suddenly experiencing e.g. back-pain, straining movements at work might be attributed as the source.

Another perception process, used to both evaluate the impact surroundings might have on health and determine appropriate actions accordingly, is c*ognitive appraisal* [21, 22]. In the primary stage of appraisal, the person estimates whether encounters with a particular situation are related to potential harm or benefits, and whether such exposure might be justified according to commitments, values, or goals. When a certain context has been identified as harmful, the secondary appraisal step encompasses an evaluation whether anything can be done to overcome or prevent harm, such as altering, avoiding or accepting the situation.

Attribution and appraisal are related concepts which involve how humans perceive and process their surroundings. They differ in the sense that attribution is used to analyse what could have caused specific events. Appraisal is the process in which the individual evaluates health effects from interaction with different events and common situations, whether such interaction is necessary to achieve goals or fulfil commitments, and what behaviour to choose in the given circumstances.

Although it has been recognized that the perception of a situation may differ from an actual or objective situation, there are several reports that individuals tend to react on their own perceptions, rather than the objective [21, 23]. Even though there is strong evidence that poor psychosocial work conditions are related to ill-health, negative perceptions and reactions associated with such dimensions have rarely been studied. In a large European study, about 28 % of the out of almost 16000 participants, found that work-stress negatively affected their health [24]. However, the study did not investigate further if such perceptions resulted in any reactive behaviour. One meta-analyses did find that negative work perceptions were related to lowered psychological well-being [7]. Additionally, several studies in patients with musculoskeletal disease, have illustrated relationships between poor work conditions and the perceptions of the workplace as unhealthy, resulting in aversive behaviour e.g. prolonged sick leave [25, 26]. Such study results illustrate that workers do perceive adverse work dimensions as unhealthy and might consequently through the appraisal process decide to avoid exposure e.g. by delaying work resumption.

Considering the strong associations between psychosocial characteristics and ill-health [2-10], there is further need to explore whether workers perceive adverse work conditions as hazardous and in order to protect health, try to either avoid or improve such conditions.

Furthermore, studies on relationships between psychosocial work conditions and health, especially in the early stages, predominantly used all-male samples or lacked gender stratified analyses [3]. For example, a fairly recent review paper on relationships of JDC to coronary heart disease [2] reported that out of 33 articles, where altogether 51 analyses were performed, only 18 analyses involved female participants and eight were stratified by gender. Lack of gender stratified analyses are coherent with the overall trends in medical research, as early studies in this field either did not include women, or adjusted for gender, rather than stratifying [27]. More recent studies, with gender stratified analyses have recorded differences in relationship between work stressors and health [7, 28, 29]. These dissimilarities are thought to partly originate from gender composition in certain occupations [30], but also from labour market inequalities [31]. Such reports indicate that men and women have different work conditions, and thus gender stratified analyses are to prefer, in order to detect differences in work to health relationships.

1.1 Models for measuring psychosocial work conditions

There has been an accumulated interest in how to measure psychosocial work environment. Although a multitude of methods have been created to capture such dimensions, the two most influential and scientifically evaluated models in this context are the Job Demand-Control (JDC) [32] and Effort-Reward Imbalance (ERI) models [33].

1.1.1 Job demand-control

In the last decades, the job demand-control model [32, 34] has been the leading model for measuring psychosocial work conditions. The demand dimension captures psychological demands and has been operationalized mainly in terms of time pressure and work load. Job control, sometimes referred to as decision latitude, specifies to what extent the individual can influence the order, volume and content of their tasks. Job control originally constituted two components; skill discretion and decision authority. While decision authority is a straightforward concept of influence over work tasks; skill discretion implies learning new skills or if the job comprises repetitive tasks with low potential for occupational development. In early studies these dimensions were usually combined into one measure, but many recent studies tend to include only decision latitude [28].

The JDC model postulates that psychological strain is not only the result from one aspect of the work environment, but rather from the joint effect of both high demands and low control. Job control is thought to reduce the negative effects of high demands; both by the influence of work tasks, but also that skill discretion implies learning and stimulation. The two variables are commonly dichotomized into high/low and combined according to Karasek [32, 34], high strain (high demand-low control), active (high demand-high control), passive (low demand-low control) and low-strain (low demand-high control), illustrated in figure 1.

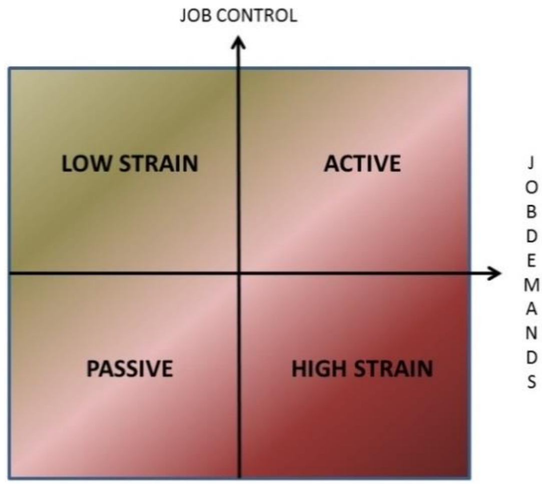

Figure 1. The job demand-control model according to Karasek

Out of the combined JDC categories, high strain is hypothesized as the job condition most related to health hazards. The stress arousal, triggered by this sort of work condition, is compared to that of acute fear, with increased heart rate and adrenaline response [34], which if it is endured for a prolonged period of time, is transformed into damaging job exposure. Traditionally, industrial blue-collar jobs and certain service jobs were identified as particularly at risk of high strain work environment and consequent ill-health. However, recent studies e.g. the Whitehall II study among British civil servant, have found similar relationships [35].

Active work is defined as challenging and intense work, but without the negative psychological effect as in high strain, and is typically found in professional work. These work situations might be demanding, but also involve high level of freedom level, learning and growth, which is thought to buffer against work load.

The opposite of active jobs is the conditions referred to as passive jobs. Although not exposed to the stress of high demands, extreme cases of passive jobs have been associated to a state close to apathy, as there is little to do, but also no control over work tasks or stimulation in doing them [34]. This state may have a spill-over effect as some findings show that those with passive jobs tend to have a passive off-work lifestyle [36]. Originally this type of work was identified as the second major problematic psychosocial conditions in the JDC model; lack of job challenges and work restrictions were hypothesized to be the least motivating job setting and related to loss of job satisfaction and innovation.

Finally low strain, constituting of low demands and high control, is debated to sometimes be less desirable than the stimulating work environment of active jobs. However, it is still most strongly related to both physical health and mental well-being [3, 5, 28, 37] and commonly used as a reference value opposite high strain.

Although the model has received some critique in later years, especially in regards to oversimplifying complex work environment issues and lacking measures for emotional or cognitive demands, there is still considerable support between high strain work environment and ill-health outcomes. In its premature years, the model was primarily used to investigate relationships to cardiovascular and coronary heart disease [2-4, 37], but in the recent decade a growing body of evidence has also found associations to psychological disorders [5, 7, 28] and harmful coping behaviour, e.g. smoking [38].

1.1.2 Social support

The JDC model was later complemented by the social support dimension [39]. Social support measures to what extent the individual receives support from colleagues and management. This variable often includes both emotional, as well as, instrumental support i.e. help with work task. The combination of both high strain and low social support is commonly referred to as ISO-strain. Studies so far have predominantly been evaluated with only the demand and control variables [2, 28], and only one paper in this thesis investigates social support, therefore the social support dimension is only described in brief.

1.1.3 Effort-reward imbalance

Another leading model when examining psychosocial work dimensions is the effort-reward imbalance model [33]. The ERI model stems from the social exchange theory of cost and gain, and focuses on the reciprocity between efforts spent and adequate rewards received. Conceptually, effort is similar to job demand in measuring work intensity. Occupational rewards are distributed by three channels; salary, esteem from colleagues and management and career opportunities, including job security. The combination of high effort combined with low reward is considered to create psychological distress, which over time can lead to adverse health outcomes (figure 2).

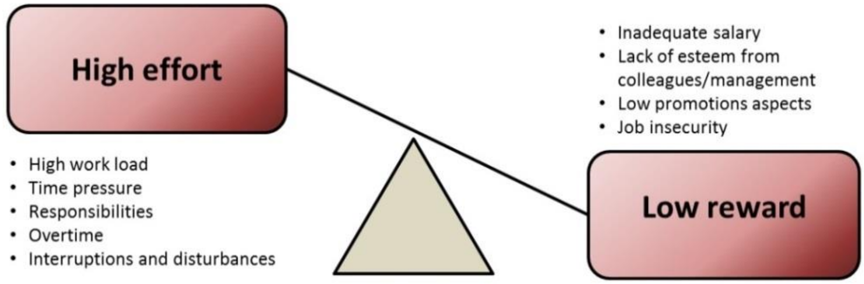

Figure 2. The effort-reward imbalance model according to Siegrist

Coming from a sociological perspective, the founder of the ERI model Siegrist also argues [33] that these types of work conditions are likely to be more frequent in blue-collar jobs, since these jobs imply hard work, yet are low-paid and often involve limited career prospects. However, a demanding work environment might also be found among white-collar workers, who for strategic reasons voluntarily put in the extra work for future career gains. Such tendencies might be a temporary and self-chosen ERI, but can be straining if endured for longer periods and are of particular harm if the costs spent does not pay off [40]. Further, these circumstances might occur, regardless of occupation, if there are limited options on the labour market or economic recession, where job efforts might be increased, but rewards in terms of salary or promotions are limited.

Similar to high strained work conditions, work environment characterized by high ERI is also associated to cardiovascular heart disease [3, 6, 37], and since ERI also imply strong negative emotions it has been linked to lowered general well-being and mental ill-health [5, 6], but also destructive coping such as smoking [38].

1.1.4 Comparison JDC and ERI

In contrast to the JDC model, which has a somewhat instrumental approach, the ERI model stems from organizational injustice and social exchange theory. These differences in theoretical background are manifested in how demands/effort interplays with either job control or reward; the JDC model emphasizes task-level control and reward captures social aspects of work. Further, the reward variable has a micro-social scope, e.g. esteem and appreciation from colleagues and management. However, the variable also reflects rewards in a macro-social perspective, where job security and promotion possibilities relate to economic recession and company downsizing [8, 33].

Moreover, consistency in study results differs between the two psychosocial measures. Studies evaluating work conditions with ERI illustrate similar findings across populations [2, 5, 6, 8]. Analyses examining JDC to health associations do on the other hand, display inconsistency between studied groups. A plausible explanation is that the JDC model was mainly developed among male blue-collar workers, and consequently is likely to be shaped to best reflect such work characteristics. As a result most JDC to ill-health associations, especially in earlier studies, were found in male dominated blue-collar work [2, 28, 41]. When broadening study populations, more conflicting findings emerged. This is especially notable when comparing men and women, as little support has been found for high-strain related ill-health in females [28]. Instead women in an active work situation (high demands-high control), report more health risks e.g. increased sick leave [42], higher risk for coronary heart disease risk [29] and increased smoking [38], than those in high strain work. Furthermore, studies of both men and women in white-collar jobs have shown that passive jobs (low demands-low control) could be associated with myocardial infarction [43] and inactive leisure time [36].

1.2 Outcome variables: Cardiovascular disease

Despite much evidence on links between psychosocial work conditions and CHD [2-4, 41], studies investigating other cardiovascular conditions related to fatality and long sick-leave spells, such as stroke, are sparse. This lack of studies is surprising as stroke is the third most common cause of death worldwide [13, 14], it involves prolonged sick-leave and disability [15] and carries notable economical costs [16]. There is, additionally, a lack of studies exploring how psychosocial factors might relate to intermediate risk factors such as blood pressure, blood lipids or obesity [44-47]. Investigating whether work environment is related to such biomarkers is important, as it could provide information on development of CHD.

1.2.1 Biological risk factors for cardiovascular heart disease

Adverse psychosocial work factors have previously been linked to different CHD risk factors, especially high strain to increased blood pressure [46, 48, 49]. But although there is some evidence indicating associations, results are conflicting. In a Swedish cross-sectional study performed in a general population, no relationships between JDC variables and systolic blood pressure were found [45]. The study also illustrated a lack of links between psychosocial exposure and total cholesterol or BMI. These findings concur with a study based on the Swedish WOLF cohort [47], which did not either find any relationship between high strain and total cholesterol. However, this study did display associations between ERI exposure and increased blood pressure and cholesterol (total cholesterol and LDL-cholesterol). Another study performed on the Whitehall II population, reported links between high ERI and ambulatory blood pressure in men [50]. Despite contradictive results, variables such as blood pressure and blood lipids are well-known biological risk-factors for CHD. Hence, investing relationships to psychosocial work factors is important, since these factors are related to lifestyle and thus amenable to intervention.

1.2.2 Coronary heart disease

The association between psychosocial factors in the work environment and coronary heart disease is supported by a number of systematic reviews. One, that included 31 studies, concluded that there is evidence of the association of psychosocial work characteristics, measured by the JDC and effort-reward imbalance models, and coronary heart disease etiology and prognosis [51]. Another review of 35 studies found consistent evidence to support the association between job strain, as defined by the JDC model, and coronary heart disease [52]. In a third systematic review of 33 studies, moderate evidence was found for high psychological demands as risk factors for coronary heart disease among men [53]. A meta-analysis of 14 studies found 50% excess risk for coronary heart disease among employees with work stress (defined by either the JDC-model, the effort-reward imbalance model or the organizational injustice model) [54] and another one that included 13 studies found an increased risk for coronary heart disease among employees experiencing job strain [55]. A Swedish study based on a general population sample, found an increased risk in the high strain group [56].

1.2.3 Ischemic stroke

The current knowledge regarding psychosocial work environment and stroke is limited, as studies are few and results conflicting. Some studies have used the single dimensions of the JDC-model as predictors. One prospective cohort study displayed an almost doubled risk of cerebrovascular disease for women exposed to high demands [57]. Another longitudinal study found an increased risk of cerebrovascular disease for workers in jobs with low control [58]. In a longitudinal study of the entire Swedish working population aged 25-64 [59] low control increased the risk for hemorrhagic stroke and any stroke in women, but not for ischemic stroke. A study of the same population aged 30-64 with a longer follow-up [60] also showed increased stroke risk for workers in jobs with low control. One study found no association between psychosocial job exposure and increased risk of stroke [56]. Studies examining the importance of social support as predictor for stroke are even sparser, with only one prospective cohort study which found that low social support was associated to stroke for women, but not men [61].

Only a handful of studies used the joint job demand-control model, with four categories, to examine the association between psychosocial work environment and stroke [56, 57, 62-64]. Out of those, one [64] found significant increased risk for high strain jobs. Another study showed increased risk for stroke for workers in active job environments [57], but did not find any relationships between high strain and stroke. Considering the contradictory results and high prevalence of mental and physical disabilities [16] and high societal costs [17], it is important to further investigate psychosocial job stress as a predictor for stroke.

1.3 Outcome variables: Perceptions and reactive behaviour

According to behaviour science, individuals use perceptive processes to identify, organize and interpret sensory information in order to understand the surrounding environment. The procedure involves cognitive and emotional responses, which in turn might result in reactive behaviour [19]. In such processes individuals ascribe properties to different elements in their surroundings, whereas some are attributed as potentially harmful. The person-environment interaction is evaluated in order to determine if the situation has an impact on well-being, and if so, whether it is primarily hazardous or challenging. When a situation is appraised as harmful, the individual will try to decide whether to accept, avoid or alter the situation, which in turn causes different reactive behaviour. Although there is vast evidence that supports associations between adverse psychosocial work characteristics and a variety of ill-health outcomes; few studies examine perceptions about such conditions or reactive strategies. The lack of investigating such mechanisms is a failure to identify the worker as an active agent, who forms both perceptions and carries out activities to either improve or avoid harmful situations.

1.3.1 Job mobility

One reactive behaviour against poor work conditions is to change jobs. Since job mobility commonly is an energy and time costly process, it is plausible that most individuals will first try to accept or improve a negative work situation. If such strategies prove unsuccessful, the final step is to engage in the job mobility process. Hence, job turnover could be seen as a strong indicator of particularly adverse and irredeemable work conditions.

Studies evaluating associations between psychosocial job factors and job turnover are sparse and many studies evaluate turn-over *intention*, rather than actual job mobility. Although both job turnover and the intention to leave an employment are steps in the job mobility process, they differ qualitatively. The intention to leave is the preceding attitude towards possible turnover, whereas job mobility is the executed behaviour. The temporal aspect of the study design is thus important since cross-sectional studies can only evaluate an intention, while longitudinal studies can capture the carried out behaviour. Some few longitudinal studies have found that high strain [65] and low job control [66] among blue-collar workers predicted executed job mobility and that nurses experiencing high ERI reported intention to leave their employment at a 1-year follow-up [67]. Yet another paper, examining predictors for intention to leave the nursing profession, displayed association for ERI as a predictor for turnover intention, but not for JDC [68]. A handful of cross-sectional studies in samples consisting of health care workers have illustrated that both high strain [69, 70] and high ERI [71] could be linked to the intention to leave current organization.

Additionally, some papers have shown health consequences from being “locked-in occupations”, meaning a combination of poor work environment and reduced possibilities for job mobility, or that job mobility within the same occupation results in similar work conditions. One report showed that the combination of high ERI exposure and being locked-in at work is related to long-term sick leave [72]. Another study [73] illustrated that workers experiencing locked-in positions had delayed return to work and more often reported mental ill-health, than subjects who could change jobs. It has also been shown that similar psychosocial factors predicted both job mobility and prolonged sick leave among nurses [74], thus emphasising job mobility as an important protective strategy.

1.3.2 Fear-avoidance attributions

One strong predictor for sick-absence in musculoskeletal disease is attribution of the workplace as unhealthy, resulting in what has been labelled as "fear-avoidance" perceptions [25, 26]. This process is intensified in painful events and is associated with a powerful aversive drive, presumably due to a survival benefit through identifying potential dangers [75]. Fear-avoidance attributions are likely to occur in traumatic disease events such as acute coronary syndrome (ACS) as this disease is both painful and potentially fatal. However, unlike musculoskeletal conditions, which are attributed to ergonomic factors [25, 26], the onset of ACS may be ascribed to job stress, caused by poor psychosocial work conditions. Hence, after ACS onset, the patient will seek plausible sources for the disease. If the poor work environment is attributed as a possible cause for ACS, strategies will likely be considered to alter or avoid this harmful situation.

There is strong support for links between poor work conditions, high strain and high ERI [2-4, 33, 34] to CHD, and to recurrent myocardial infarction [76, 77]. Further, two review papers among musculoskeletal pain patients [25, 78] identified fear-avoidance as more strongly linked to delayed work resumption, than high psychological demands. Considering such findings, it is surprising that none of the papers found have investigated whether ACS survivors with adverse psychosocial work conditions hold fear-avoidance beliefs, and if so, whether such perceptions are related to RTW.

1.3.3 Expected return to work after ACS onset

Advances in the treatment of acute coronary syndromes (ACS), e.g. pharmacological treatment and revascularisation procedures, chiefly angioplasty but also CABG, have resulted in improved survival and augmented the numbers of survivors still in the work force [79]. Despite improvements in medical outcomes, ACS remains a substantial cause of extended work absences [79] and premature retirement [80]. Extended sick-leave may imply suffering for the individual, such as social isolation and weakened economic position [81], as well as societal consequences due to loss of productivity [12]. Although there is evidence that psychosocial work factor are related to prolonged time for sick-leave [11, 82, 83] and predict RTW in musculoskeletal [78] and mental disorders [84, 85]; there is limited knowledge whether psychosocial characteristics are related to RTW after ACS.

Poor psychosocial work conditions are likely to be perceived as having an adverse health impact and thus the individual will evaluate whether enduring them is part of an overall goal or value, and how to act in order to overcome or avoid harm. If the workplace is perceived as harmful and does not incline particular commitment or goals, it is likely that the individual will try to avoid or prolong RTW.

2 AIM OF THE THESIS

The overall aims of this thesis were to improve our understanding of (1) relationships between adverse psychosocial work conditions and less well-studied cardiovascular disease outcomes, and (2) perceptions and reactive behaviours to such work conditions. In studies that included both men and women, analyses were stratified by gender.

The specific study aims were as follows:

Paper I To explore relationships between psychosocial work conditions, evaluated with the job demand-control and effort-reward imbalance models, to seven biological CHD risk factors, among the general populations of West Sweden.

Paper II To examine whether exposure to various levels of job demand-control-social support was associated with ischemic stroke or coronary heart disease in a cohort of Swedish construction workers.

Paper III To investigate whether job demand-control or effort-reward imbalance predicted job mobility, among the general populations of West Sweden.

Paper IV To investigate whether job demand-control and effort-reward imbalance were related to fear-avoidance attributions towards the workplace, and if such aversive perceptions mediated relationships between psychosocial job environment and return to work, among acute coronary syndrome survivors.

3 METHODS

3.1 Overview

The individual studies were either based on the Adonix/Intergene study cohort, the Swedish Construction Industry Cohort or the VGR-heart cohort (table 1). Study I, II and VI were approved by the Regional Ethical Review board of Gothenburg and study III was approved by Regional Ethical Review board of Umeå.

Table 1. Overview of design and sample in each paper

Study	I	II	III	IV
Design	Cross-sectional	Cohort study	Cohort study	Cross-sectional
Data collection	Adonix/Intergene	The Swedish Construction Industry Cohort	Adonix/Intergene Adonix follow-up	VGR-heart
Inclusion criteria	Resident of Greater Gothenburg, aged 24-75 years, currently working, completed questionnaire with psychosocial variables	Male construction workers, filled-in psychosocial variables, no previous history of coronary heart disease or ischemic stroke	Resident of Greater Gothenburg, aged 24-60 years, working at baseline, “yes” response to job insecurity, filled-in job mobility item	Acute myocardial infarction or unstable angina diagnosis, aged <65 years, resident of the West county of Sweden and currently working
Sample size	1306	75236	940	509
Outcome	CHD risk factors	Coronary heart disease and ischemic stroke	Job mobility	Fear-avoidance attributions and time for expected RTW
Statistical method	Multiple linear regression	Cox proportional hazards regression	Multiple logistic regression	Multiple linear regression

3.2 Data collection and study subjects

Data analysed in paper I and III was based on the Adonix/Intergene study cohort. However, due to different design in the two papers, the study populations were not identical. In this paragraph, the core constitution of the sample is described. Further adjustments are described under the heading of each paper. Adonix, which is an acronym for "Adult-onset asthma and nitric oxide", is the collective name for a study investigating new onset of asthma and markers for airway inflammation. The Intergene project aimed to investigate the INTERplay between GENEtical susceptibility, environmental factors including life-style and psychosocial background for the risk of cardiovascular diseases. Men and women aged 24-75 years were randomly selected from the source population of Greater Gothenburg, during April 2001 to December 2003. All selected individuals received participant information, an invitation to a clinical examination by mail and two questionnaires. A supplementary questionnaire was administrated during the clinical examination. In total, 2492 subjects accepted participation at baseline. This constituted the core cohort used in both paper I and III.

3.2.1 Paper I

Examined subjects in paper I were drawn from the core Adonix/Intergene study cohort described above (n=2492). Additionally, all participants who had not completed any psychosocial variables (n=501) or were not currently working (n=685) were excluded. The final sample used for analyses consisted of 1306 participants (49 % men). Age ranged 24-71, with a mean age of 46.2 (SD 10.5) years. Since calculations with JDC and ERI were based on sum scores, subjects with missing values for either JDC or ERI were excluded. Hence two subsamples were created, where all subjects with missing values for either JDC or ERI had been excluded (figure 3).

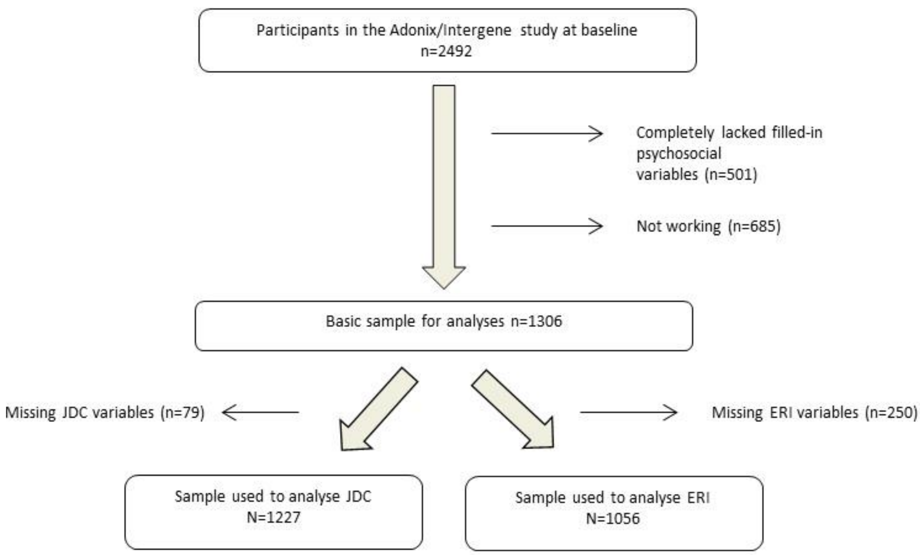

Figure 3. Flowchart of the sample used in study I

3.2.2 Paper II

This study uses data from the Swedish Construction Industry Cohort. The Foundation for Occupational Safety and Health in the Swedish Construction Industry (Bygghälsan) was a national occupational health service established in 1968. At 2 to

5 year intervals, all construction workers were invited to a health examination. Over 80% of all eligible workers participated at least once. During 1989 to 1993, a questionnaire regarding work environment was administered during the health examination. In addition to the questionnaire, information on age, weight, height, blood pressure, smoking status and job type were available. Also, by linkage to the Swedish Causes of Death and National Patient Registers, date and causes of deaths and diagnostic codes for inpatient visits were available until the end of 2003, providing a median follow-up time of 12.6 years. The baseline was defined as the date of response to the questionnaire.

A total of 87105 persons answered the questionnaire at least once. For those with more than one filled-in questionnaire, the first questionnaire was used. Despite an interest in gender based differences regarding psychosocial work to health relationships, the 3405 women who had answered the questionnaire were excluded. The reason was that these women tended to work in administrative jobs, compared with the men who predominantly worked in manual jobs. Furthermore, 2915 male office workers were excluded. After excluding 5326 subjects for missing responses for the psychological variables and 11 for missing or incorrect response date, and 212 with history of coronary heart disease or ischemic stroke previous to baseline, a total of 75236 respondents were left (figure 4). Mean age in the sample was 36.8 years (SD 12.1).

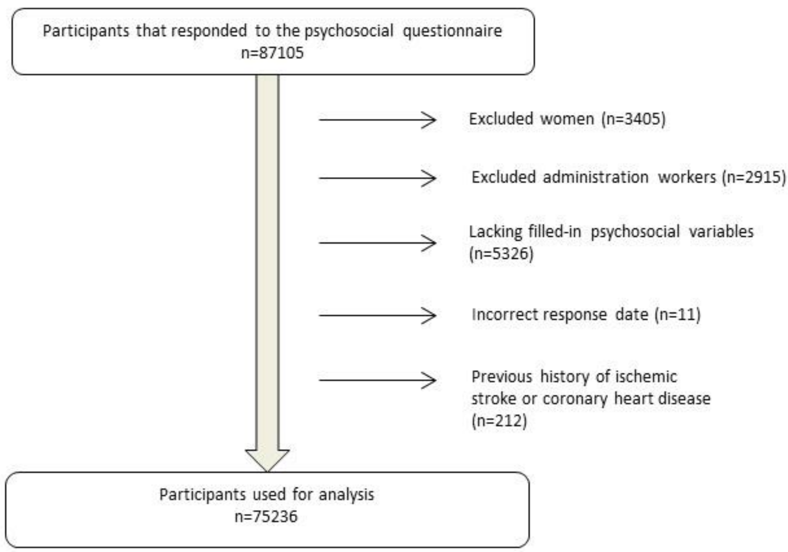

Figure 4. Flowchart of the sample used in study II

3.2.3 Paper III

Subjects were drawn from the core Adonix/Intergene cohort (n=2492). Further, this study also used data from the Adonix follow-up questionnaire, which was sent to all baseline participants five years after baseline. Out of those, 2108 individuals replied (54.4 % women). Since analyses were based on work variables, all subjects who had not completed the psychosocial questionnaire (n=343), were not working at baseline (n=548), or had not filled-in the job mobility item in the follow-up questionnaire (n=12) were excluded. Additionally, subjects aged over 60 (n=97) were omitted, because reported job change in that age group predominantly referred to retirement. Further, persons with "yes" responses to the Effort-Reward Imbalance at Work Questionnaire item "Are you at risk of losing your job?" (n=168) were excluded, as involuntary job mobility might deflate associations between psychosocial exposure and job turnover. The final sample analysed for job mobility consisted of 940 subjects (54.3 % women) (figure 5).

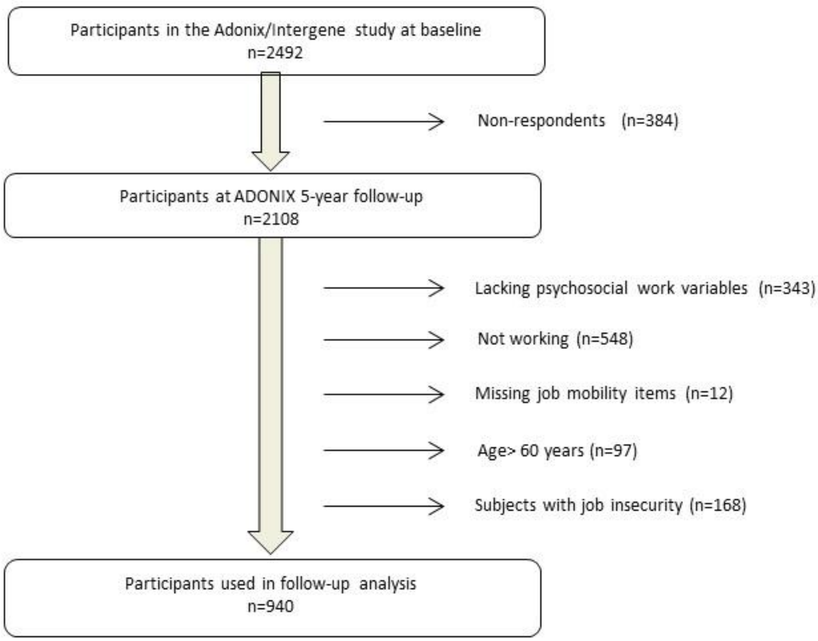

Figure 5. Flowchart of the sample used in study III

3.2.4 Paper IV

Studied subjects were recruited from the VGR-heart study (VGR=Västra Götalands Regionen i.e. West county of Sweden). The VGR-heart project is a population based cohort study which aims to identify occupational predictors for RTW after ACS among residents in the West county of Sweden. Data collection was carried out December 2010 to December 2013. Inclusion criteria were: acute myocardial infarction or unstable angina diagnosis, an upper age of 65 years, being a resident of the West county of Sweden and currently working. Screening for participants took place at four hospitals: Sahlgrenska University hospital, Östra hospital, Skaraborg hospital and North Älvsborg county hospital. Due to administrative circumstances the North Älvsborg county hospital only participated in subject recruitment for part of the period, March 2011-March 2013.

In total, 907 patients fulfilled the inclusion criteria. Out of those, five individuals died shortly after discharge and four lacked a valid postal address. This resulted in 898 potential participants, who were all sent one questionnaire and a consent form, allowing hospital record and register data collection. A total of 576 subjects agreed to study participation, representing a response rate of 64.2%. Some participants lacked filled-in items for psychosocial work factors (n=5), fear-avoidance (n=5) or expected time for RTW (n=57) and were omitted; hence the final sample consisted of 509 subjects (figure 6).

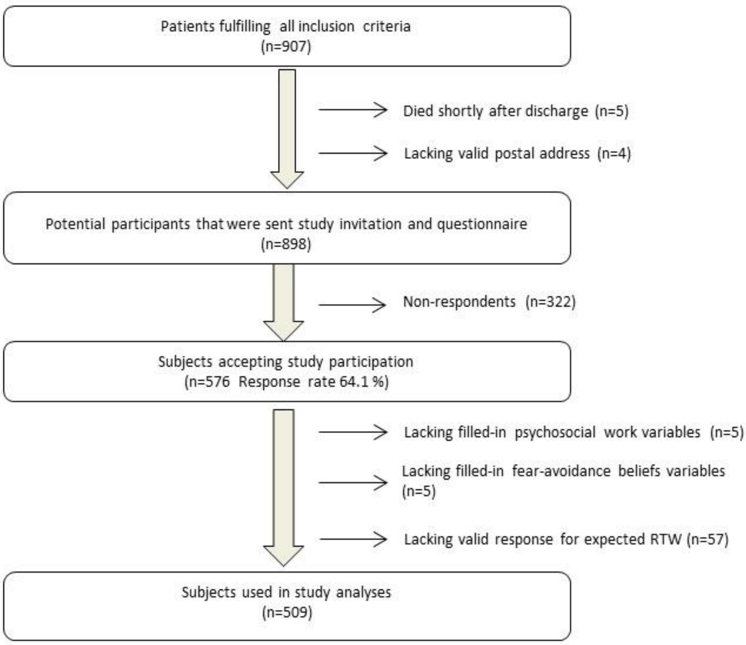

Figure 6. Flowchart of the sample used in study IV

3.3 Psychosocial work conditions measurements

3.3.1 Job demand-control

The instruments used to measure JDC varied between the studies. In the Adonix/Intergene study (paper I & III) a JDC short version [86] was used. In the Swedish Construction Industry Cohort (paper II) data collection was carried out before the standard Job-demand control instrument was developed. The variables available in this paper do, however, capture similar dimensions and are hence referred to as job demand-control. Study IV captured job demand-control with the

Swedish version of the standard instrument [87]. Despite differences in instruments used, all studies assigned the standard practice of tallying job demand and control separately and inverting both variables positively; high scores equated high demands or high control. Then both variables were dichotomized into high/low. For all analyses, except in paper II, demand and control were dichotomized by the median of the respective distribution, according to standard praxis. Due to highly skewed values in paper II, the variables were dichotomized by approximately half the scale. Regardless of method for dichotomizing, the variables were then combined as proposed by Karasek, [32]; *high strain* (high demand-low control), *active* (high demand-high control), *passive* (low demand-low control) and *low strain* (low demand-high control).

Study I & III

Demand and control were explored with three items each, using a scale (1-5) ranging from "Never" to "Almost all of the time". Sample item for job demands was; "How often during the last year has there been an increased amount of work?" and for job control; "Do you have the possibility to decide your work tasks". In both paper I and III, the median score was similar for job demand (median=11) and control (median=11).

Study II

All items were scored using a scale (1-5) ranging from "Seldom" to "Often". Job control consisted of three items (range 3-15), job demand of four items (range 4-20) and social support of two items (range 2-10). In this cohort the answers were highly skewed towards low demand and high control. The medians were 8 and 11 for demands and control respectively, and hence using the median to dichotomize would lead to individuals with quite low demands and high control being classified as high demands and low control. We used a score of approximately half of the scale instead; individuals with 13 or higher were classified as high demands, 8 or lower as low control and 5 or lower as low support.

Study IV

Job demand-control was measured using the Swedish version of Karasek & Theorell's Job Content Questionnaire, labelled The Swedish Demand—Control—Support Questionnaire (DCSQ) [87]. Summary scores ranged from 5-20 (job demand) and 9-24 (job control). Median scores for demand and control were 13 and 19, respectively.

3.3.2 Effort-reward imbalance

Effort-reward imbalance was measured with the Effort-Reward Imbalance at Work Questionnaire [88] in paper I and III. In paper IV, only reward was capture by this standard battery. Instead effort was replaces with the five items used to measure job demands from the Swedish Demand—Control—Support Questionnaire (DCSQ) [87], as these two variables have proven to capture similar dimensions [89].

When using the standard questionnaire, effort is captured by either five or six items. If the sample predominantly consists of white-collar workers the five-item version for measuring effort is used, excluding the item “My work is physically demanding”. For all calculations, effort and reward were positively inverted and summed. To compute the imbalance between the two variables, the effort score is put in the enumerator and the reward score in the denominator, where the latter score has been multiplied with a correction factor in order to adjust for the unequal number of items. The correction factor is 0.4545, if the enumerator contains five effort items. Effort and reward are then divided ($\Sigma_{effort}/(\Sigma_{reward*0.4545)}$), thus creating a ratio. A larger ratio indicates a greater imbalance between effort and reward.

Study I

The tallied effort scores ranged from 5-25 (mean=12.6) and sum reward scores ranged between 18 and 55 (mean=47.2). The ratio was then divided into categories, which were defined by the quartiles of the score distribution.

A complementary method for evaluating ERI, based on that of Siegrist and colleagues [90], was also used in this study. In this alternative analysis, the effort and reward variables were dichotomized by the median (effort median=12; reward median=49) into high/low and then combined into four categories (figure 7). Since there were no standard names for these categories, they were labelled as follows; ERI-1 (high effort and low reward), ERI-2 (high effort and high reward), ERI-3 (low effort and low reward), ERI-4 (low effort and high reward), The reason for utilizing this altered method was based on an assumption that equal ratios may not relate to similar job experience e.g. low effort-low rewards can create a similar ratio as high effort-high reward. By using both methods it is possible to compare this study to other ERI-research, but also bring forth an additional perspective.

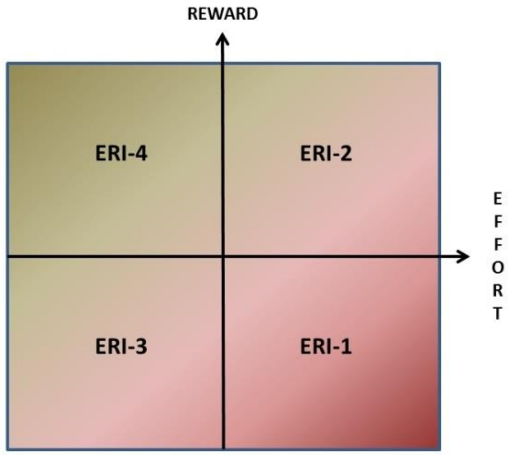

Figure 7. Complementary effort-reward imbalance categorization

Study II

The ERI model was not used to evaluate psychosocial work conditions in this study.

Study III

The tallied effort scores ranged from 5-25 (mean=12.3) and sum reward scores ranged between 11 and 55 (mean=47.9). The ERI-ratio ranged 0.2-2.0, with a mean value of 0.6 (SD 0.3). Considering the narrow range and in order to better interpret results from the regression analyses we decided to specify levels for the ERI-ratio. In this sample the distribution was skewed towards lower scores. Unlike the division in paper I, where analyses were also based on the Adonix/Intergene sample, we decided to not categorize the ERI-ratio distribution by the quartiles, since a ratio scores above 1.0 is a standard cut-off to indicate a high ERI and the upper quartile cut-point in this sample was 0.7; hence a quartile division would be misleading. Instead specified levels for the ERI-ratio were set per 0.5 of the distribution.

Study IV

Effort was replaced with the five items used to measure job demands from the Swedish Demand—Control—Support Questionnaire (DCSQ) [87], as these two variables have proven to capture similar dimensions [25, 26]. Further steps to create the ERI-ratio were carried out according to common praxis. Sum reward scores ranged 14-50 (mean=42.7). According to the standard algorithm, a ratio value was created ($\Sigma_{effort}/(\Sigma_{reward*0.4545)}$). Since the number of job demand items corresponds to the amount of items in the original ERI-scale, the reward score was multiplied with the correction factor (0.4545). The observed ERI-ratio values ranged from 0.2 – 2.1.

Similar to the analyses in paper III, we wanted to specify levels for the ratio, given the narrow range, skewed ERI-ratio distribution and in order to better interpret results. In this study we decided to specify levels per 0.25 of the distribution.

3.4 Outcome measurements

3.4.1 Paper I: Cardiovascular heart disease risk factors

The CHD risk factors used in this paper were diastolic blood pressure (DBP), systolic blood pressure (SBP), triglycerides, total cholesterol, HDL-cholesterol, LDL-cholesterol and body mass index (BMI). Measurements for all risk factors were gathered during a basic clinical examination, conducted at a hospital in Gothenburg. All subjects were instructed to fast for 4 hours before attending. Body weight was measured to the nearest 0.1 kg and body height to the nearest cm, with the subjects in light clothing and without shoes. Blood pressure measurements were carried out in a sitting position and after a 5-minute rest using an inflationary oscillometric blood pressure apparatus (Omron 711 Automatic IS). The blood pressure was measured twice and then the mean of the two was used. Blood samples were collected into tubes containing 0.1 % EDTA for immediate serum lipid (total cholesterol, HDL-cholesterol, triglycerides) and plasma glucose analysis. Serum total cholesterol (TC) and triglyceride concentrations were determined by enzymatic assays. LDL-cholesterol levels were estimated for all subjects with triglyceride levels under 4.00 mmol/L, using the Friedewald equation.

3.4.2 Paper II: Coronary heart disease and ischemic stroke

Coronary heart disease was defined as either hospitalization for acute myocardial infarction using codes ICD9 410 and ICD10 I21 from the National Patient Register or death from coronary heart disease using codes ICD 9 410-414 and ICD10 I20-I25 from the causes of death register. Ischemic stroke was defined as ICD9 434, 436 and ICD10 I63-I64 from either register. Only the first event of each type was used in the analysis.

3.4.3 Paper III: Job mobility

Job mobility was measured with a single self-reported item, “Have you changed jobs in the last 5 years?” with a dichotomous response option (yes/no).

3.4.4 Paper IV: Fear-avoidance attributions and expected return to work

Fear-avoidance attributions were captured by five items from the Fear-avoidance Beliefs Questionnaire [75] and one item from the Obstacles for Return to Work

Questionnaire in chronic pain [91]. The Likert-type response option scale for all items ranged from “Completely disagree” to “Completely agree,” scored 1-6. The original instruments focused on pain in relation to physical activities and therefore the items were rephrased for this study to be better adapted to heart disease.

Fear-avoidance beliefs about work and heart disease used in this paper:

1. My heart condition has been caused by my work or something that happened at work
2. My work will make my condition worse
3. My work is too heavy for me
4. I should not do my normal work as I did before I fell ill with heart disease
5. My job is detrimental to my health
6. If I had had a another kind of job my heart disease would never have occurred

Corresponding items from the Fear-avoidance Beliefs Questionnaire (1-5) [75] and The reduced items for obstacles for return to work questionnaire (6) [91]:

1. My pain was caused by my work or by an accident at work
2. My work makes or would make my pain worse
3. My work is too heavy for me
4. I should not do my normal work with my present pain
5. My work aggravated my pain
6. If I had had another kind of job I would never have gotten any pain

Summed fear-avoidance scores ranged from 6-36 with a value mean of 13.7. To assess the performance of this new measure, internal consistency was evaluated using Cronbach’s alpha, yielding a score of 0.89. Coherence was also measured, using factor analysis. All six items loaded strongly and positively on the first factor, with a sharp fall-off in eigenvalue after that, consistent with a battery reflecting one single domain. Fear-avoidance was then converted into an index based on each participant’s mean score. The index ranged 1-6 (mean value=2.3, SD=1.2). The mean, instead of the median was used, since we wanted to allow extreme values to have an impact on the index.

To measure expected time for return to work, one single item was used: “Based on everything you know and feel now, when do you think you will be able to return to work? Estimate the amount of weeks”. This amount was then added together with the response time, i.e. time elapsed between hospital discharges and the date when the questionnaire was filled-in. Some subjects (n=13) had already returned to work when filling-in the questionnaire, but had provided information on time on sick leave. Although this measure could be considered as actual time for RTW, this information was incorporated in the measure for expected time for RTW.

3.5 Statistical analyses

Statistical analyses in all papers were performed with SAS statistical software (version 9.2 for Windows; SAS Institute; Cary; NC). In all studies JDC variables were combined as previously been described into categorical variables; high strain, active, passive and low strain, using low strain as a reference. Studies investigating ERI (paper I, III, IV) utilized the standard procedure for converting effort and reward into a ratio ($\Sigma_{effort}/(\Sigma_{reward*0.4545)}$). However, the division of the ratio-score into categories varied between the studies and is further described separately for each paper. For all t-test, chi2-test and regression analyses, significance level was set to p-value <0.05. In studies that included both men and women, analyses were stratified by gender.

3.5.1 Paper I

Relationships between psychosocial work conditions and CHD risk factors were explored with linear regression models. When analysing ERI, categorical variables were defined by the quartiles of the ratio-distribution, comparing the first quartile with the fourth, in order to enhance the effect. This paper also included an alternative model; engaging a similar procedure as for JDC analyses and thus dichotomizing both effort and reward at the median of the distribution. High/low effort and reward were combined and converted into categorical variables, with low effort-high reward as reference. All outcome variables; DBP, SBP, triglycerides, total cholesterol, HDL-cholesterol, LDL-cholesterol and BMI were entered as continuous variables.

3.5.2 Paper II

Cox proportional hazards regression were used for survival analysis [92]. The proportional hazards assumptions were investigated using tests and plots based on weighted residuals [93] using the R package Survival. The assumptions were found reasonable except for smoking status, and hence we stratified for this variable. Tests of functional form [94] indicated model misspecifications in most of the CHD models, which were handled by adding a quadratic term for the continuous covariates. In the adjusted analyses 3087 (4.1%) subjects were excluded due to missing values on BMI or blood pressure. Missing values of smoking status (n=300) were handled by creating an additional category. In order to reduce the amount of missing data, job demand and control were imputed using the mean of the remaining values for subjects with only one missing item.

3.5.3 Paper III

Multivariate logistic regression models were engaged to investigate JDC or ERI variables as predictors for job mobility. In the models analysing the single measures, job demands, job control, effort and reward, all variables were analysed in separate models and entered as continuous variables. When analysing the combined JDC measures, variables were entered as categorical variables, as has been described previously. In the regression models analysing ERI-ratio, specified levels per 0.5 of the ratio distribution was set. Both unadjusted models and models controlled for age and occupational status were calculated.

3.5.4 Paper IV

Associations between psychosocial variables and fear-avoidance beliefs, and mediation effects for fear-avoidance were investigated with linear regression models. The fear-avoidance index and time for RTW were entered as continuous variables. Two models were calculated; model 1 was unadjusted and Model 2 was adjusted for occupational status, self-efficacy and general mental health.

To evaluate mediator effects for fear-avoidance, a four step procedure [95] was used (Figure 4). Three linear regression analyses were assigned to explore relationships between direct effects; psychosocial variables to fear-avoidance (X→M): psychosocial factors to RTW (X→Y), and fear-avoidance to RTW (M→Y). Should all associations in step 1-3 prove significant, a fourth linear regression analysis is carried out where psychosocial variables and mediator are entered in the same model (X+M→Y). If the effect for the mediator (M) remains significant, there is support for partial mediation, and if relationships for the psychosocial variables (X) simultaneously become non-significant, the findings support full mediation effect.

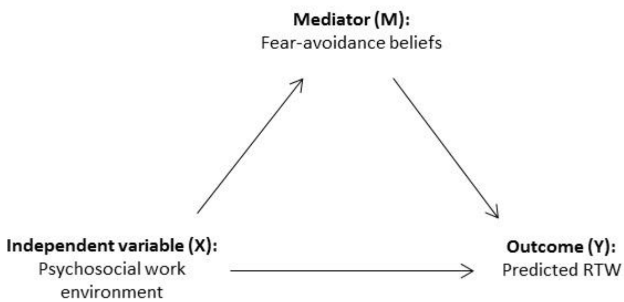

Figure 8. Stepwise procedures for mediation testing

3.5.5 Confounders

The confounders used in each paper are found in table 2. Confounders for paper III and IV were selected by stepwise purposeful selection for regression analyses as proposed by Hosmer and Lemeshow [96]. Cut-off for variable inclusion throughout the selection procedure was Wald p-value or F-test value <0.25. Selection of confounders for each model utilized separate calculations for the main independent variables JDC and ERI.

The purposeful selection process began with univariate analyses of each potential confounder. Any variable meeting the inclusion criteria was selected as a candidate for multivariate analysis. These variables together with either JDC or ERI constituted the full model. Chosen variables were then entered together in a regression analysis where all variables not meeting p-value <0.25 were excluded. After concluding this step, any variable not selected were added back one at a time and reinserted into the model if meeting inclusion criteria. The remaining variables constituted the reduced model. If main effects between the reduced and full models were less than 15%, the reduced model was kept.

Table 2. Confounders in each paper

	Paper I	**Paper II**	**Paper III**	**Paper IV**
Age	X	X	X	X
Education	X			
Occupational status	X		X	X
Smoking	X	X		
BMI		X		
Systolic blood pressure		X		
Self-efficacy				X
General mental health				X

Age was entered as a continuous variable. *Education* was measured by highest education attended and divided into four categories: primary school, lower secondary, upper secondary and university/higher education. *Occupational status* was measured with one single item and classified according to ISCO-88 [97]. The categorization did, however, differ between papers. In paper I occupational status was divided into four categories: high/low skilled white-collar and high/low skilled blue-collar workers. In paper III and IV, three categories were created: high skilled white-collar, low skilled white-collar (referred to as pink-collar jobs in paper IV, due to consisting of female dominated occupations) and blue-collar jobs. *Smoking* comprised of three categories: current smoker and ex-smoker with “never smoker” as reference. *BMI* and *systolic blood pressure* were entered as continuous variables.

In Paper IV analyses were adjusted for personality variables and psychological well-being; self-efficacy and general mental health. *Self-efficacy* was captured with two items; “Once I’ve decided to return to my job, it won’t be difficult for me to accomplish this” and “Despite what has happened, I know that I’ll manage to carry out my work when I feel well enough”, scale ranging (1-4) from “Completely disagree to “Completely agree”. Mental health was measured with the 12-item General health questionnaire (GHQ-12). Self-efficacy and general mental health were both analysed as continuous variables.

4 RESULTS

4.1 Paper I

Multiple linear regression analyses between job demand-control variables and CHD risk factors (table 3), showed that men exposed to a high strain work environment had higher mean DBP (β 3.3; 95% CI 0.5-6.0) and SBP (β 4.6; 95% CI 0.5-8.8) compared to men in low strain. The effect for increased triglycerides values was borderline significant (β 0.2; 95% CI (-0.002)-0.4). Men in passive jobs had significantly increased mean total cholesterol and LDL-cholesterol, and male subjects in active jobs displayed increased total cholesterol. In contrast to men, there were no significant relationships between JDC variables and CHD risk factors among female participants.

Table 3. Multiple linear regression between JDC and CHD risk factors.
95 % CI= 95 % confidence interval

	High strain		Active		Passive	
	β (95 % CI)	P-value	β (95 % CI)	P-value	β (95 % CI)	P-value
DBP (mmHg)						
Men	**3.3 (0.5-6.0)**	**0.02**	1.4 ((-1.0)-3.8)	0.26	2.0 ((-0.1)-4.2)	0.06
Women	0.5 ((-1.9)-3.0)	0.68	-0.1 ((-2.8)-3.0)	0.95	0.003 ((-2.2)-2.2)	0.99
SBP (mmHg)						
Men	**4.6 (0.5-8.8)**	**0.03**	2.1 ((-1.7)-5.8)	0.28	2.0 ((-1.3)-5.3)	0.20
Women	-1.7 ((-5.7)-2.3)	0.40	0.9 ((-3.8)-5.7)	0.70	-1.3 ((-5.0)-2.3)	0.47
Triglycerides (mmol/L)						
Men	**0.2 ((-0.002)-0.4)**	**0.05**	0.1 ((-0.1)-0.2)	0.45	-0.1 ((-0.2)-0.1)	0.39
Women	-0.03 ((-0.2)-0.1)	0.59	-0.002 ((-0.2)-0.1)	0.97	-0.01 ((-0.1)-0.1)	0.74
Total Cholesterol (mmol/L)						
Men	0.1 ((-0.1)-0.4)	0.31	**0.2 (0.003-0.5)**	**0.04**	**0.3 (0.1-0.5)**	**0.01**
Women	-0.2 ((-0.4)-0.1)	0.21	-0.05 ((-0.3)-0.2)	0.70	-0.1 ((-0.4)-0.1)	0.20
HDL-cholesterol (mmol/L)						
Men	-0.04 ((-0.1)-0.1)	0.45	0.02 ((-0.1)-0.1)	0.74	0.04 ((-0.04)-0.1)	0.36
Women	-0.03 ((-0.1-)-0.1)	0.55	0.04 ((-0.1)-0.2)	0.52	0.02 ((-0.1)-0.1)	0.73
LDL-cholesterol (mmol/L)						
Men	0.1 ((-0.1)-0.4)	0.41	0.2 ((-0.01)-0.4)	0.06	**0.3 (0.1-0.5)**	**0.01**
Women	-0.1 ((-0.3)-0.1)	0.35	-0.1 ((-0.4)-0.1)	0.46	-0.1 ((-0.3)-0.05)	0.15
BMI (kg/m2)						
Men	0.5 ((-0.4)-1.4)	0.25	0.6 ((-0.2)-1.4)	0.13	-0.4 ((-1.1)-0.3)	0.22
Women	-0.2 ((-1.1)-0.7)	0.64	-0.1 ((-1.2)-1.0)	0.85	-0.7 ((-1.5)-0.1)	0.10

High strain, active and passive were analysed as dummy variables, using low strain as reference.
Each model is adjusted for age, smoking, education and occupational status.

Men with high ERI had increased mean triglycerides (β 0.2; 95% CI 0.01-0.3), and BMI (β 1.2; 95% CI 0.5-1.9), while women had lower HDL-cholesterol (β (-0.1); 95% CI (-0.2)-(-0.1)), as illustrated in table 4.

Table 4. Linear regression effort-reward imbalance and CHD risk factors. 95 % CI=95 % confidence interval

	DBP	SBP	Triglycerides	Total Cholesterol	HDL-Cholesterol	LDL-Cholesterol	BMI
Men							
Estimate	0.3	0.7	**0.2**	-0.3	-0.02	-0.2	**1.2**
CI (95 %)	((-1.9)-2.5)	((-2.7)-4.1)	**(0.01-0.3)**	((-0.4)-0.1)	((-0.1)-0.1)	((-0.4)-0.02)	**(0.5-1.9)**
p-value	0.77	0.68	**0.04**	0.22	0.65	0.08	**0.01**
Women							
Estimate	0.7	-2.0	0.04	-0.1	**-0.1**	-0.02	0.5
CI (95 %)	((-1.4)-2.7)	((-5.4)-1.4)	((-0.1)-0.1)	((-0.3)-0.1)	**((-0.2)–(-0.1)**	((-0.2)-0.2)	((-0.2)-1.3)
p-value	0.53	0.25	0.48	0.25	**0.02**	0.78	0.17

Quartiles were created from the ERI-ratio distribution, comparing the lowest to the high quartile.
Each model is adjusted for age, smoking, education and occupational status.

Associations between the complementary ERI model and CHD biomarkers (table 5) showed that high effort-low reward was associated with increased BMI for men. This alternative method also showed that the females reporting high effort-high reward had slightly lower values for triglycerides (β-0.2; 95% CI (-0.3)-(-0.2)) and increased mean HDL-cholesterol (β 0.2; 95% CI 0.03-0.3), compared to women with low effort-high reward work conditions. In addition, women with low effort-low reward had lower SBP.

Table 5. Multiple linear regression for complementary ERI model and CHD risk factors. Confidence interval (95%)

	ERI-1 **High Effort-Low Reward** Estimate (95 % CI)	P-value	**ERI-2** **High Effort- High Reward** Estimate (95 % CI)	P-value	**ERI-3** **Low Effort-Low Reward** Estimate (95 % CI)	P-value
DBP (mmHg)						
Men	-1.0 ((-3.6)-1.5)	0.43	-1.2 ((-3.7)-1.3)	0.35	-0.7 ((-3.5)-2.2)	0.64
Women	-1.6 ((-4.0)- .8)	0.19	-1.7 ((-4.8)-1.4)	0.29	-2.2 ((-4.8)-0.4)	0.10
SBP (mmHg)						
Men	-0.7 ((-4.6)-3.2)	0.73	-1.5 ((-5.4)-2.3)	0.44	-2.0 ((-6.3)-2.3)	0.36
Women	-3.8 ((-7.7)-0.1)	0.06	-4.2 ((-9.3)-0.9)	0.11	**-4.5 ((-8.8)-(-0.2)**	**0.04**
Triglycerides						
Men	0.1 ((-0.1)-0.3)	0.23	0.1 ((-0.06)-0.3)	0.21	-0.02 ((-0.2)-0.2)	0.86
Women	0.01 ((-0.1)-0.1)	0.82	**-0.2 ((-0.3)-(-0.02)**	**0.03**	-0.08 ((-0.2)-0.1)	0.24
Total cholesterol (mmol/L)						
Men	-0.01 ((-0.3)-0.2)	0.91	-0.1 ((-0.4)-0.1)	0.33	0.04 ((-0.2)-0.3)	0.78
Women	0.04 ((-0.3)-0.2)	0.83	-0.01 ((-0.3)-0.3)	0.97	-0.01 ((-0.2)-0.3)	0.78
HDL-cholesterol (mmol/L)						
Men	-0.002 ((-0.1)-0.09)	0.96	-0.06 ((-0.2)-0.04)	0.22	0.03 ((-0.1)-0.1)	0.60
Women	-0.02 ((-0.1)-0.1)	0.76	**0.2 (0.03-0.3)**	**0.02**	0.02 ((-0.1)-0.1)	0.75
LDL-cholesterol (mmol/L)						
Men	-0.05 ((-0.3)-0.2)	0.69	-0.1 ((-0.3)-0.1)	0.35	0.1 ((-0.2)-0.3)	0.85
Women	-0.01 ((-0.2)-0.2)	0.89	-0.1 ((-0.4)-0.2)	0.50	0.1 ((-0.2)-0.3)	0.61
BMI (kg/m2)						
Men	**0.9 ((0.1-1.7)**	**0.03**	0.5 ((-0.3)-1.3)	0.22	0.5 ((-0.8)-1.1)	0.76
Women	0.7 ((-0.2)-1.5)	0.14	-0.6 ((-1.7)-0.5)	0.29	0.5 ((-0.4)-1.5)	0.26

ERI-1, ERI-2, ERI-3 were analysed as dummy variables, using ERI-4 (Low effort-High Reward) as reference.
Each model is adjusted for age, smoking, education and occupational status.

4.2 Paper II

Overall, there were 739 ischemic stroke events and 1884 CHD events. Subjects reporting high demand showed a significantly higher risk for ischemic stroke (HR 1.22, 95% CI 1.00-1.47) (table 6). The risk for CHD was increased for low support (HR 1.18, 95% CI 1.02-1.36). In general, the adjustment for smoking, BMI and systolic blood pressure only resulted in minor changes in the hazard ratios, although in some cases the results became statistically non-significant.

Table 6. Cox Proportional Hazard Regression. Hazard ratio, point estimate and 95% CI. Fatal and non-fatal ischemic stroke and coronary heart disease

	Ischemic stroke HR (95% CI)	**Coronary heart disease HR (95% CI)**
High demands[1]	**1.22 (1.00-1.47)**	1.12 (0.99-1.26)
Low control[1]	1.02 (0.83-1.24)	1.09 (0.96-1.23)
Low support[1]	1.00 (0.77-1.27)	**1.18 (1.02-1.36)**
High demands[2]	1.21 (0.99-1.47)	1.07 (0.94-1.21)
Low control[2]	0.97 (0.78-1.19)	1.08 (0.95-1.23)
Low support[2]	0.98 (0.75-1.26)	1.16 (0.99-1.34)

High control, low demands and high support are used as reference category, respectively.
1 Adjusted for age
2 Adjusted for age, smoking, BMI and systolic blood pressure

An increased risk of ischemic stroke was seen in the active group (HR 1.27; 95% CI 1.03-1.56), which remained significant after additional adjustment (HR 1.26; 95% CI 1.02-1.55). No other significant results were obtained from the analyses using the JDC categories (table 7).

Table 7. Cox proportional hazard regressions. Fatal and non-fatal ischemic stroke and CHD. Hazard ratios, point estimates and 95% CI.Hazard ratio, point estimate and 95% CI.

	Ischemic stroke HR	**CHD HR**
Low strain (ref)[1]	1.00	1.00
Passive[1]	1.03 (0.82-1.28)	1.09 (0.94-1.24)
Active[1]	**1.27 (1.03-1.56)**	1.10 (0.96-1.26)
High strain[1]	0.87 (0.51-1.38)	1.09 (0.82-1.42)
Low strain (ref)[2]	1.00	1.00
Passive[2]	0.97 (0.76-1.22)	1.08 (0.94-1.24)
Active[2]	**1.26 (1.02-1.55)**	1.08 (0.93-1.24)
High strain[2]	0.82 (0.47-1.32)	1.06 (0.79-1.39)

1 Adjusted for age
2 Adjusted for age, smoking, BMI and systolic blood pressure

Excluding subjects with events in the first 5 years after baseline resulted in slightly lower estimates of the hazard ratios and all were non-significant (table 8).

Table 8. Hazard ratios from Cox regression models. Subjects with events in the first five years after baseline excluded.

	Ischemic stroke		CHD	
	N (N events)	HR	N (N events)	HR
Low strain	9885 (73)	ref	9842 (164)	ref
Passive	55664 (404)	1.11 (0.86-1.42)	55480 (951)	1.06 (0.90-1.25)
Active	7245 (80)	1.23 (0.96-1.55)	7208 (166)	1.06 (0.90-1.25)
High strain	1677 (12)	0.85 (0.45-1.44)	1672 (37)	1.10 (0.78-1.51)

All models are adjusted for age.

4.3 Paper III

Logistic regression analyses, evaluating single psychosocial variables as predictors for job mobility (table 9) resulted in several weak, but significant associations. In the unadjusted models high job demands (OR 1.09; 95% CI 1.01-1.17) and the conceptually similar variable high effort (OR 1.04; 95% CI 1.00-1.07) were slightly related to job mobility. High job control (OR 0.93; 95% CI 0.88-0.98) and high rewards (OR 0.96; 95% CI 0.94-0.99) were associated with lower odds for job turnover. The results for the adjusted model displayed similar results, except for non-significant associations for effort. Gender stratified analyses found somewhat elevated odds ratio for job mobility in high demand work and lowered odds for high control among men, while high rewards was related to slightly decreased odds for job mobility for female participants.

Table 9. Multiple logistic regression analysis between single psychosocial variables and job mobility OR=Odds ratio, 95% CI = 95% confidence interval

	All OR (95% CI) p-value	**Men** OR (95% CI) p-value	**Women** OR (95% CI) p-value
Job demands[1]	**1.09 (1.01-1.17)** **0.02**	**1.13 (1.01-1.25)** **0.03**	1.06 (0.96-1.16) 0.26
Job control[1]	**0.93 (0.88-0.98)** **0.005**	**0.89 (0.83-0.96)** **0.004**	0.97 (0.90-1.03) 0.30
Effort[1]	**1.04 (1.00-1.07)** **0.05**	1.05 (0.99-1.11) 0.09	1.03 (0.98-1.07) 0.24
Reward[1]	**0.96 (0.94-0.99)** **0.003**	0.97 (0.93-1.01) 0.17	**0.96 (0.92-0.99)** **0.01**
Job demands[2]	**1.10 (1.02-1.18)** **0.01**	1.12 (0.99-1.26) 0.05	1.08 (0.98-1.19) 0.27
Job control[2]	**0.92 (0.87-0.97)** **0.002**	**0.87 (0.80-0.96)** **0.004**	0.95 (0.89-1.03) 0.19
Effort[2]	1.03 (0.99-1.07) 0.10	1.03 (0.97-1.09) 0.37	1.03 (0.99-1.08) 0.18
Reward[2]	**0.96 (0.93-0.99)** **0.003**	0.97 (0.93-1.02) 0.24	**0.95 (0.92-0.99)** **0.007**

Job demand, job control, effort and reward were analysed in separate models
1 Unadjusted
2 Adjusted for age and occupational status

The logistic regression analyses for the combined JDC variables as job mobility predictors (Table 10), did not result in any significant associations in the unadjusted model, but when entering chosen confounders, high strain was linked to increased odds for job turnover (OR 1.63: 95% CI 1.03-2.59). In the gender stratified analyses, odds ratio for job mobility were more than doubled among men reporting high strain job conditions in both the unadjusted (OR 2.52; 95% CI 1.25-5.01) and adjusted model (OR 2.72; 95% CI 1.24-5.98). All relationships between the combined JDC variables and job turnover among women were both weak and non-significant.

Table 10. Multiple logistic regression analysis between single psychosocial variables and job mobility OR=Odds ratio, 95% CI = 95% confidence interval

	All OR (95 % CI) p-value	**Men** OR (95 % CI) p-value	**Women** OR (95 % CI) p-value
Low strain (ref)[1]	1.00	1.00	1.00
Passive[1]	1.29 (0.87-1.91) 0.10	1.65 (0.91-3.00) 0.84	0.99 (0.58-1.68) 0.71
Active[1]	1.20 (0.74-1.95) 0.88	1.32 (0.68-2.59) 0.42	1.12 (0.55-2.27) 0.69
High strain[1]	1.48 (0.95-2.30) 0.20	**2.52 (1.25-5.01)** **0.01**	0.98 (0.55-1.75) 0.83
Low strain (ref)[2]	1.00	1.00	1.00
Passive[2]	1.23 (088-2.01) 0.18	1.80 (0.93-3.46) 0.08	1.01 (0.58-1.76) 0.96
Active[2]	1.22 (0.74-2.01) 0.45	1.27 (0.62-2.59) 0.52	1.18 (0.57-2.42) 0.66
High strain[2]	**1.63 (1.03-2.59)** **0.04**	**2.72 (1.24-5.98)** **0.01**	1.14 (0.63-2.07) 0.67

1 Unadjusted
2 Adjusted for age and occupational status.

High ERI was related to increased odds ratio for changing jobs (Table 11) both in the unadjusted and adjusted analyses (OR 1.42; 95% CI 1.11-1.81 and OR 1.46; 95% CI 1.13-1.89 respectively). The analyses examining men and women separately showed that men displayed elevated odds for job turnover in both models (unadjusted OR 1.8; 95% CI 1.24-2.80; adjusted model OR 1.74; 95% CI 1.11-2.72). Similar to the results for the JDC analyses, associations between ERI and job mobility were both weak and statistically non-significant among women.

Table 11. Multiple logistic regression analysis between effort-reward imbalance and job mobility OR=Odds ratio, 95% CI = 95% confidence interval

	All OR (95 % CI) p-value	**Men** OR (CI 95%) p-value	**Women** OR (CI 95%) p-value
Effort-reward ratio[1]	**1.42 (1.11-1.81)** **0.005**	**1.86 (1.24-2.80)** **0.003**	1.20 (0.88-1.64) 0.24
Effort-reward ratio[2]	**1.46 (1.13-1.89)** **0.004**	**1.74 (1.11-2.72)** **0.02**	1.31 (0.95-1.81) 0.10

1Unadjusted
2 Adjusted for age and occupational status.

4.4 Paper IV

Linear regression analyses between psychosocial work conditions and fear-avoidance attribution (X→M) (table 2) showed that in total sample analyses, subjects with high strain (β 1.4; CI 1.2-1.6) had significant higher values of fear-avoidance attributions. Workers with an active (β 0.6; CI 0.3-0.9) or passive work situation (β 0.4; CI 0.2-0.6) also reported higher fear-avoidance compared to subjects with low strain jobs, although these relationships were weaker than among the high strain workers. These associations remained in the fully adjusted model, but estimates were slightly lower. The analyses among male subjects were coherent with findings in the total sample analyses, as high strained, active and passive workers had higher scores for fear-avoidance, than low strained workers. In female participants, only high strain work was associated with increased aversive job beliefs, and results became non-significant when entering chosen confounders. High ERI was related to increased fear-avoidance for both men and women, and in both models.

Table 12. Linear regression analyses between psychosocial variables and fear-avoidance (X → M). 95 % CI= 95 % confidence interval

	All		**Men**		**Women**	
	β	95 % CI	β	95 % CI	β	95 % CI
Job demand-Control						
Low strain (ref)[1]						
Passive[1]	**0.4**	**0.2-0.6**	**0.5**	**0.2-0.7**	0.1	(-0.6)-0.7
Active[1]	**0.6**	**0.3-0.9**	**0.7**	**0.4-1.0**	0.3	(-0.6)-1.3
High strain[1]	**1.4**	**1.2-1.6**	**1.6**	**1.3-1.8**	**1.0**	**0.4-1.6**
Low strain (ref)[2]						
Passive[2]	**0.3**	**0.03-0.5**	**0.4**	**0.1-0.6**	-0.3	(-0.9)-0.3
Active[2]	**0.5**	**0.3-0.8**	**0.6**	**0.3-0.9**	0.04	(-0.8)-0.9
High strain[2]	**1.2**	**0.9-1.4**	**1.3**	**1.1-1.6**	0.5	(-0.04)-1.1
Effort-reward imbalance						
ERI-ratio[1]	**0.6**	**0.5-0.7**	**0.7**	**0.6-0.8**	**0.6**	**0.4-0.8**
ERI-ratio[2]	**0.5**	**0.4-0.6**	**0.6**	**0.5-0.7**	**0.4**	**0.2-0.6**

1 Unadjusted
2 Adjusted for Occupational status, self-efficacy and general mental health

Step two in the mediation testing (X→Y) illustrated in table 13, showed that high strain workers reported significant longer expected time for RTW than participants with low strain, in all subjects analyses (β 2.8; 95% CI 1.7-4.0) and among men (β 3.1; 95% CI 1.8-4.4). Passive jobs were also related to increased time for RTW, but these relationships became non-significant in the adjusted model. High ERI was related to RTW in total sample (β 1.1; 95% CI 0.6-1.5) and in male subgroup analyses (β 1.1; 95% CI 0.5-1.6), with somewhat lowered estimates for the adjusted analyses. Notably, there were no significant associations between psychosocial job conditions and predicted time for RTW among women.

Table 13. Linear regression analyses between psychosocial variables and expected RTW (X→Y)
95 % CI= 95 % confidence interval

	All		**Men**		**Women**	
	β	95 % CI	β	95 % CI	β	95 % CI
Job demand-Control						
Low strain (ref)[1]						
Active[1]	0.7	(-0.8)-2.2	0.5	(-1.1)-2.2	1.7	(-2.7)-6.1
Passive[1]	**1.3**	**0.1-2.5**	**1.3**	**0.01-2.6**	0.9	(-2.2)-4.0
High strain[1]	**2.8**	**1.7-4.0**	**3.1**	**1.8-4.4**	1.6	(-1.2)-4.5
Low strain (ref)[2]						
Passive[2]	0.9	(-0.2)-2.0	1.0	(-0.2)-2.3	-0.1	(-3.2)-3.0
Active[2]	0.6	(-0.8)-2.1	0.5	(-1.0)-2.1	-0.3	(-4.6)-4.0
High strain[2]	**2.1**	**1.0-3.2**	**2.4**	**1.1-3.6**	0.7	(-2.3)-3.6
Effort-reward imbalance						
ERI-ratio[1]	**1.1**	**0.6-1.5**	**1.1**	**0.5-1.6**	0.8	(-0.1)-1.8
ERI-ratio[2]	**0.7**	**0.3-1.2**	**0.8**	**0.2-1.3**	0.3	(-0.7)-1.3

1 Unadjusted
2 Adjusted for Occupational status, self-efficacy and general mental health

The analyses for relationships fear-avoidance to RTW (M→Y), displayed significant associations between aversive work perceptions and prolonged RTW in total sample analyses (β 1.4; CI 95% 1.0-1.7) and among men (β 1.4 CI 95% 1.0-1.8).

In the final regression analyses (X+M→Y), both psychosocial and fear-avoidance variables were entered in the same model, thus evaluating mediator effects for fear-avoidance (Table 14). Since only total sample or male subgroups analyses fulfilled the requirements for mediation testing, female participants were not analysed in this final step. The results supported full mediation effects for fear-avoidance between both high strain and high ERI to RTW, when analysing all sample subjects or males in both the unadjusted models and models adjusted for confounders.

Table 14. Multiple linear regression testing mediator effects for fear-avoidance beliefs (M) between psychosocial variables (X) and expected time for RTW (Y). 95 % CI= 95 % confidence interval

	All		**Men**	
	β	95 % CI	β	95 % CI
Job demand-Control				
- Low strain (ref)[1]				
- Passive[1]	0.8	(-0.3)-2.0	0.7	(-0.5)-2.0
- Active[1]	-0.2	(-1.5)-1.5	-0.3	(-1.9)-1.3
- High strain[1]	1.2	(-0.1)-2.4	1.2	(-0.2)-2.7
Fear-avoidance beliefs[1]	**1.2**	**0.7-1.6**	**1.2**	**0.7-1.7**
- Low strain (ref)[2]				
- Passive[2]	0.7	(-0.4)-1.8	0.7	(-0.5)-1.9
- Active[2]	0.2	(-1.3)-1.6	0.03	(-1.5)-1.6
- High strain[2]	1.1	(-0.1)-2.4	1.3	(-0.1)-2.7
Fear-avoidance beliefs[2]	**0.8**	**0.4-1.3**	**0.8**	**0.3-1.3**
Effort-reward imbalance				
- Effort-reward imbalance[1]	0.3	(-0.3)-0.8	0.2	(-0.4)-0.8
- Fear-avoidance beliefs[2]	**1.2**	**0.8-1.7**	**1.3**	**0.8-1.8**
- Effort-reward imbalance[1]	0.3	(-0.3)-0.8	0.2	(-0.4)-0.8
- Fear-avoidance beliefs[2]	**0.9**	**0.5-1.4**	**0.9**	**0.4-1.5**

1 Unadjusted
2 Adjusted for Occupational status, self-efficacy and general mental health

5 DISCUSSION

There is substantial evidence for relationships between adverse psychosocial work conditions and CHD. Other cardiovascular outcomes, such as biological risk factors for CHD or ischemic stroke are less well-studied. Furthermore, most studies in this domain, focus on work conditions to disease relationships, but do not take into account whether workers themselves perceive work as hazardous and protect their health by improving or avoiding detrimental work conditions. This thesis focused on two overall aims: investigating (1) relationships between psychosocial work environment and less studied cardiovascular outcomes, and (2) workers' perceptions and reactive behaviour to poor psychosocial job conditions.

5.1 Findings: Cardiovascular disease outcomes

5.1.1 Paper I: Biological risk factors for CHD

Evidence for relationships between psychosocial work environment, evaluated with JDC or ERI, and CHD has strong support in the literature [2-4]. However, links between psychosocial job dimensions and biological CHD risk factors are less explored and results are inconsistent [44-47]. Associations between high strain and increased blood pressure [46, 48, 49] have been the most consistent finding. Study results in paper I supported such evidence, as high strain was related to increased diastolic and systolic blood pressure, and in additions, high ERI was associated with adverse values in triglycerides and HDL-cholesterol.

Furthermore, there were some notable gender dissimilarities; for men high strain was related to elevated scores in DBP and SBP, triglycerides, active work to increased total cholesterol and passive work to total cholesterol and LDL-cholesterol. Among women all relationships between JDC variables and biomarkers were non-significant. The gender differences in results concur with previous studies with CHD as outcome; strong links between high strain and CHD for men, but weak or no relationships in female populations [5, 7, 28, 29]. Some papers have identified active jobs as more hazardous for female health than high strain [29, 42], but this was not coherent with the results in this paper.

The analyses using the ERI-ratio showed that men reporting effort-reward imbalance had higher mean values in BMI and triglycerides, while women had lowered HDL-cholesterol. These results are to some degree similar to previous findings [47, 50], illustrating relationships between high ERI and adverse values in total cholesterol and LDL-cholesterol. Surprisingly, there were small but significant health beneficial effects among women reporting high effort-high reward. These female workers had somewhat lower mean triglycerides and elevated mean HDL-cholesterol compared to those in to low effort-high reward jobs.

5.1.2 Paper II: Ischemic stroke & coronary heart disease

The most original novel finding in this study among construction workers was that active job environment, rather than high strained, was related to increased risk of ischemic stroke. Of the individual job demand-control variables, only high demand showed a significant increased risk of ischemic stroke that was slightly lowered after adjustment for chosen confounders.

Studies on associations between JDC and stroke are sparse and results conflicting. Our findings that active jobs increased the risk for ischemic stroke are in line with one study large study by Kivimäki et al [57] including almost 50 000 female employees in the Finnish public sector. Their outcome was a broad definition of cerebrovascular disease, including subarachnoid bleedings, ischemic and haemorrhagic stroke, and findings showed an increased risk associated with high demands and a rather high risk associated with active jobs, HR 2.3 (95% CI 1.3-4.1). However, since several studies have found gender differences in JDC to cardiovascular disease relationships, it is uncertain if their results are comparable with our results in paper II. Further, in a Japanese study [64], high strain jobs were associated to increased hazard ratio for total stroke among men, even when adjusted for age, living area, demographics, behavioural and biological risk factors (HR 2.53; 95 % CI 1.08-5.94). Although there was an increased risk for total stroke among women in high strain jobs, compared to low strain, these relationships were not significant (HR 1.46; 95 % CI 0.63-3.38). Additionally, when analysing ischemic and hemorrhagic stroke separately, most analyses displayed increased stroke risk for those reporting poor work conditions, but results were non-significant.

There was no significant association between high strain and coronary heart disease, although the point estimate was slightly increased and somewhat in accordance to some of the individual studies in [55]. Of the single variables, only low social support demonstrated a significantly increased risk of coronary heart disease. Both high demands and low control showed a tendency towards increased risk, but results were only borderline significant.

Job demands in this sample were notably skewed towards lower scores, which might partly explain the lack of significant results. Such tendencies could be a result of overall low job demands in the construction sector in the early 90s. Another possible explanation is that, since construction work is a manual labour, older workers and those with physical conditions may be more likely to switch to lighter job, which could further diminish potential associations. Furthermore, according to gendered response patterns, men are generally taught to supress sensations, especially if they can be associated with weaknesses, which can be further enhanced in male dominated cultures and groups [98]. Hence, there may be a tendency to understate psychosocial work circumstances in these types of work cultures.

Low socioeconomic status has consistently been identified as a stroke predictor [58, 62, 99, 100]. It has also been found that JDC strengthens the effect of socioeconomic status rather than explains it [57]. One advantage with the cohort of construction workers, examined in paper II, is that the members have similar socioeconomic status, and hence it is unlikely that the results are affected by this.

5.2 Findings: perceptions and reactive behaviour

5.2.1 Paper III: Job mobility

Both high strain and high effort-reward imbalance predicted job mobility in this sample drawn from the general population. Considering the substantial evidence for relationships between poor psychosocial work characteristics and both physical and mental ill-health outcomes [2-10], it is positive that workers might actively engage in strategies to alter or avoid adverse work environment.

Our findings parallel those of earlier studies, where psychosocial factors have been related to both intention to leave current job [67, 69-71] and predicted executed job mobility [65]. Low job control as a predictor for turnover [66] was also partly confirmed in this study, as our results illustrated slightly lowered odd for job mobility in high control jobs (OR 0.92; 95% CI 0.87-0.97). Our results deviate from one previous study, which illustrated that JDC was not related to intention to leave current job among nurses [68]. It is plausible that these dissimilarities in results stem from differences in job mobility behaviour between this specific occupational category and tendencies in a general population.

Notably, gender stratified analyses showed that all relationships between psychosocial variables and job mobility, except for a small effect for reward (OR 0.95; 95% CI 0.92-0.99), were non-significant among women. In comparison, men in high strain jobs displayed more than doubled odds for job turnover (OR 2.52; CI 1.24-5.98), while relationship analyses between high strain and job mobility among women displayed both weak effects and were non-significant (OR 1.14; 95% CI 0.63-2.07). High ERI was also a predictor for job mobility among men (OR 1.74; 95% CI 1.11-2.72), but consistent with JDC analyses, ERI was not related to job turnover among women.

Since lacking information on motivations for job change, conclusions cannot be made about the reasoning behind turnover, such as job dissatisfaction or career opportunity. However, given that job mobility was related to high strain and high ERI, the job conditions most strongly associated with ill-health, and participants with job insecurity were excluded; it is likely that turnover was, at least partly, a reactive process to negative perceptions of the job environment.

5.2.2 Paper IV: Fear-avoidance attributions & expected return to work

Results supported full mediation effect for fear-avoidance attributions towards work in the relationship between adverse psychosocial work conditions and expected time for return to work among acute coronary syndrome survivors. Moreover, high strain, active and passive work and high ERI, was related to fear-avoidance beliefs. However, these results were only found in total sample analyses or among men, where similarities presumably were due to a majority of male participants (78.2 %). In female subjects, fear-avoidance beliefs were associated to high strain and high ERI, but relationships to high strain became non-significant after adjusting for chosen confounders. Additionally, aversive job perceptions could not be considered as a mediator between psychosocial factors and RTW among female participants. These results are partly consistent with studies in musculoskeletal-pain patients, were fear-avoidance has been proven to be a stronger predictor for RTW than job demands or high strain [25, 78]. However, these analyses were not gender stratified nor did they investigate mediating effects for fear-avoidance in a similar design as this study.

Hence, the study results indicate that ACS survivors perceive adverse work conditions as harmful and thus delaying RTW might be an active strategy to avoid such exposure. Fear-avoidance attributions could therefore be an important psychological factor in the RTW process, which could be beneficial to account for in ACS rehabilitation programs.

5.3 Findings: gender differences

All samples which consisted of both men and women (Paper I, III & IV) were stratified by gender and apparent differences were noted. Despite not being one of the main aims of this thesis, earlier conflicting findings and notable dissimilarities in the current studies emphasize the need to elaborate further on gender differences found in this thesis.

Gender segregated labour market and work cultures

One explanation for differences in results is that men and women predominantly worked in different occupational sectors. In the Adonix/Intergene sample (Table 15) there were a higher proportion of men in executive jobs and blue-collar jobs, while women more frequently worked in office, client and health care jobs. Similar tendencies were found in the VGR-heart cohort (table 16); almost half of the women (47.9 %) worked in pink-collar jobs, defined as health care and office work, whereas most men worked in either academic or blue-collar jobs. The divisions in occupations between men and women, found in the Adonix/Intergene and VGR-heart cohorts, are supported by official Swedish statistics [30]. Additionally, findings from the MOA-project [101] do not only illustrate that the labour market is gender segregated, but also that work cultures dominated by women, in general are characterized by worse psychosocial work conditions. This implies that due to gender segregation in the labour market, men and women generally have different work conditions. Consequently, since the gender stratified analyses are not matched in terms of occupation, differences in the results in this thesis could largely be due to differences in work cultures dominated by either gender.

Table 15. Occupational categorization for men and women in the Adonix/Intergene sample

	Men	**Women**
White-collar jobs	N (%)	N (%)
Executive work	**78 (12.2)**	39 (5.8)
High skilled academics	160 (25.1)	166 (24.9)
Low skilled academics	101 (17.8)	118 (17.7)
Office and client service work	49 (7.7)	**130 (19.5)**
Care and retail service work	26 (4.1)	**134 (20.1)**
Blue-collar jobs		
Farming, gardening and foresting	6 (0.9)	2 (0.3)
Construction and installation work	**97 (15.2)**	6 (0.9)
Machine operators and transport	**60 (9.4)**	8 (1.2)
Work that does require any training	35 (5.5)	39 (5.8)

Table 16. Occupational categorization for men and women in the VGR-heart cohort

	Men		**Women**	
	N	**%**	**N**	**%**
White-collar, N (%)	**140**	**43.9**	35	36.5
Pink-collar, N (%)	38	11.9	**46**	**47.9**
Blue-collar, N (%)	**141**	**44.2**	15	15.6

The lack of relationships between psychosocial variables and job mobility among women (paper III) could relate to the concept of being “locked in occupation” [72], a situation which refers to inability to find employment outside their current occupation or that job mobility within the same occupation results in similar work conditions. As mentioned, a large proportion of the women in this study worked in health care/retail service work, where especially health care work is knows to be both demanding and stressful. Two previous cross-sectional studies have illustrated associations between high strain and the *intention* to leave current employment [69, 70] among health care workers. However, no studies found examined whether such work conditions predicted actual job turnover.

According to the appraisal concept, individuals evaluate strategies to prevent harm, such as altering or accepting a situation. Employees in health care might appraise their possibilities of positive reactive behaviour, such as getting a better job, as limited, whereas for white-collar workers changing jobs might carry the notion of improvement. Thereby, differences found in job mobility patterns might not be due to gender dissimilarities per se, but rather to differences in male or female dominated work cultures. Previous studies have shown that the combination of poor psychosocial conditions and limited work options increases mental ill-health [6, 74, 102] and days on sick leave [72-74]. Thus, the lack of job mobility among women in paper III might imply that women more often are locked into detrimental work conditions and therefore are at greater health risks.

There could also be differences between male and female dominated work cultures regarding core values and commitments. In primary stage of appraisal, the individual does not only assesses whether there is harm in exposing themselves to hazardous situations, but also how such exposure relates to commitments or values [22]. It is likely that values differ between the female dominated health care sector and white-collar cultures. Leaving a job with heavy work load, due to responsibilities for sick patients, is likely qualitatively different from an intense work situation due to information processing overload. E.g. the "burnout" concept was first established among health care staff, as a genuine commitment to help others made it harder to set boundaries in work load [103]. This could further explain why one study found that high ERI predicted intention to leave, but not high strain [68]. Health care workers might accept an intense work situation due to moral values, but expect rewards, such as esteem from colleagues and patients. Such observations emphasize health care work culture as characterized by high commitment, strong loyalty, but possibly also emotionally rewarding.

Lack of precision in job demand measures

The JDC model was originally developed when investigating male blue-collar work conditions [32, 51] and is therefore sometimes considered to best assess task-oriented work characteristics. Since male participants in paper I, III & IV, more frequently were employed in blue-collar jobs than women, their work conditions were likely more accurately evaluated. Occupations dominated by women, like service work and health care, may not be properly reflected, as e.g. emotional demands were not captured [104]. The lack of such dimensions, have been one of the main sources for critique against the JDC model and the standard instrument, the Job content questionnaire [104]. More recent batteries, e.g. the Copenhagen psychosocial questionnaire (COPSOQ) [105], measure job demand and control, but add to this model emotional, cognitive and sensorial demands. Hence, some of the lack of significant relationships between JDC measures and outcomes among female participants could be a result of both gender segregation in the labour market and that the JDC instrument does not accurately reflect job demands in female dominated work cultures.

Labour market inequalities

Despite improvement in gender equality in the labour market in recent decades, injustice in the workplace is still a current issue, as e.g. recent official Swedish statistics [30] report unequal salaries and male dominance in high status positions. The lack of job mobility among women (paper III), could stem from the notion that enduring negative work conditions are an investment for future gains. The process is unhealthy, and will be of particular harm if the investment does not pay off [40]. In this sample a large share of the women was highly educated, suggesting that career-determined individuals voluntarily remain in adverse job situations. However, given mentioned gender inequalities [30], women are likely at higher risk of making occupational investments that will not pay off, which in turn might have health consequences.

Although not part of the study aims for paper IV; there were a notable lack of significant relationships between adverse job conditions and expected time for RTW among women (paper IV), whereas both high strain and high ERI were related to increased time for RTW among men. Such differences could also be part of labour market inequalities, as health care work, typically dominated by female workers, has a lower salary in relation to the work efforts made. Low salary, and consequently less sick-leave pay, might be a reason for fast RTW, despite intense work load. In addition, as mentioned health care work cultures are often characterised by a strong sense of loyalty towards colleagues and commitment towards helping patients [103], which further could hasten RTW.

The results, when analysing the alternative ERI model (paper I) found, minor but significant, health beneficial scores for women exposed to high effort-high rewards (ERI-2). This group contained the highest proportion of university educated subjects in the sample. Hence, results imply that women in professional jobs, who receive appropriate reward for their labours, are healthier than other women. Such categorization does probably create a group with high socioeconomic status, which might connect to healthier lifestyle behaviour e.g. diet and exercise [106]. However, male subjects reporting high effort-high reward did not display these health beneficial results, and analyses were adjusted for socioeconomic status.

"Double exposure"

In paper IV, women reporting high strain or high ERI held aversive perceptions towards work, but associations to JDC became non-significant in the adjusted models. In contrast, results among men showed that both high ERI and several JDC variables, in particular high strain, were related to fear-avoidance attributions. Such dissimilarities could partly be explained by findings in one study [107], illustrating that men to a larger degree attribute harmful events to job stress or unfair treatment, while women more frequently engage in self-blaming or attribute ill-health to private life stress. The attribution of ill-health to off-work stressors among women could be related to that women, more often than men, experience what has been labelled as "double exposure" [31, 108]. The concept refers to that women commonly are expected to live up to both traditionally male social demand, to have a successful career and make an income, while simultaneously maintaining traditionally female roles, e.g. child care and household work. This is still a current issue, as a recent study among the Swedish working population illustrated women spent more than double the amount of time on household work compared to men [109]. It has also been shown that for women, child care [110] or marital issues, [108] can be an even greater source of stress than occupational factors. Double work of this sort might explain the lack of relationships between female high strain and fear-avoidance attributions, as women are likely to attribute ill-health to a broader variety of causes than men.

5.4 Methodological consideration

In all studies, psychosocial work conditions were evaluated. As such, studied subjects were limited to those currently working and this could have contributed to a healthy-worker effect [111], which implies that a sample might be biased since sick-listed subjects are not able to work. If some are sick-listed due to work related ill-health, the sample becomes skewed towards more healthy participants and better psychosocial work scores, which weakens the effects of studied relationships and undermines the validity. Yet another general methodological consideration involves the constitution of ERI items. The effort-reward imbalance at work questionnaire was designed for samples with similar work. As a consequence, the item "My work is physically demanding" is to be either included or removed depending on whether one is examining white- or blue-collar subjects. The analysed Adonix/Intergene cohort used in paper I & III included a broad variety of occupations, which means that excluding this item might create a bias in measuring effort in blue-collar jobs. However, in a study by the creator of the ERI model [88], it is argued that the item measuring physical work load should be removed for samples predominantly consisting white-collar workers.

Paper I

Apart from the cross-sectional design, which in itself constituted a limitation, one crucial source of potential bias was the constitution of the sample. The Adonix/Intergene sample consisted of randomly-selected subjects from Greater Gothenburg and surrounding areas. A selection bias study of the Adonix/Intergene sample [112], illustrated that those declining participation tended to be men, be younger, have lower education and to originate from outside Scandinavia. The study also showed that individuals with lower education, which likely translates to lower socioeconomic status, tended to have worse values with respect to triglycerides, HDL-cholesterol, LDL-cholesterol, hypertension and BMI. Given this information, added to the fact that young and middle aged men tend to have more heart disease; it is possible that the sample is biased towards a healthier sample and thus not representative for the general population of Greater Gothenburg.

Additionally, the study design in paper I relied on the use of sum scores regarding psychosocial variables; consequently all subjects with missing values in JDC or ERI items were excluded, which is likely to have altered the constitution of the sample However, analyses comparing mean for the demand, control, effort and reward variables between those included in the study and those that were excluded showed very minor differences.

Paper II

It can be questioned to which degree the questionnaire captures the JDC dimensions since it has not been validated and was created before the construction of the standard instrument Job Content questionnaire [104]. The items did, however, resemble the JDC dimensions, and according to examined coherence analyses each variable: job demand, job control and social support, all loaded strongly in respective factor. Another limitation of the study was that only men were included in the analysis. Previous studies have shown gender differences with respect to the effect of psychosocial stress to stroke [58, 59, 61, 64], but this was not possible to investigate this since there were few women in this sample, and they predominantly worked in administrative jobs. Hence, it is uncertain if the results apply to women. Also, the distribution of predictors was skewed, in general the subjects reported low demands and high control. Since relatively few individuals were classified as having high strain the power for comparison between the high and low strain groups was limited.

Paper III

One major limitation in this study was that motives for job mobility were not elucidated. If job changes are due to career opportunities or redundancies, psychosocial stressors are less important in the job turnover process. This shortage may have blurred the extent to which psychosocial poor work exposure was related to job mobility, thus weakening internal validity. A further limitation was the constitution of the studied sample. As the previously mentioned selection bias study for the Adonix/Intergene cohort [112] illustrated; individuals who declined participation tended to be men, younger and have lower education. Drop-out of younger subjects with lower education might have skewed the male proportion of the sample towards individuals with higher occupational status and thus better labour market opportunities.

Paper IV

The main outcome in this paper was self-reported expected time for RTW. Hence, one source of potential bias is the lack of accuracy in participants' evaluation. One review paper of non-chronic non-specific lower back pain patients [113] and a longitudinal study among subjects with mental disorders [114] found that expected RTW predicted actual RTW time. Since the VGR-heart study project is a longitudinal project, both follow-up questionnaires and register data can be used to collect exact time for RTW, and make comparisons between these two measures. In the analyses there were thirteen participants, who already resumed work, but still reported time on sick leave, hence actual time for RTW. Exploratory calculations without these participants showed only very minor differences in results. Since this did not notably affect results and we did not want to exclude participants from a fairly small sample, we decided to keep these participants in our analysis. Another limitation is possible bias in self-reported psychosocial work conditions. Recent ACS onset is likely to affect psychological well-being and previous studies have illustrated that people suffering from depression or mental health issues tend to inflate self-reported job demand [115]. We have adjusted our calculations for general mental health (GHQ-12), but it is possible that more confounders capturing mental health dimensions should have been used.

The lack of measures for stressors in the private life, e.g. difficult life events or child care was another major limitation, especially considering the seemingly strong interplay between these dimensions and occupational factors to health among women. Furthermore, one paper support that the combination of dimensions are also important in time for RTW, as RTW among women involved a complex process of simultaneously managing both work and private life [107]. Civil status was included as a possible confounder, but the stepwise purposeful selection analyses did not illustrate this as an important variable in our analyses, even when stratifying by gender. Additionally, there were few women in the VGR-heart study (n=111, representing 21.1 % of the total sample) which further lowered the external validity of interpreting results among women.

Yet another source of potential bias was the difference in response time. The questionnaire was sent shortly after hospital discharge, but the response time varied to some extent in the sample. Previous papers have shown that exposure training and gradual RTW in back-pain patients reduces fear-avoidance attributions over time [116]. Thus those with short response time might therefore be inclined to higher fear-avoidance perceptions, than those already in rehabilitation training. Since our outcome measure, time for RTW, was created by adding response time to expected time for RTW, we could unfortunately not use that variable as a confounder.

In order to evaluate external validity, we gathered data on non-respondents, ordered from Statistics Sweden based on Swedish personal identity numbers (Table 17). The data obtained showed that those declining participation displayed similar proportions between men and women, and mean age as the subjects in our sample. The most notable deviation was an overrepresentation of white-collar workers among the subjects in our sample. Socioeconomic have proven to be an important factor for both ACS onset and return to work [117], and hence the disproportion in occupational belonging weakens this study's external validity.

Table 17. Descriptives of participants and non-respondents

	Participants	Non-respondents
Number of individuals	568	322
Percentage of women	21.3 %	23.0 %
Age, mean	55.7	54.0
White-collar work, N (%)	192 (41.7)	100 (29.1)*
Pink-collar work, N (%)	93 (20.2)	73 (21.2)*
Blue-collar work, N (%)	175 (38.0)	143 (41.6)*

* Statistics Sweden lacked occupational information on some of the non-respondents, hence missing values

6 CONCLUSIONS

6.1 Cardiovascular disease

The two first papers in this thesis (I & II) partly confirmed prior knowledge about relationships between adverse psychosocial work conditions and cardiovascular ill-health outcomes, as well as previously illustrated lack of significant associations among females. In the gender stratified analyses, high strain among men was related to increased diastolic and systolic blood pressure, and high ERI was associated with adverse values in triglycerides and HDL-cholesterol. In an all-male sample active job environment, rather than high strained, was related to increased risk of ischemic stroke. Most results among women were non-significant, except for the findings that high effort-high rewards were related to slightly lower mean values in triglycerides and elevated HDL-cholesterol.

6.2 Perceptions and reactive behaviour

Paper III and IV explored less well-studied outcomes, such as perceptions and reactive behaviour among workers in poor psychosocial work environment. Results showed that both high demands-low control and high effort-reward imbalance predicted job mobility in a sample drawn from the general population. Additionally, fear-avoidance attributions towards work mediated the relationship between adverse psychosocial work conditions and expected time for return to work among acute coronary syndrome survivors. High strain, active and passive work and high ERI, was also related to fear-avoidance perceptions among men. Considering the substantial evidence for relationships between psychosocial work characteristics and, both physical and mental ill-health outcomes it is a positive notion that workers might protect their health, by actively engaging in strategies to alter or avoid poor work environment.

6.3 Gender differences

In the gender stratified analyses (paper I, III, IV) notable differences were detected, as for female participants, there were no significant relationships between psychosocial job dimensions and blood pressure, job mobility, expected return to work or fear-avoidance attributions. Possible reasons behind this lack of significant findings could stem from a gender segregated labour market or work cultures. Other plausible explanations are structural inequalities in both the workplace and society, and that the burden of double exposure, meaning both work and private life demands, deflates relationships between work conditions and health among women.

7 FUTURE PERSPECTIVES

Given the conflicting findings in relationships between cardiovascular outcomes, CHD risk factors and ischemic stroke, further studies are needed to clarify possible associations. Modern work, to a large extent, implies occupational hazards due to psychosocial work load. The high economic burden for these diseases, and indications of relationships to negative psychosocial job conditions, emphasizes the need for more studies in this context and improved legislations for health promotion in the workplace.

More studies should adapt the notions of workers as active agents that both perceive poor work conditions as harmful, but also engage in reactive and protective strategies. Longitudinal studies, capturing psychosocial measures at baseline and then investigates health consequences at follow-up, frequently do not account for that workers might have changed work conditions. As a consequence psychosocial factors might be only accurately measured for a limited period of time. Furthermore, evidence that workers with adverse work conditions tend to change jobs or avoid return to work, could be useful knowledge in the rehabilitation process, as well as for organizations, as lack of improved work conditions could lead to risks of production loss by sick-leave or staff turnover.

There is a need for further studies investigating relationships between psychosocial work conditions and cardiovascular disease among women, and how a gender segregated labour market and differences in work cultures might affect perceptions and possibilities for reactive behaviour, such as job mobility or time for RTW. Previous literature and results in this thesis emphasize that men and women generally have different work environment, but also are subjected to different straining factor in the private life. Exploration of differences between men and women is problematic since both work and private life is gender segregated. The gender order is embedded in daily work, organizational structures, the labour market and society as a whole. Future epidemiological studies would therefore benefit from, not only analysing men and women separately, but also including measures for private life stress and variables specific for female dominated work cultures, in order to better evaluate occupational health risk among women.

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