Job strain and social capital at the work place and their impact on the incidence of coronary heart disease

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Abstract

Among the employable share of the population the work place is a central life aspect, which has its specific impact on the individual's health and well being. Using the concept f social capital we want to quantify the impact from social components at work on health. In this study social capital is defined following Bourdieu's interpretation as personal asset, representing relationships or interactions with potential benefits. We assume that the amount and type of social capital at the work place have direct impact of the general health status of the individual. This study is following the Karasek job strain model to categorise the subjective work conditions. Survival analysis and Cox-proportional-hazard models were used to illustrate the impact from social capital and job strain on incidence of coronary heart diseases. Empirical information are coming from the Malmö Diet and Cancer Study, Sweden (N = 13260). The main findings are that mechanisms of job strain and social capital at the work place are working very different for men and women. While the Karasek model of job demand and control explains differences in health among men, we could not verify this connection for women in equal measure. On the other hand social capital differences seem to be more important for women than for men. Overall, medical and behavioural issues like smoking behaviour and BMI are still the main driving force behind coronary heart disease.

Introduction

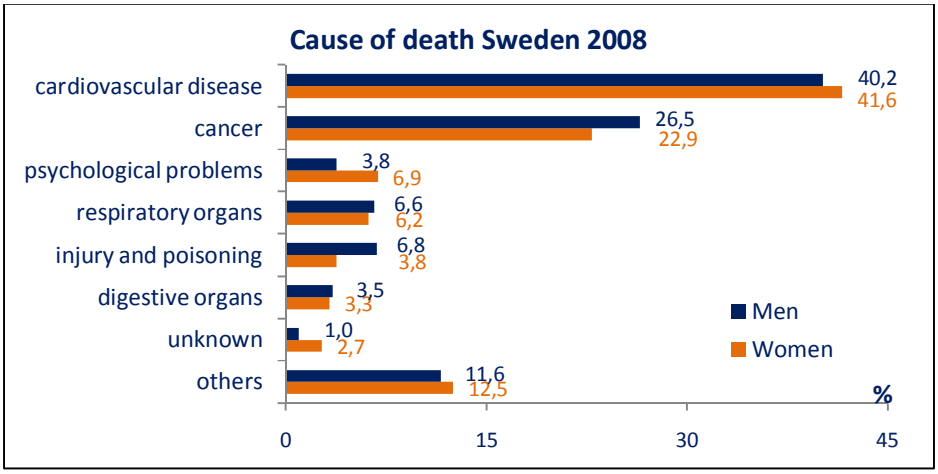
For the working share of the population the work place is an important social environment. In average a worker spends 8h per day, 5 days of the week at the work place. The influence from macro work conditions, educational and occupational groups is well documented. The aspect of social capital or social components at the work place is a rather new field of investigation. In this study we want to have a closer look on subjective work conditions, different kinds of social capital and their impact on individual health.

Social capital has its origin in the field of sociology, but recently found its place as well in politics, economics and public health research (Putnam, 1993, 2000; Fukuyama, 2000; Coleman, 1988, Kawachi and Berkman, 2000). More and more we start to understand the role of social relationship, social integration and networks for the personal well being, economic, psychological as well as medical well being.

The concept of social capital contains a confusing amount of definitions and opinions. The reader of social capital literature is often left with more questions than answers. In contrary to this irritating fuzziness, we will investigate a specific defined type of social capital, taking place in a specific environment. Assuming that differences in social capital have an influence on individual well being, we will investigate the incidence of coronary heart events, as subgroup of cardiovascular disease as a health outcome in a Swedish population.

Among developed countries cardiovascular disease is the most frequent causes of death. In fact the share of this kind of disease appears to be a kind of indicator of the level of development. Sweden is no exception and in the graph below we can see that diseases of the cardiovascular system alone have been responsible for about 40% of all deaths in Sweden in 2008. Consequently the investigation of cause and origin of health differences among cardiovascular disease remain an important topic of science, public health and policy implications.

Figure 1: Cause of death by sex in Sweden, 2008



Swedish statistical office, Socialstyrelsen, "Cause of Death 2008", published 2010

Social Capital Concept

The term social capital appeared in the early 20th century for the first time (Hanifan, 1916; Jacobs,1961; Loury, 1977) and evolved later to an important aspect in the field of sociology as well as in economy, political science and public health. An attempt to provide an overview about all existing definitions and concepts of social capital provoked Portes to state that *"[The] remarkable range of applications has been accompanied by a great deal of confusion concerning the actual meaning of social capital and growing controversy about its alleged effects"* (2000).

This study is working with individual assets of social capital. This definition is geared to the social capital concept by Bourdieu. He defined the term as "*the aggregate of actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition"* (1986). He considers the sum of relationship as the stock of social capital, while this is exchangeable with other forms of capital (cultural and economical).
Applied to the context of work environment we find various examples for social connections and their actual or potential benefit. Bourdieu is emphasizing the convertibility of all three forms of capital – economic, cultural and social capital - therefore we assume an impact from social capital on other characteristics like socio-economic factors as well as individual health and well being. Like other forms of capital, these assets become worthless without the possibility of interaction and investment. Therefore, the expression and use of social capital is necessary to maintain and increase the stock of social capital. Subsequently the existence of a social network, the interaction with other individuals, is essential. Concerning the work environment this network will contain mainly colleagues, superiors, subordinates, business partners and clients.

As mentioned before, there is much discussion about how social capital is applied. Reviewing the literature we can find different dimensions where social capital is supposed to operate. One of the most known dimensions includes the two oppositional aspects bonding (exclusive) and bridging (inclusive) social capital (Putnam(2000)). Bonding works among persons with equal or similar attributes inside a community. This kind of connection provides the feeling of togetherness and membership as well as restricted access and information for individuals outside this group. Due to common interests, attributes or backgrounds, a group of individuals is separating themselves from the rest of the society and "bond" together. Bridging social capital on the other side is connecting individuals from different levels and different communities with each other. Here we can identify again common interests, attributes or backgrounds which are leading to the bridging contacts, but in this case the overall differences between the individuals will be greater than their similarities. Therefore, bridging capital is a mean to reach resources outside the borders of the own network. A population in which the subgroups of individuals are connected by bridging relations will have a more complete information flow and resource than a population where some subgroups are isolated. Granovetter (1973) published this famous work about the quality of relationships (weak and strong ties) and their purpose for employment. While strong ties are often of a bonding nature, weak ties are overlapping with the term of bridging connection.

Concerning the work place the terminology and concept of bonding and bridging transform to horizontal and vertical social capital. Horizontal capital is operating between individuals of the same stage, in case of the work place colleagues of the same status. Often these connections have a bonding character. On the other side vertical capital does exist between individuals of different hierarchical order, outside the own position inside the hierarchy. This kind of relationship often has a bridging character. Given the hierarchical order at the work place we would prefer the term of horizontal and vertical capital, which are partly overlapping with bonding and bridging.

Health and well-being in the concept of social capital

One of the first problems we face dealing with social capital and health is the direction of causality. While it is often argued that an active social life leads to better individual health, we have reason to belief that causality the other way around might be true (as well). The individual health situation could simply not allow an intense social life. In the situation of handicapped persons and individuals with specific illnesses, an easy access to all social activities is not always given. There are studies (Brummet et al., 2001; Hanson et al., 1989) about social isolation in old ages and their impact on physical and psychological health. Older people with problems in the musculoskeletal system might not be able to meet people or attend other social activities outside their home regularly. In some cases the connection between health status and social activity is not so obvious and both directions of causation are possible. In this study we will focus on health as outcome, influenced by differences in social capital and circumstances at the work place.

In the majority of studies social capital is investigated as positive impact on health (Lin, 2001; Berkman and Glass, 2000; Kawachi and Berkman, 2000). Only few authors have considered social capital to imply as well negative aspects. Burt (1997) is analysing the negative impacts resulting from holes inside social networks, so the lack of connections or exclusion from groups and their benefits. Another example for negative aspects is specific kinds of social groups. For example criminal associations will provide advantages for their members but not for outsiders or the community itself. Fukuyama (2000) is dealing with this effect when he talks about miniaturisation of society and claims that the "radius of trust is diminishing". Furthermore, social groups can have negative consequences for their own members. Some social associations are requiring duties as consideration for the membership. Moreover some memberships can include limitation of other social contacts or isolation in the worst case. Therefore, we assume that social capital provides benefits and can cause negative impact.

One of the first large scaled studies which connected directly social network ties and health outcome was the Alameda County Study from 1965 to 1974. Some results (Berkman & Syme 1979) showed that a lack of contacts to friends and relatives but as well the marital status and low rates of group membership were directly associated with higher overall death rates. People with fewer social contacts were 1.9 to 3.1 times more likely to die in the 9 year follow-up study. More and more studies were analysing the connection between social activity and different health outcomes. Further, there was found a strong connection between recovery rates of patients with severe diseases and their social embeddings and social support resources (Cassel, 1976; Cobb, 1976; Seeman, 1996). Evidences were found which proved that degeneration processes due to aging could be decelerated with intervention in physical and social activity (Buchner et al. 1992; Wolinsky et al. 1995).

One biomedical explanation is connecting social isolation with lower functioning of the immune system. Glaser et al (1985) found a lower level of natural killer cell activity among a population of students who reported to be lonely. This effect would cause an indirect impact of social conditions on latent infections due to a suppressed immune system. There are evidences for the link between depression and incidence of cardiovascular disease (Goble and Le Grande, 2008). Another biomedical response on stress is the release of adrenalin for short term reaction. Is the individual exposed longer to stress, the hypophysis is sending signal to the kidneys to release cortisol which will have an impact on the metabolism. Meant to adapt the body to the stress situation, this hormonal change can be damaging if the individual stays in this condition too long (Selye, 1955).

Literature has shown that social circumstances are a strong indicator for prognosis for people with recognized cardiovascular disease (CVD). Further, it is assumed to be a risk for the incidence of CVD as well (Goble and Le Grande, 2008). CVD is the sum of diseases that involves the heart or blood vessels. Coronary heart disease (CHD) as a subgroup of CVD and is mainly caused by accumulation of plaque within the walls of the arteries, what leads to failure of the coronary circulation of the cardiac muscles and surrounding tissues. Symptoms of CHD are angina pectoris (chest/heart pain) and myocardial infarction (heart attack).

Islam (2007) is proposing 4 main possible channels how social capital might influence health issues. First, social capital could have an effect on psychological stress reduction, health related behaviours through norms and

values. This is mainly concerning information channels and buffering effects of social networks. Second, there are direct changes of the personal health behaviour caused by social relationships. According to Berkman and Glass (2000) common norms about health behaviours, which includes nutrition, smoking and physical activity, are a possible impact factor on the behaviour among individuals in that social environment. Good and healthy living conditions will work as role model for others to follow. This kind of group pressure is possible as well in the negative direction. Well known examples are smoking and alcohol consumption, especially among young adults (Cleary et al., 1988). The direct impact of these social and health behaviours are well known. We can relate easily health promoting behaviour like regular physical exercise with prevention of cardiovascular disease. Sport and physical training is strengthening the heart muscle and the blood circulation system which will prevent arteriosclerosis, a major trigger for coronary events. As the third channel Islam points out that there could be an impact where the individual health is influenced by better access to health care and communal amenities. The forth channel is increase social order, including lower crime rates and general safety which takes place on a macro- or meso-level.

In case of the work environment we can identify 2 of these channels. First a positive work environment and second good relationships to your co-workers could work as a stress buffer for job strain as well as for general psychological status. Health behaviour at the work place will easily affect the individual. Some companies have extensive health programs or groups at work developed their own traditions of nutrition, exercise or smoking behaviour.

In this study we are dealing with individual data and therefore will concentrate on the connections between social capital at the work place and health. In a further study where we might be able to group the individuals to their work places, an investigation of the other two channels would be possible. Kouvonen et al. (2008) tried something similar, investigating social capital on the individual and work place level. Unfortunately they only were able to find a connection between low social capital and higher risk of incidence of depression among the co-workers on the individual level.

The field of occupational stress and health impact is one of the more developed areas in social medicine. As already mentioned, an insecure employment situation is concerning the private life in a certain amount, since income, future plans and occupational career are affected. But even under stable condition the working environment can produce stress. Johnson et al. (1989) found a much slower cardiovascular aging structure among people with low strain in the work environment. Further, they concluded that people with higher occupational stress have higher probabilities of dying due to heart disease. In the review of occupational stress and cardiovascular diseases by Byrne and Espnes (2008) the authors could find the strongest relationship between blood pressure and hypertension as result of work related stress.

Reciprocity is one more component of social interaction which seems to have impact on the individual health status. Trust will be developed by reciprocal activities. Siegrist (2005) found evidence for incidence of cardiovascular disease, depression and substance dependency under non-reciprocal working conditions. His studies have shown that non-reciprocal imbalances in work environments are only tolerated by people without alternatives or on a short term bases, linked to either a high competition market or with a suggested postponed reward. According to this and other literature we assume that a supportive and collegial environment at work will lead to better working condition, better stress management and better health. The imbalance of requirements and qualifications of tasks and positions and their different impact on psychological stress and therefore individual health is topic of the work from Karasek (1979) and Karasek and Theorell (1990). They showed that under- or over-qualified people have worse overall health.

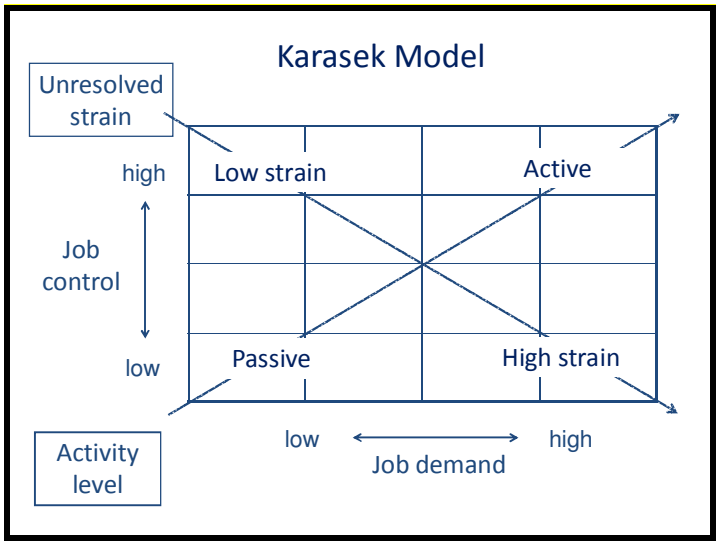
Different than other authors of his time Karasek did not only focus on the demands and stressors a job can contain. Karasek combine the dimension of job demand with the dimension of decision latitude (control over work tasks). Therefore he used information from 15 different questions about the work tasks and conditions. With help of a factor analysis these variables have been divided in the two dimensions of job demand and job control (table 1), depending on for which factor the major factor loading of the single variable were accounted.

Table 1: Job characteristics distribution to the control and demand dimension in the Karasek model

Job Demand	Job control
• Work fast • Work hard • Lots of work • Not enough time • Excessive work • Conflicting demands • No time to finish	• High skilled job • Non repetitious job • Allows freedom • Make one's own decisions • Learn new things • Creative • Participate in decisions • Have say on the job

The calculation from the factor analysis is providing as well continuous variable for each dimension, giving every individual a value for their personal level of job demand and job control. Karasek combined these two dimensions into one diagram, where every person would be placed according to the level of the two dimensions. Regarding a threshold value from where we define a level to be low or high, the model can end up in a different number of combinations between job control and job demand. For US data Karasek used 4 categories in each dimension resulting in 16 combinations of control and demands. Regardless the number of subgroup Karasek labelled the 4 extreme corners of the model as low strain, high strain, active and passive.

Figure 2: Karasek model - dimensions of job constrain



The combination of low demands and high control was labelled low strain and the opposite case would include low control and high demands and called high strain. In both cases the dimensions are imbalanced. Combinations which are balanced are called passive and active.

Karasek tested if these different job strain categories have different impact on job satisfactory and life satisfaction in general as well on medical outcomes like depression. He discovered that the low strain groups are more satisfied with their job and life in general and are less vulnerable to depressions. Active and passive people had slightly higher values than the low strain groups. Outstanding in all models was that the high strain groups, the combination of having high job demands but low job control, were the most disadvantaged groups. The Karasek demand-control model can be seen as an alternative to the classical occupational group analysis. While the occupational group provide macro information about demands for a specific kind of job, the Karasek

model delivers self rated information about the individual job circumstances. The latter one therefore provided an insight to the subjective work conditions.

Data

The data resource for this study is the Malmö Diet and Cancer Study (MDCS). Between 1991 and 1996 about 17.000 women (born between 1923 -1950) and 11.000 men (born between 1926 -1945) living in Malmö, Sweden were investigated. Next to the variables of job strain and work environment, we will include classical risk factor for CHD (age, sex, smoking behaviour and BMI) which will have a major impact on CHD (Lindström & Hanson, 2001).

We only consider people who are employed or unemployed, who have an employment history, in the baseline questionnaire. For the employed we have all the information of the current occupation. The unemployed were asked to make the same statements for their last occupation. Further, we had to excluded everyone with a foreign origin (not born in Sweden) from the dataset since the origin has an impact on the CHD and the share of the foreign born is too small and diverse (82 countries) to consider them appropriately in the analysis. Additionally, we decided to exclude people over the retirement age 65 (N=244) at the baseline questionnaire. All included people were followed until the end of the observation period or until an event took place, disregarding. Therefore, we work in this study with a sample of N = 13260 individuals. While the output variable has been updated until the 31.12.2006 with linkage to the medical register data, all covariates are form the baseline dataset.

Coronary heart disease (time variable)

The depending variable is the incidence of CHD. It is measured as time since the baseline interview. In this study we don't distinguish between fatal and non-fatal CHD incidences, since the survival is partly due to early recognition and treatment of the patient.

Prevalence cases of CHD (before the interview date) are used as dichotomous control variable in the model. Further we will include the information of a heredity score for CHD. This indicator was generated from detailed information about close blood relatives and their medical history. This variable has three values, (0) being the status of the lowest heredity score, (1) as medium and (2) and high heredity score for myocardial infarct.

Social capital of the work place

Social capital will be captures as vertical and horizontal social capital, as well as environmental situation at the work place. Vertical capital contains the information of one question, asking the relationship to the superior. Horizontal social capital is combining the answers from 3 different questions. Participants were asked if "their colleagues would stand by them", if "their colleagues would understand if one has a bad day" and if "the participants like their colleagues". Both vertical and horizontal capital are coded as categorical variable with the 4 values "no colleagues/superior", "bad relationship", "medium relationship" and "good relationship". The last variable measuring social capital is called work environment and contains the answers from 3 questions about the general circumstances at the work place (atmosphere, solidarity and the feeling of being rooted at the work place). The output contains 3 ordinal categories (bad, medium, good), with 3 as the highest social capital at the work place.

Karasek model

As mentioned before, the Karasek model contains 4 categories of job strain regarding the 4 possible combinations of demands and control (high or low). From the information of the demands and control possibility of the individual job we calculated continuous variables for both these characteristics using factor analysis. A more detailed generation of this variable will be explained later, since this study is using a modified version of the original Karasek model.

Age and sex

Age is measured as continues decimal years from time of the baseline questionnaire until an incidence in case of the event or was right censored at the last update (31. 12. 2006). Due to the restrictions of retirement age, the range of the age variable is 44.7 - 65 years, with a mean age of 54.0 years. Pre-tests have show very different results for male and female participants. To take these differences into account, we decided to present separated models for men and women.

BMI

The body mass index is a rough measurement of the physical condition of the individual, mainly dependent on nutrition and exercise habits. It is defined as the ratio of weight in kilogram and the square of the height in metre. It will be presented as categorical variable including the categories underweight ($BMI < 18.5$), normal weight ($18.5 < BMI \leq 24.9$), overweight ($25.0 < BMI \leq 30$) and obese ($BMI > 30$).

Smoking behaviour

Smoking behaviour was asked in the questionnaire with standard answer categories. Participants had the choice between the answers being a non-smoker, a regular smoker, an occasional smoker and have stopped smoking. The latter group is unspecific, since we don't have information when the person has stopped and for how long they have been smoking in total. Therefore these people have to be analysed as separated group.

Table 2: Descriptive analysis of the set of variables

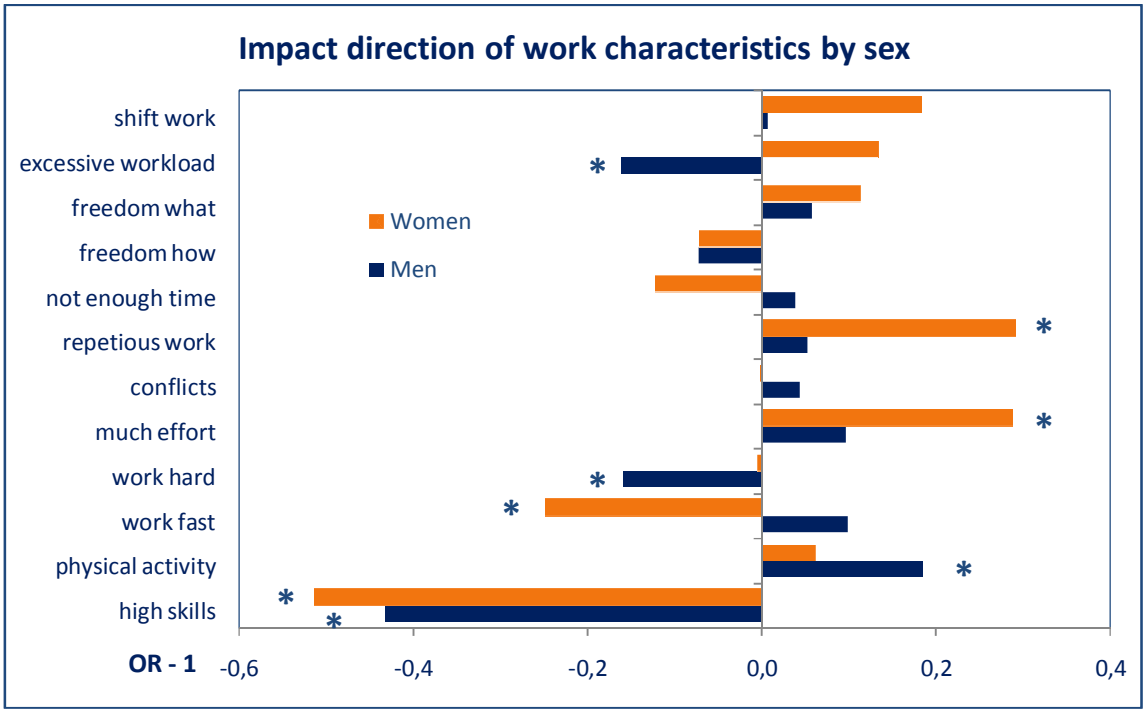
Variable		Men (N = 5025)		Women (N = 8235)		Total (N = 13260)	
		N	%	N	%	N	%
Coronary heart event	no	4636	*92,3*	8073	*98,0*	12709	*95,8*
	yes	389	*7,7*	162	*2,0*	551	*4,2*
Karasek model	active	448	*8,9*	539	*6,5*	987	*7,4*
	passive	2618	*52,1*	4999	*60,7*	7617	*57,4*
	low strain	1164	*23,2*	1164	*14,1*	2328	*17,6*
	high strain	795	*15,8*	1533	*18,6*	2328	*17,6*
Horizontal social capital level	no colleagues	454	*9,0*	486	*5,9*	940	*7,1*
	low	1821	*36,2*	2972	*36,1*	4793	*36,1*
	medium	1693	*33,7*	2651	*32,2*	4344	*32,8*
	high	1057	*21,0*	2126	*25,8*	3183	*24,0*
Vertical social capital level	no superior	807	*16,1*	504	*6,1*	1311	*9,9*
	low	229	*4,6*	326	*4,0*	555	*4,2*
	medium	1667	*33,2*	2763	*33,6*	4430	*33,4*
	high	2322	*46,2*	4642	*56,4*	6964	*52,5*
Work environment	bad	926	*18,4*	1746	*21,2*	2672	*20,2*
	medium	2268	*45,1*	3839	*46,6*	6107	*46,1*
	good	1831	*36,4*	2650	*32,2*	4481	*33,8*
Body Mass Index	underweight	15	*0,3*	101	*1,2*	116	*0,9*
	normal	1922	*38,2*	4677	*56,8*	6599	*49,8*
	overweight	2508	*49,9*	2594	*31,5*	5102	*38,5*
	obese	580	*11,5*	863	*10,5*	1443	*10,9*
Prevalent case	no	4919	*97,9*	8213	*99,7*	13132	*99,0*
	yes	106	*2,1*	22	*0,3*	128	*1,0*
Heredity score	low	3238	*64,4*	5092	*61,8*	8330	*62,8*
	medium	1495	*29,8*	2594	*31,5*	4089	*30,8*
	high	292	*5,8*	549	*6,7*	841	*6,3*
Smoking	regular smoker	1227	*24,4*	2172	*26,4*	3399	*25,6*
	occasional smoker	283	*5,6*	420	*5,1*	703	*5,3*
	stopped smoking	2005	*39,9*	2445	*29,7*	4450	*33,6*
	non smoker	1510	*30,0*	3198	*38,8*	4708	*35,5*

Methodology

Using Cox-proportional-hazard regression we will be able to analyse the incidence of heart disease controlling for the list of impact variables described above. As mentioned before we will present specific CHD models stratified by sex. The independent variables are coming from the cross sectional questionnaire and therefore will be handled as time constant. The parameter estimation will be performed with help of survival analysis and Cox-proportional-hazard regressions using the statistical software package STATA and its implications.

The first step in the analysis is the generation of the Karasek model from the information in the MDCS dataset. Therefore, we try to simulate the modelling of the two variable of job demand and job control from the information we had in the dataset. Karasek (1979) used 15 items to generate, with help of factor analysis, the two dimensions of control and demand. We were able to replicate 10 of these 15 original items from our data set and added two more which were available in the MDCS. Before performing the factor analysis we will provide a pre-model which indentify the direct impact of all these 12 single items on the incidence of CHD. To illustrate the results in a clear way, we provide a graph with the values for all items divided by sex. Please notice that the results are presented in Odds Ratio – 1. Therefore an easy interpretation of the impact direction is given. All values on the positive side are increasing factors. All factors with values on the negative side are decreasing the risk of CHD. Values marked with a star are significant on a 95% confidence level.

Figure 3: Regression results of single impact factors on incidence of coronary heart disease



Even the first look at the graph tells us two important things. First, the impact direction and strength of impact of the single items is very different. Second, the results differ as well among the sexes, not only in the value but as well in impact direction. For men we find four significant impact factors, which are being high skilled, physical activity at work, level of hard work and level of excessive work share. While a higher education level decreases the risk of heart disease, we find higher risks among people with higher activity levels at work. Surprisingly a higher level of hard and excessive work has a reducing influence of heart disease risk. For women we find as well four significant items. Being higher skilled has similar impact as for men. A higher share of fast work has reducing impact of female heart disease risk. Lots of work (effort) and repetitive (repeat) jobs have an increasing influence for women. All other impact factors are close to 0 and not significant.

These results do not provide a clear overview about the work environment. At that point we follow the Karasek model and transform these single items into two dimensions – job demands and job control - via factor analysis. The distribution of variables on the two dimensions in the different datasets can be seen in the table 2. The variables have been distributed to one or the other dimension according to the main factor loading resulting from the factor analysis.

Table 3: Karasek model simulation with MDCS data

Job Demand	Job control
• Work fast (fast) • Work hard (hard) • Lots of work (effort) • Not enough time (no-time) • Excessive work (excess) • Conflicting demands (conflict) • Shift work	• High skilled job (high-skill) • Non repetitious job (repeat) • Allows freedom (free1) • Make one's own decisions (free2) • Physical activity at work (activity)

Interesting to note here is, that all items which appeared in both datasets have been distributed by factor analysis in the same dimensions of job demand and job control (compare with table 1). That is a good hint for consistency of the model. Factor analysis is providing two continuous variables given the individual level of job demand and job control. Before we continue with building the job strain groups of the Karasek model, we will have a look at the impact of these two variables.

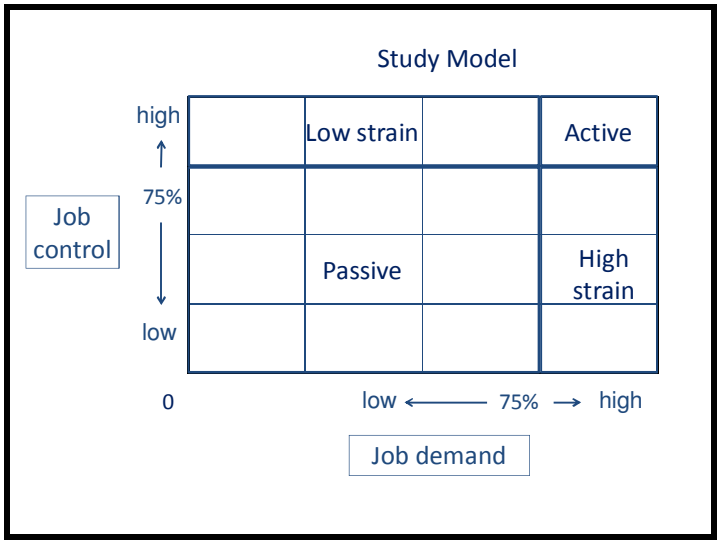
Table 4: Logistic regression of incidence of heart disease by sex

	Men		**Women**	
	OR (CI)	Significance	OR (CI)	Significance
Job demand	0,99 (0,90-1,08)	0,794	0,95 (0,83-1,09)	0,508
Job control	0,83 (0,76-0,90)	0,000	0,85 (0,75-0,97)	0,047
Nr. of observation	5025		8235	
Prob (chi2)	0,003		0,097	
Pseudo R2	0,004		0,003	

As we can see for both sexes job demand has no significant impact on the incidence of heart disease. On the other side it appears that job control has a negative impact on the incidence of CDH. The more control and individual has in their job performance, the smaller the risk of CHD. Further we will distribute the sample population according to their job demand and job control combination.

At that point our model differs from the original Karasek model. We define the last quartile of each dimension as benchmark for distinguishing between high and low. We will use the original Karasek terminology and call the subgroups low strain (low demand – high control) and high strain (low control – high demands) in case the dimensions are imbalanced. In case both dimensions are balance, one is called passive (low demand-low control) and the other one active (high demand-high control).

Figure 4: Variation of the Karasek model used in this study



In the following we test these job strain groups and the set of control variables for their impact on the incidence of coronary heart disease. As mentioned before we perform a survival analysis and test the hypotheses with help of Cox-proportional hazard models.

Results

Below we can see the results for the step wise models stratified for men (table 5) and women (table 6). We distinguish between three different models, where the first one includes only the job strain groups. In the following model we added the variables of social capital and work environment. The last models contain additionally the medical and behavioural control variables.

In the male model the most evident characteristic is the distinct higher CHD risk for the passive and high strain group have in comparison of the reference group low strain, while the active group is indifferent to the reference group. These values do not change significantly in model 1.2, when we introduce the next set of variables, but in model 1.3 when we present our full model. The value of both groups of passive and high strain decreased and the significance level changed from 99% to 95%.

Both variables of horizontal and vertical social capital do not seem to have any impact for the men. Values are close to the reference group (medium social capital) or insignificant. Similar results we find for the work environment. The values let assume that a worse work environment increase the risk for heart disease, however we could not verify a significant difference compared to the reference category.

For the set of medical issues we find unsurprisingly highly significant results in line with our expectations. Every additional year at the time of the baseline questionnaire increase the CHD risk by 7% among men. Taking normal weighted people as reference, overweight and obese people have considerable enhanced risks. There was no case of an underweight man experiencing a CHD; therefore no results can be reported. A previous case of a CHD, before the baseline questionnaire, increases the risk of a new incidence by 2.6 times. People with a medium or higher heredity score for infarct suffer from up to nearly twice the risk of people with low family heritage score. The last variable concerns the smoking behaviour. Here we can see clearly that compared to non-smoker, regular smokers (HR 2.26) and even occasional smokers (HR 1.75) have significantly higher risk of a heart disease.

Table 5: Cox proportional Hazard model for CVD males, Hazard ratios

Variable	Value	Model 1.1			Model 1.2			Model 1.3		
		HR	Sign.	CI	HR	Sign.	CI	HR	Sign.	CI
Karasek model	Active	0,91		(0,62-1,34)	0,91		(0,61-1,34)	0,94		(0,64-1,40)
	Passive	1,50	***	(1,19-1,88)	1,51	***	(1,20-1,90)	1,36	**	(1,08-1,71)
	Low strain	1			1			1		
	High strain	1,56	***	(1,18-2,06)	1,58	***	(1,19-2,09)	1,42	**	(1,07-1,89)
Horizontal social capital level	No colleagues				1,23		(0,85-1,78)	1,14		(0,79-1,66)
	Low				1,04		(0,83-1,32)	1,02		(0,81-1,29)
	Medium				1			1		
	High				1,25		(0,97-1,60)	1,18		(0,92-1,52)
Vertical social capital level	No superior				1,00		(0,91-1,64)	0,98		(0,92-1,65)
	Low				0,82		(0,82-1,82)	0,81		(0,81-1,80)
	Medium				1			1		
	High				0,86		(0,85-1,31)	0,82		(0,82-1,26)
work environment	Bad				1,17		(0,85-1,60)	1,30		(0,94-1,79)
	Medium				1,19		(0,94-1,51)	1,20		(0,95-1,53)
	Good				1			1		
Age								1,07	***	(1,05-1,09)
Body Mass Index	Underweight							-		
	Normal							1		
	Overweight							1,36	***	(1,12-1,65)
	Obese							1,95	***	(1,51-2,52)
Prevalent event	Yes							2,63	***	(1,85-3,76)
Heredity score infarct	Low							1		
	Medium							1,30	**	(1,09-1,56)
	High							1,89	***	(1,41-2,53)
Smoking	Non smoker							1		
	Regular smoker							2,26	***	(1,80-2,84)
	Occasional smoker							1,75	**	(1,22-2,51)
	Stopped smoking							1,07		(0,85-1,35)
Nr. of observations		5025			5025			5025		
Events		389			389			389		
P(chi2)		0,002			0,050			0,000		

*** p- value ≤0.010; ** ≤ 0.050; *≤ 0.100

Table 6: Cox proportional Hazard model for CHD females, Hazard ratios

Variable	Value	Model 2.1			Model 2.2			Model 2.3		
		HR	Sign.	CI	HR	Sign.	CI	HR	Sign.	CI
Karasek model	Active	0,97		(0,49-1,95)	1,04		(0,52-2,09)	1,21		(0,60-2,44)
	Passive	1,27		(0,84-1,91)	1,24		(0,83-1,87)	1,04		(0,68-1,58)
	Low strain	1			1			1		
	High strain	1,20		(0,74-1,95)	1,29		(0,80-2,10)	1,13		(0,69-1,87)
Horizontal social capital level	No colleagues				2,22	**	(1,20-4,11)	2,30	**	(1,24-4,26)
	Low				1,18		(0,81-1,74)	1,15		(0,77-1,70)
	Medium				1			1		
	High				1,56	**	(1,10-2,22)	1,50	*	(1,05-2,14)
Vertical social capital level	No superior				0,46	*	(0,22-0,96)	0,50		(0,23-1,07)
	Low				0,53		(0,20-1,43)	0,56		(0,21-1,52)
	Medium				1			1		
	High				1,20		(0,86-1,68)	1,20		(0,87-1,67)
work environment	Bad				1,00		(0,61-1,65)	1,10		(0,66-1,81)
	Medium				0,99		(0,69-1,41)	1,11		(0,78-1,59)
	Good				1			1		
Age								1,10	***	(1,07-1,13)
Body Mass Index	Underweight							0,56		(0,11-2,77)
	Normal							1		
	Overweight							1,25		(0,93-1,68)
	Obese							1,72	**	(1,17-2,53)
Prevalent event	Yes							14,35	***	(6,81-30,24)
Heredity score infarct	Low							1		
	Medium							1,67	***	(1,26-2,21)
	High							2,23	***	(1,45-3,43)
Smoking	Non smoker							1		
	Regular smoker							2,99	***	(2,20-4,07)
	Occasional smoker							1,89	*	(1,01-3,54)
	Stopped smoking							1,14		(0,78-1,65)
Nr. of observations		8235			8235			8235		
Events		162			162			162		
P(chi2)		0,728			0,138			0,000		

*** p- value ≤0.010; ** ≤ 0.050; *≤ 0.100

For females (table 6) we have a different picture. Regarding the job strain groups, we could not identify a significant difference between the groups. When we include more variables in the model 2.2 and 2.3, the values change but stay insignificant. Horizontal capital, the relationships among equals, seems to have a strong impact on females. Women without contact to colleagues and co-workers suffer from a much higher risk (HR 2.22-2.30) compared to women with medium horizontal social capital. Further we can identify an increased risk (HR 1.50-1.56) for females who state to have high horizontal social capital. Vertical social capital seems to have an impact on females as well. Taking medium as reference category, we can see that women who do not have any superior (HR 0.46) or low social capital (HR 0.53) have a decreased risk for CHD. On the contrary females with high vertical social capital have increased risks (HR 1.20). In the full model 2.3 all of these results stay insignificant. The categories of the work environment variable do not show any influence for females.

In comparison age has more impact for women than for men; every additional year will increase the risk by 10% for women. According to the results for BMI, underweight females have medical advantage, but this result stays insignificant. For overweight and obese we find similar but weaker effect than in the male model (HR 1.25 and 1.72). That could be connected to the biological differences between the sexes of fat accumulation.

For prevalence case of heart disease we find the amazing number of an HR of 14.35. We do not deny a strong effect here but assume that the small number of women with a prevalent case of CHD in relative early ages is a very selective group and therefore possible bias the result. The heritage effects are stronger for women than for men (HR 1.67 and 2.23), however as highly significant as in the male model. Smoking has similar results as reported for men, higher risk for CHD for regular smokers (HR 2.99) and occasional smokers (HR 1.89).

Conclusion

This study aimed to verify whether differences in job strain and social capital at the work place determine incidence risks for coronary heart disease. For categorisation of job strain we applied a modified version of the Karasek model. We could confirm the job strain model for men but not for women. Including variables for social capital at the work place and general environment showed that these indicators have no significant impact on men but partly on women. These two important finding cause us to assume the existence of very different influence mechanism for men and women. A separation of both sexes in future analysis is therefore essential. The medical and behavioural characteristics are still the driving force for cardiovascular disease, in our case coronary heart disease. Even if the effect from the social capital and job strain groups are partly small, we have shown that they are not insignificant impact factors.

Discussion

In our analysis we could verify Karasek's results from 1979, that the high strain group has the highest medical risks, at least for men. Most applications of the Karasek model have been performed on male populations (Karasek et al. 1981, 1988; Johnson et al., 1989). The absence of differences among the strain groups among women could assume a gender difference how to cope with work related stress as well in perception of the own work tasks, therefore the characteristics which placed the males and females in the different job strain groups. Another sex difference we have seen in the influence from social capital at work. These variables did not seem to have considerable impact on males. On the other side we could verify an influence for females. These differences are probably connected to gender specific behaviour at the work place. Social components of the work environment and social relationships at the work place could have more importance for women than for men. It is reasonable that a lack of social connections, having no co-workers, can lead to feelings of loneliness and consequently have a negative impact on physical health. Further we found hints that too much social capital at the work place has negative effects as well. Women with a high level of horizontal social capital had increased risk to experience a CHD. We like to call that the "Fika" effect. The Swedish tradition of coffee break at the work places is called "Fika". High social capital could mean a higher level of these social activities which could include higher level of caffeine, fat or cigarette consumption, which will have a negative impact on cardiovascular disease. We would assume that a very high level of social capital contains negative indirect effects on the individual health. Own analyses of indirect impact have shown that social capital and work environment have a substantial influence on the classic cardio impact factors BMI and smoking.

The strongest influence from the social capital variables is placed in the categories of not having any colleagues and not having any superiors. During our investigations we checked if these results have been triggered by the group of people reporting themselves as "self employed". Excluding this share of people did not change the values of the specific social capital categories, so we did not see a reason to exclude this people in the full model.

While the MDCS data set contains detailed data about diverse aspects and the possibility to connect this information with the medical register data, it has well some shortages. The baseline questionnaire was performed in the early 90s, what is on one hand necessary for a long term survival analysis, but on the other

side unfortunate “old” data. Since we only use the baseline questionnaire, we had to assume all covariates as constant, which is a rather strong assumption. The analysis of event history data or panel data would provide the possibility to observe health impacts from changing circumstances.

In summary we have shown a rather complex set of relationships of work place circumstances, control variables and their impact on coronary heart events. The work place is only one out of several life spheres which could be under influence of social capital. Further studies will try to cover more aspects of the personal life to eventually get a more complete picture of which part social relationships and social capital play as impact factor for individual health and well being.

References

Berkman, L. F. and T. Glass (2000). Social Integration, Social Networks, Social Support, and Health. Social Epidemiology. L. F. Bergman and I. Kawachi. Oxford, Oxford University Press**:** 137-173.

Berkman, L. F. and S. L. Syme (1979). "Social Networks, Host Resistance and Mortality: a nine year follow-up study of Alameda Country residents." American Journal of Epidemiology **109**(2): 186-204.

Bourdieu, P. (1986). The Forms of Capital. Handbook of theory and research for the sociology of education. J. G. Richardson. US, Greenwood Press, Inc. **:** 241-255.

Brummett, B. H. and D. B. Mark (2001). "Characteristics of Socially Isolated Patients With Coronary Artery Disease Who Are at Elevated Risk for Mortality." Psychosomatic Medicine **63**: 267-272.

Buchner, D. M., S. A. A. Beresford, et al. (1992). "Effects of Physical Activity on Health Status in Older Adults II: Intervention Studies." Annual Review of Public Health **13**(1): 469-488.

Burt, R. S. (1997). "A note on social capital and network content." Social Networks **19**(4): 355-373.

Byrne, D. G. and G. A. Espnes (2008). "Occupational stress and cardiovascular disease." Stress and Health **24**(3): 231-238.

Cassel, J. (1976). "The Contribution of the Social Environment to Host Resistance: THE FOURTH WADE HAMPTON FROST LECTURE." American Journal of Epidemiology **104**(2): 107-123.

Cleary, P. D., J. L. Hitchcock, et al. (1988). "Adolescent Smoking: Research and Health Policy." The Milbank Quarterly **66**(1): 137-171.

Cobb, S. (1976). "Social Support as a Moderator of Life Stress." Psychosomatic Medicine **38**(5): 300-314.

Coleman, J. S. (1988). "Social Capital in the Creation of Human Capital." The American Journal of Sociology **94**(Supplement: Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure): 95-120.

Fukuyama, F. (2000). The Great Disruption. Human Nature and the Reconstitution of Social Order. New York, Touchstone.

Glaser, R., J. K. Kiecolt-Glaser, et al. (1985). "Stress, Loneliness, and Changes in Herpesvirus Latency." Journal of Behavioral Medicine **8**(3): 249-260.

Goble, A. and M. Le Grande (2008). "Do chronic psychological stressors accelerate the progress of cardiovascular disease?" Stress and Health **24**(3): 203-212.

Granovetter, M. (1973). "The strength of weak Ties." American Journal of Sociology **78**(6): 1350-1380.

Hanifan, L. J. (1961). "The Rural School Community Center." Annals of the American Academy of Political and Social Science **67**(New Possibilities in Education (Sep.)): 130-138.

Hanson, B. S., S.-O. Isacsson, et al. (1989). "Social Network and Social Support Influence Mortality in Elderly Men." American journal of epidemiology. **130**(1): 100-111.

Islam, M. K. (2007). Essays on Social Capital, Health and Socioeconomic Inequalities in Health. A Health Economic Study. Lund, Sweden, Lund University.

Jacobs, J. (1961). The Life and Death of Great American cities. New York, Random House.

Johnson, J. V., E. M. Hall, et al. (1989). "Combined effects of job strain and social isolation on cardiovascular disease morbidity and mortality in a random sample of the Swedish male working population." Scandinavian Journal of Work Environment and Health **15**: 271-279.

Karasek, R. (1979). "Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign." Administrative Science Quarterly **24** (2). 285-308.

Karasek, R., D. Baker, et al. (1981). "Job Decision Latitude, Job Demands, and Cardiovascular Disease: A Prospective Study of Swedish Men." American Journal of Public Health **71**(7): 694-706.

Karasek, R., T. Theorell, et al. (1988). "Job Characteristics in Relation to the Prevalence of Myocardial Infarction in the US Health Examination Survey (HES) and the Health and Nutrition Examination Survey (HANES)." American Journal of Public Health **78**(8): 910-918.

Karasek, R. and T. Theorell (1990). Healthy Work. Stress, Productivity, and the Reconstruction of Working Life. New York, Basic Books, Inc., Publishers.

Kawachi, I. and L. F. Berkman (2000). Social Cohesion, Social Capital, and Health. Social Epidemiology. L. F. Bergman and I. Kawachi. Oxford, Oxford University Press**:** 174-190.

Kouvonen, A. et al. (2008). "Low Workplace Social capital as a Predictor of Depression. The Finnish Public Sector Study". American Journal of epidemiology **167** (10): 1143-1151.

Lin, N. (2001): Social capital. Theory and research. New York, NY: Aldine de Gruyter.

Lindström, M., B. S. Hanson, et al. (2001). "Socioeconomic differences in leisure-time physical activity: the role of social participation and social capital in shaping health related behaviour." Social Science & Medicine 52(3): 441-451.

Loury, G. (1977). A Dynamic Theory of Radical Income Differences. Women, Minorities, and Employment Discrimination. A. LeMund. Lexington, Mass., Lexington Books.

Official Statistics of Sweden (2010). "Cause of death 2008". Statistics – Health and Medical Care.

Portes, A. (2000). "The Two Meanings of Social Capital." Sociological Forum **15**(1): 1-12.

Putnam, R. D. (2000). Bowling Alone. New York, Simon & Schuster Paperbacks.

Putnam, R. D., R. Leonardi, et al. (1993). Making democracy work: civic traditions in modern Italy. Princeton, N.J., Princeton University Press.

Seeman, T. E. (1996). "Social Ties and Health: The Benefits of Social Integration." Annals of Epidemiology **6**(5): 442-451.

Selye, H. (1955). "Stress and Disease." Science **122**(3171): 625-631.

Siegrist, J. (2005). "Social reciprocity and health: New scientific evidence and policy implications." Psychoneuroendocrinology **30**(10): 1033-1038.

Wolinsky, F. D., T. E. Stump, et al. (1995). "Antecedents and Consequences of Physical Activity and Exercise Among Older Adults." The Gerontologist **35**(4): 451-462.