The impact of job strain and social aspects of the work place 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. In this study social capital is defined after Bourdieu as personal asset, representing relationships or interactions with potential benefits. Social relationships among co-workers and people of different hierarchical order around the work environment have probably more than only an impact on work performance. 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 model of job strain groups to analyse the different influences on health. The Karasek model has been proven valid in other studies concerning job strain and various health outcomes. In a second step we will perform a survival analysis and investigate with help of Cox-proportional-hazard models the impact from job strain and social capital on incidence of coronary heart diseases. Using a sample (N = 13260) of the Malmö Diet and Cancer Study from Sweden we could verify various connections between social capital and health. 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

Studies about medical and socio-economic impact factors on cardiovascular mortality and morbidity are well known. Why are writing another one? First, among the developed world cardiovascular disease and cancer are the main 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.
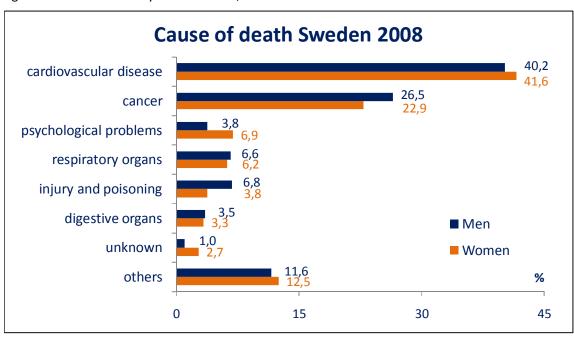
Figure 1: Cause of death by sex in Sweden, 2008

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

The living conditions of an individual are explaining a huge amount of the variety of health differences among the population. The work environment is taking a major role as life aspect among the employable share of the society. The working population is spending an important part of their time at the work place surrounded with co-worker, superiors and clients. We assume that the personal connections to these people and the work environment setup have impact on psychological and physiological health. When it comes to personal relation and their meaning and impact on the individual we enter the field of social capital. This term is often used in modern social science. Unfortunately there are almost as much definitions and opinions about it as authors. To avoid

misunderstanding we will briefly explain the main streams of theoretical thoughts on that term and define which of them is used in this study.

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"* (Portes, 2000). Nevertheless we can identify 3 main streams of conceptualizations in the scientific discussion among the vast amount of diverse contributions among social capital literature.

Putnam (1993) is investigating social capital as quality of whole populations and their impact on political and social life. Coleman (1988) is arguing on a less aggregated level, emphasizing the role of family and group relations. As the oldest of the three streams we count Bourdieu, who defines social capital as individual asset and exchangeable with other forms of capital (human and economical).

In this study we will focus on the definition from Bourdieu, as we work with social capital on the individual micro level. Bourdieu described social capital 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"* (Bourdieu, 1986). Applied to the content 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, human and social capital - therefore we assume an impact from social capital on other characteristics like socio-economic factor as well as individual health and well being. Bourdieu believed that even if social capital is an individual asset it cannot exist without social interaction and relationships. Therefore, the expression, use and maintenance of social capital only work in interaction with other individuals as well. Concerning the work environment these contacts will be mainly colleagues, superiors, subordinates, business partners and clients. Individuals can benefit from the advantages of social relations and networks under the condition of (active) membership.

As mentioned before there is much discussion about how social capital is applied by the people. Reviewing the literature we can find 4 different dimensions where social capital is suppose to

operate. One of the most known dimensions includes the two controversial aspects bonding (exclusive) and bridging (inclusive) social capital (Putnam(2000)). Bonding is working 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 site 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 usual social 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.

Related to the bridging and bonding component you can find the dimensions of horizontal and vertical social capital. Horizontal capital is operating between individuals of the same stage which could be social-economic class, colleagues of the same status or people of one generation. Often these connections have a bonding character. On the other site vertical capital does exist between individuals of different hierarchical order, between different levels of employment, membership or age groups. These kinds of relationship often have a bridging character.

Often social capitalist distinguish between cognitive and structural social capital as the third dimension. The cognitive component includes theoretical norms and values of the particular society which is normally shared by most of the members of that society (Rostila, 2007). Studies about social trust are referring to the cognitive component of social capital (Putnam, 2000). The structural component is more an individual aspect which includes the extent and intensity of social links, e.g. size and structure of the social networks.

Another dimension of social capital is the strength of ties. Both types, strong and weak, have their advantage and purpose. Strong ties are found in general among close family members and in the inner circle of friends. These contacts provide all kind of support and resource possibility (e.g. financial, material and emotional resource) and will count for the bonding functions in the majority of cases. Weak ties on the other hand have a different function. They are determined by temporary and loose contacts, but nevertheless are seen as essential as the strong ties. Granovetter (1973) published this famous work about weak ties and their advantage for the job market. He concluded

that people use more often weak ties for job searching. One reason for that is that more distant contacts can provide information which is going beyond the usual network borders. Consequently most weak ties will have a bridging function which do not require the same maintenance and often have a specific purpose.

In our study we will focus on the dimensions of vertical and horizontal capital which will contain the quality of relationship between the individuals and its co-workers as horizontal capital and the relationship to the superior as vertical capital. Further, we will be able to introduce a variable about the general social aspect of the work place covering parts of the dimensions of bonding and bridging and as well weak and strong ties.

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 causation. While it is often argued that an active social life is leading to better individual health conditions, there are hints that causation the other way around might be true (as well). The personal health situation could simply not allow an intense social life. In the situation of handicapped persons and individuals with specific illnesses, a free access to all social activities is not always given. There are studies 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 a causation direction in both directions is possible. In this study we will focus on health as outcome parameter, influenced by differences in social capital and circumstances at the work place.

In the majority of studies social capital is investigated as positive impact factor (Lin, 2001; Putnam 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 are specific kinds of social groups. For example criminal associations will provide advantages for their members but not for outsiders or the community itself. 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 to other social contacts or isolation in the worst case. Therefore, we assume that social capital provides benefits as well as causes negative impact.

One of the first large scaled studies which connected directly social network ties and health outcome was the Alameda Country 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 outcome. 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). Cardiovascular Disease (CVD) is the sum of diseases that involves from the heart or blood vessels. Coronary heart disease as a subgroup of CVD and is mainly caused by accumulation of plague within the walls of the arteries, what leads to failure of the coronary circulation of the cardiac muscles and surrounding tissues. Symptoms of coronary heart disease are angina pectoris (chest/heart pain) and myocardial infarction (heart attack).

While the analysis of the different kinds of social ties, their function and their combination in association with health outcome is a more recent topic, social networks have been in the centre of attention in the field of infectious diseases for a long time. While the connection between infectious disease and personal contacts is comprehensive even for a non-scientific audience, the more complex and difficult question is to explain the mechanism behind social capital and their different physical and psychological health status.

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 consume, 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 all 4 of these channels. First a positive work environment and 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 introduced health programs or groups at work have their own traditions of nutrition, exercise or smoking behaviour as an example for negative impact. The third channel would concern the work place policies regarding health insurance plans and advantages provided by the company, like sickness leave or access to health programs. The forth channel in the content of work environment could be represented by company rules about job security, safety arrangements and training as well as general positive work environment.

In this study we are dealing with individual data and therefore will concentrate on the first two 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, as an indirect medical consequence. 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.

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. The data set includes rich information about job situation and medical characteristics of the individuals. Next to the variables of job strain and work environment, we will include classical risk factor for CHD (age, sex, smoking behaviour and BMI) to ensure a valid estimation. Despite any possible social influence from the work environment, we have evidence that the medical issues have the major impact on health condition (Lindström & Hanson, 2001).

Due to some restrictions we use only a sub sample of the entire MDCS dataset. We only consider people who are currently employed or unemployed. 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 (N=2096) and diverse (82 countries) to consider them appropriately in the analysis. Additionally, we decided not to include people older than 65 (N=244). The latter one is mainly a double check on the

occupational status, since in Sweden we have a retirement age of 65. Therefore, we work in this study with a sample of N = 13260 individuals.

Coronary heart disease (time variable)

The focus of this study will be on the social circumstances at the work place and their impact on the health and well being. Literature has shown that the 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). Therefore, coronary heart disease as main sub category of cardiovascular disease, will be used as medical output factor in this study, measured as incidence cases and controlled for prevalence cases. The incidence of this event is measured as time since the interview till the event takes place. The data is coming from medical records which have been updated in the dataset regularly since the interview. Prevalence cases of CHD before the interview date are used as dichotomous control variable in the model. Pre-tests have shown that the isolated model for CHD is providing very different parameters than the overall effect for CVDs and inconclusive results for stroke events. Since strokes can have very different symptoms and causes and more detailed information are missing, we will present only models for CHD. Further we will include the information of a heredity score for CHD. This indicator was generated from very 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 and myocardial infarct.

Social capital of the work place

These 3 variables are generated from a whole set of questions concerning the work place. We will be able to distinguish between the dimension of vertical and horizontal social capital. While vertical capital is capturing the answers from only one question, asking the relationship to the superior, horizontal social capital is combining the answers from 3 different questions. Persons 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

The Karasek model contains 4 groups of occupations with demands and control in balance or imbalance. From the information of the demands and control possibility of the individual job we calculated continues variables for both these characteristics using factor analysis. The generation of this variable will be explained later, since it is a rather complex model.

Age and sex

Age is measured as continues decimal years from birth to incidence in case of the event or last update of the questionnaire, which is in this case 31.12.2006. Due to the restrictions of retirement age, the range of the age variable is 44.7 - 65 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 centimetre. It will be presented as categorical variable including the categories underweight (BMI ≤ 18.4), normal weight (18.4 < BMI ≤ 24.9), overweight (24.9 < BMI ≤ 30) and obese (BMI > 30).

Smoking behaviour

Smoking behaviour was asked in the questionnaire and therefore is a self reported characteristic. 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. But literature has shown that this group has particular different results for CHD, therefore we will keep them as separated group.

Child care

Often in the literature is discussed if the "burden" of care for little children at home has a negative impact on medical issues. We generated a dichotomous variable determining if the individual has a child under the age of 10. This information is only available for women, unfortunately.

Table 1: descriptive analysis of the set of variables

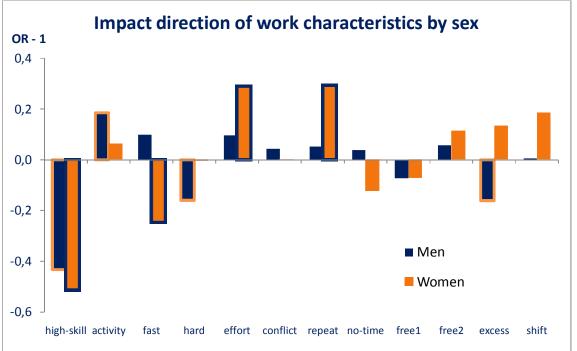| Variable		Men (N = 5025)		Women (N = 8235)		Total (N = 13260)	
		N	%	N	%	N	%
Coronary heart event	no	4636	92,3	8073	98,0	12709	95,8
	yes	389	7,7	162	2,0	551	4,2
Karasek model	active	448	8,9	539	6,5	987	7,4
	passive	2618	52,1	4999	60,7	7617	57,4
	low strain	1164	23,2	1164	14,1	2328	17,6
	high strain	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
		4636	92,3	8073	98,0	12709	95,8
Child care	no	-		7818	94,9		
	yes	-		417	5,1		

Methodology

In a survival analysis using Cox-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 divided 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 13 single items on the incidence of coronary heart disease. 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 Ration – 1. Therefore an easy interpretation of the impact direction is given. A different coloured frame of the bar means that the value is significant.

Figure 2: 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 in two dimensions – job demands and job control. The factor analysis is dividing the items either in the demand or control group. The distribution of variables on the two dimensions generated by factor analysis in the different datasets can be seen in the table below. Marked in dark shade we see additionally the 5 items from the Karasek paper (1979) which are not included in our model.

Table 2: Karasek model simulation with MDCS data

	Job Demand	**Job control**
Karasek & MDCS data	• Work fast (fast) • Work hard (hard) • Lots of work (effort) • Not enough time (no-time) • Excessive work (excess) • Conflicting demands (conflict)	• High skilled job (high-skill) • Non repetitious job (repeat) • Allows freedom (free1) • Make one's own decisions (free2)
Only Karasek data	• No time to finish	• Learn new things • Creative • Participate in decisions • Have say on the job
Only MDCS data	• Shift work (shift)	• 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. That is a good hint for consistency of the model. Factor analysis is providing two continues variables given the individual
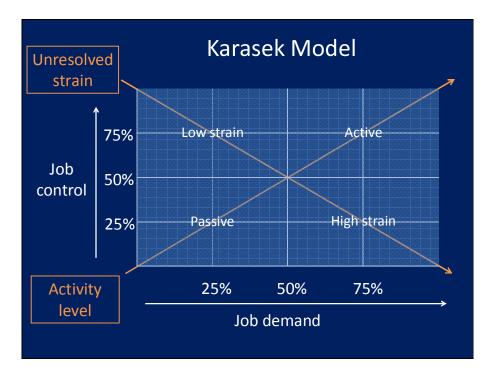
level of job demand and job control. Before we continue with building the job strain groups of the Karasek model, we will have a look at the impact of these two variables.

Table 3: Logistic regression of incidence of heart disease by sex

	Men		Women	
	OR	Significance	OR	Significance
Job demand	0,99	0,793	0,95	0,508
Job control	0,83	0,001	0,85	0,047
Nr. of observation	5025		8235	
Prob (chi2)	0,003		0,116	
Pseudo R2	0,004		0,003	

As we can see in both male and female model job demand has no significant impact on the incidence of heart disease. Karasek found evidence from the literature that job demand had inconclusive results. He thought that job demand alone can't be the answer. This fact provoked Karasek to include the second dimension of job control. When we put the distribution of both dimensions in one diagram and divide both axes we can group all data in 4 groups.

Figure 3: Karasek model: dimensions of job constrain

In two combinations the both dimensions are balance, "passive" (low demand-low control) and "active" (high demand-high control). The diagonal from passive to active is distinguishing the activity level. The both other groups are imbalanced concerning job dimensions. The case of individuals who have high job control but low demands is called "low strain" and the other way around "high strain".

Karasek divided the control and demand dimension at the quartiles and was analysing a 4x4 chart of different occupational groups. At that point our model differs from the original Karasek model. We define the first 75% of each dimension as low and only the last quartile as high. So we have in total only 4 groups.
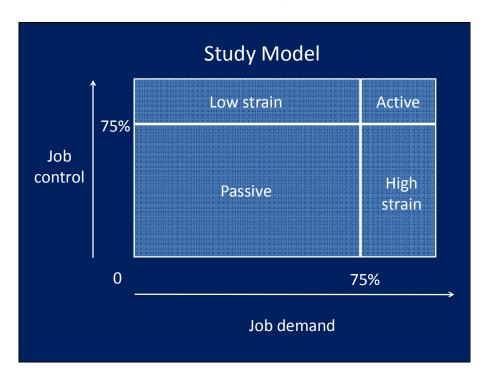
Figure 4: Variation of the Karasek model used in this study

Karasek tested if these different occupational classifications have different impact on job satisfactory and life satisfactory in general. He tested as well if they have different results 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.

In the following we now 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 models divided for men in table 4. 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.

The most evident characteristic of model one is, that compared to the low strain group, the passive and high strain group have much higher risk for coronary heart disease, while the active group is indifferent to the reference group. These values do not change much in model 2, when we introduce the next set of variable, but in model 3 when we present our full model. Both groups of passive and high strain decreased a bit and the significance level changed from 99% to 95%. Nevertheless we can conclude to verify Karasek's results that the high strain group has the highest medical risks.

Both variables of horizontal and vertical social capital do not seem to make any difference in the male model. Values are close to the reference group and insignificant. Similar results we find for the work environment. Even when in model 1.3 it seems that a worse work environment increase the risk for heart disease, we could not verify a significant difference to the reference category.

For the set of medical issues we find unsurprisingly highly significant results. In our data every additional year means an increase of 7% for the heart disease risk among men. According the BMI we see expected results as well. Compared with normal weighted people, overweight and obese people have highly significant enhanced risks. The case of underweight men is very rare n our data and there is no case of a heart disease, so no results can be reported. On the other hand a previous case of heart disease increases the risk of a new incidence by 2,6 times. People with a medium or higher heredity score for this kind of disease suffer from up to nearly twice the risk of people with low medical heritage. The last variable concerns the smoking behaviour. Here we can see clearly that compared to non-smoker regular smokers and even occasional smokers have much higher risk of a heart disease.

Table 4: Cox proportional Hazard model for CVD males, Odds ratios

Variable	Value	Model 1.1	Model 1.2	Model 1.3
Karasek model	Active	0,91	0,91	0,94
	Passive	1,50 ***	1,51 ***	1,36 **
	Low strain	1	1	1
	High strain	1,56 ***	1,58 ***	1,42 **
Horizontal social capital level	No colleagues		1,23	1,14
	Low		1,04	1,02
	Medium		1	1
	High		1,25	1,18
Vertical social capital level	No superior		1,00	0,98
	Low		0,82	0,81
	Medium		1	1
	High		0,86	0,82
work environment	Bad		1,17	1,30
	Medium		1,19	1,20
	Good		1	1
Age				1,07 ***
Body Mass Index	Underweight			-
	Normal			1
	Overweight			1,36 ***
	Obese			1,95 ***
Prevalent event	Yes			2,63 ***
Heredity score infarct	Low			1
	Medium			1,30 **
	High			1,89 ***
Smoking	Non smoker			1
	Regular smoker			2,26 ***
	Occasional smoker			1,75 **
	Stopped smoking			1,07
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

For females we have a different picture. Regarding the job strain groups, we could not identify a significant different between the groups. When we include more variables in the model, he values and direction of these results start changing. 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 compared to women with medium horizontal social capital. What might seem surprisingly is that women with high horizontal social capital suffer as well from higher risk. We like to call that the "Fika" effect. Fika is the Swedish tradition of common coffee break in Swedish work places. High social capital could mean a higher level of these social activities which could include higher level of caffeine, fat or smoke consumption, which will have a negative impact on cardiovascular disease. Vertical social capital seems to have an impact on working women as well. Taking medium as reference category, we can see that no contact or low social capital have positive effects. The risk is nearly half of women with medium social capital. The high category has increased risk, but stays insignificant. For the two first categories we could not find significance either, at least not in the full model. The variable of work environment is similar to the male model, indifferent and insignificant.

Age has more impact for women than for men; every additional year will increase the risk by 11% for women. According 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. 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 Odds ration of 14,53. We do not deny a strong effect here but assume that the small case number for this case will be responsible for most of this effect. The heritage effects are stronger for women than for men, however as highly significant as in the male model. Smoking has similar results as reported for men.

The additional variable of child care indicates a more than twice as high risk for coronary heart disease if women have a small child.

Table 5: Cox proportional Hazard model for CHD females, Odds ratios

Variable	Value	Model 2.1	Model 2.2	Model 2.3
Karasek model	Active	0,97	1,04	1,22
	Passive	1,27	1,24	1,06
	Low strain	1	1	1
	High strain	1,20	1,29	1,15
Horizontal social capital level	No colleagues		2,22 **	2,28 **
	Low		1,18	1,15
	Medium		1	1
	High		1,56 **	1,49 *
Vertical social capital level	No superior		0,46 *	0,50
	Low		0,53	0,56
	Medium		1	1
	High		1,20	1,21
work environment	Bad		1,00	1,10
	Medium		0,99	1,11
	Good		1	1
Age				1,11 ***
Body Mass Index	Underweight			0,56
	Normal			1
	Overweight			1,24
	Obese			1,72 **
Prevalent event	Yes			14,53 ***
Heredity score infarct	Low			1
	Medium			1,67 ***
	High			2,22 ***
Smoking	Non smoker			1
	Regular smoker			3,03 ***
	Occasional smoker			1,92 *
	Stopped smoking			1,14
Child care	Yes			2,20 *
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

Conclusion

This studied aimed to verify whether differences in job strain and work environment determine incidence risks for coronary heart disease. For categorisation of job strain we applied a 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. But even when the effect from the social capital and job strain groups are partly small, we have shown that they are not insignificant impact factors. Further, analysis of indirect impact directions have shown than the social capital and work environment have a substantial influence on the classic cardio impact factors BMI and smoking. Therefore, it is possible that the effects from the social capital and work environment variables was partly absorbed form BMI and smoking, which are themselves influenced by them.

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

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