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Session I: Conditions of work, stress and occupational health: Present conditions and likely future trends

Job Stress, Absenteeism and Coronary Heart Disease in Europe (JACE) a Multicenter Prospective Study

Marcel KORNITZER, Ph.D.[1], Irène HOUTMAN, Ph.D.[2], Françoise LEYNEN, M.D.[1], Patrick De SMET, B.A.[1], Guy De BACKER, Ph.D.[3], Ruud MAK, M.D.[3], Mouique ROMON, M.D.[4], Charles BOULENGUEZ, M.D.[4], Marco FERRARIO, Ph.D.[5], Gianfranco CESANA, M.D.[5], Suzana SANS, M.D.[6], Inaki PEREZ, M.D.[6], Lars WILHELMSEN, Ph.D.[7], Anita ROSENGREN, M.D.[7], Sven-Olof ISACSSON, M.D.[8], Per-Olof, ÖSTERGREN, M.D.[8]

[1]School of Public Health, U.L.B., Brussels, Belgium
[2]NIA TNO, Hoofddorp, The Netherlands
[3]Department of Public Health, University Hospital, Gent, Belgium
[4]CERESTE, Lille, France
[5]Institute of Biomedical Sciences, Hospital San Gerardo, and Institute of Occupational Health, University of Milan, Monza (MI), Italy
[6]Institute of Health Studies, Barcelona, Spain
[7]Section of Preventive Cardiology, Göteborg University, Göteborg, Sweden
[8]Department of Community Health Sciences, Malmö General Hospital, Malmö, Sweden.

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ABSTRACT

Objectives

In this paper, the JACE-study, a multicenter prospective study on Job Stress, Absenteeism, and Coronary Heart Disease in Europe is presented: its motive and objectives and its design. Some specific gaps in the literature reviewed are explicitely tapped on by the Jace study. Its objectives are (1) to compare the distributions of the Karasek job stress scales for the same broad categories of occupations in different European countries (in males and females), (2) to study the predictive power of the job stress scales and the job strain model on one year of sickness absence (in males and females), and (3) to study the predictive power of the job stress scales and the job strain model on a 3-year incidence of coronary heart disease (in males only).

Methods

In answering these questions, relations are studied controlling for gender, age, level of education, company size, physical work risks and shift work, as well as traditional risk factors for CHD (i.e. serum cholesterol, serum HDL-cholesterol, smoking habits and blood pressure).

The JACE study is a Biomed 1 concerted action. The JACE group consists of eight participating centers from six countries, i.e. from Belgium (two centers), France, Italy, Spain, Sweden (two

Key words : job stress, sickness absence, coronary heart disease, multicenter prospective study.

Correspondence : Marcel Kornitzer, Professor, School of Public Health, Campus Erasme, CP 597 route de Lennik 808, B-1070 Brussels, Belgium.
Email: mkornit@ulb.ac.be

centers) and the Netherlands. The coordination of the group is in Brussels. The participating centers bring in over 38,000 European workers to test the hypotheses.

Introduction

For numerous years job stress has been a controversial issue in both applied and fundamental research areas. Observational epidemiology, occupational and behavioral medicine as well as psychophysiology have mainly been directed at establishing and understanding the assumed relationship between job stress and coronary heart disease (CHD), the first cause of mortality in Western countries[1), 2)]. However, in the field of organizational health psychology, research has been directed at softer outcomes like mood and job satisfaction as well as behavioral outcomes like sickness absence and medical consumption, and finally work disability as related to mental ill-health and musculoskeletal problems[3)~7)].

The theoretical model mostly used during the last 15 years is the so-called «Demand-Control» model, which was developed by Robert Karasek[1), 8)] and was originally directed at two major risk dimensions for job stress : one scale for psychological job demands and one for job control or decision latitude. The latter was operationalized by the addition of questions on decision authority and skill discretion. The Demand-Control model states that it is the combination of high job demands and low job control or «job strain» that will lead to negative health outcomes. In a later phase, social support at work has been added to the model as a third dimension[1), 9)]. This model is basically simple, has high face validity and has been found to be supported by a number of studies in the field of epidemiology, psychophysiology, organizational and health psychology. Finally, the model tackles productivity issues and provides starting points for eventual structural stress management by way of job redesign.

Job stress and coronary heart disease

Most validity studies within the framework of the DC-model, have been directed at Cardio-Vascular Disease (CVD), and more specifically at Coronary Heart Disease (CHD). In 1994 Schnall et al.[2)] published an extensive review on the available evidence. From the 10 prospective studies on CHD, four were case-control studies, six had a prospective cohort study design, and two studied the relation between job stress and all-cause mortality in a prospective cohort study design as well. Seven out of the eight prospective cohort studies were found predictive for CHD or all-cause mortality. The study from Siegrist et al.[10)] not included in that review using a somewhat different job stress model, supports the predictive value of job stress for CHD. From six prospective studies on the job stress—CHD relationship, not included in the review[11)~17)], five reported positive results[12)~16)], of which four[12), 14~16)] only found limited support for the «strain» model. Particularly, the recent studies by Lynch et al., Marmot et al. and Steenland et al.[14)~16)] find control to be the only psychosocial work characteristic significantly and inversely related to CHD. For job demands Steenland et al.[16)], however, found a significant inverse trend in CHD-risk for blue collar workers, and the combination of high control and high demands was found protective among these same workers. In the study by Hlatky et al.[17)] the severity of CHD in patients who underwent an angiography, showed no relation with job strain. This study, then, was not a population representative study group but a clinical cohort study.

Finally, very recently Theorell et al. reported the results of a Swedish case referent study: both a decrease in inferred decision latitude during the 10 years preceding the myocardial infarction and self-reported job strain according to the Karasek model increased significantly the risk of a first myocardial infarction after adjustment for biological and sociodemographic variables[18)].

Noteworthy is the fact that most of the studies on the DC-model referred to above, have been performed either in Sweden or in the US. One negative study from the US was per-

formed on subjects living in Hawai and being of Japanese origin[19]. The most recent studies, mainly from Europe, provide only partial support to be the job-strain model. It may be that certain national or cultural groups are more prone to be differentiated in their CHD risk by psychosocial work related risk factors[6]. On the other hand homogeneity in risk factors for job strain has been put forward as an explanation for the absence of a convincing relation between job strain and CHD[11]. A problem almost opposite to that of homogeneity is that several of the studies made use of the imputation method (e.g. ref. 16, 20, 21). This method links 'risk weights' of occupations found in another study, to occupations in databases where no risks but only health outcomes are measured. The use of this method allows only between, and not within occupational group analyses. One of the consequences is that this method prohibits a proper disentanglement of social economic status (SES) and job stress risk. Moreover, not all prospective studies controlled for all the 'traditional' coronary risk factors: smoking, serum cholesterol and blood pressure levels. The recent prospective studies on psychosocial risks and CHD mortality by Lynch et al.[14] and Marmot et al.[15] point to the necessity of measuring at least all traditional risk factors for CHD mortality or incidence as well as being able to disentangle SES from occupational risks.

The lack of coherence in the results of the prospective studies illustrates the need to further study the relationship between job stress and CHD, particularly in a prospective multinational, multicultural setting, and controlling for all traditional risk factors. Analyzing the results on across and within occupational group differences is highly warranted.

Job stress and sickness absence

At industrial level competitivity is partly related to productivity and the most often cited relation to productivity is repeated sickleave or its pejorative synonym 'absenteeism'. One of the main reasons for employers to take preventive measures at the workplace is to reduce absenteeism and promote productivity[22]. The demand-control model has not received yet an important place in the study of sickness absence. A literature research leads to 21 published papers that more or less explicitely tapped on the relationship between job stress and sickness absence. Some studies indicate that job stress and other job characteristics play no role in sickness absence[22] or play an indirect role in explaining the prior 3–6 months of sickness absence[23), 24)~28)] whereas other studies indicate a clear and main effect of one or more job stress risks on sickness absence[8), 29~36)]. Finally, a number of studies find weak or partial relationships between job stress and repeated sickleave[37)~39)].

The studies are difficult to compare since they often differ in the operationalization of both job stress and sickleave and as well as in the size and type of the population of the study. Sickleave absence was almost always measured before the completion of the questionnaire measuring job stress. The analyses of Manning and Osland[40] indicate that job stress risks may even be more correlated with retrospective or present absenteeism than with consecutive absenteeism, suggesting the hypothesis that sickleave results in job stress and not the reverse. Also, several non-work factors like kin responsibilities and lifestyle factors (alcohol consumption) are found to be significantly related to absenteeism[22), 25)].

A recent longitudinal study by North et al.[35] shows that job stress leads to short absence spells, that is ≤ 7 days. Correcting for occupational grade of the subjects of that study of Whitehall civil servants resulted in the relation between job strain and long spells, that is > 7 days, becoming insignificant. Finally, absenteeism itself and short spells in particular have been discussed as a type of coping behavior used in situations where a longer recovery period is felt needed[32].

The Jace study is one of the first prospective studies that looks into the relations between the strain model and incidence of sickness absence and CHD at the same time in a multinational, multi-occupational cohort, taking into account the known moderators such as personal characteristics like educational level, kin responsibilities and lifestyle factors.

Objectives and working hypothesis of the study

Objective 1: to compare the distributions of the Karasek self-perceived job stress scales as

well as job strain for the same occupation defined by the International Standard Classification of Occupations (ISCO 88) in eight centers scattered over six countries.

Working hypothesis: the distributions of the self-perceived job stress scales as well as prevalence of job strain within the same occupation group are different in different countries.

Objective 2: to study the predictive power of the scales of self-perceived job stress as well as job strain with sickness absence of ≥ 15 days.

Working hypothesis: in each of the participating centers as well as in the total sample there is an association of incidence of sickness absence for medical reasons in males and females and self-perceived job stress independently of age and level of education. Differences in sickness absence between countries could at least partly be explained by differences in distribution of the self-perceived job stress scales.

Objective 3: to study the predictive value of self-perceived job stress on the incidence of coronary heart disease (hard events: non fatal and fatal myocardial infarction, sudden deaths in middle-aged worked males).

Working hypothesis: the combination of high job demands and low job control is related to the increased risk of coronary disease in males; this relation is independent of age, serum total cholesterol, HDL-cholesterol, smoking habits and blood pressure. This working hypothesis will be verified by putting centers together incidence rate in males of all participating centers.

Material and methods

Organization of the study

The Jace study is a Biomed 1 concerted action. The JACE group consists of eight participating centers from six countries, i.e. from Belgium (two centers), France, Italy, Spain, Sweden (two centers) and the Netherlands. The coordination of the group is in Brussels.

Choice of Populations for the Study and Samples Sizes

Study populations were searched from an organizational perspective. Except for the Spanish, the Malmö and the Gothenburg center who used a population sample, all centers recruited a more or less diverse employee population from one or more organizations that agreed to participate. Men and women aged 35 to 59 years, are screened for the core study. The screening periods and some population characteristics are shown in table 1.

Study design

This concerted action applies a prospective study design with an average follow-up of at least three years for incidence of myocardial infarction and a one-year

follow-up for incidence of sickleave of 15 days or more. The core programme will be similar in all centers and additional measurements related to local interests are included as well.

The questionnaires

In the core-questionnaire the following information is collected:

- — *Socio-demographic variables*[41), 42)], *job title*[43)] *and branche of industry* (NACE-EU classification);
- — *Perceived risk for job stress*: the Job Content Questionnaire (JCQ, 44) and *other working conditions*[44), 45)];
- — *Smoking habits, alcohol consumption*:[41)];
- — *Presence of disease* (cardiovascular disease, diabetes and hypertension and other chronic disease(s)[41), 46)];
- — *General health complaints*: [47), 48)] and psychological stress responses[49)~51)].

Clinical and biological measures

For each participant a single standardized screening visit is organized in order to obtain data on (1) height and weight, (2) arterial blood pressure and heart rate, and (3) serum total cholesterol and HDL-cholesterol. From height and weight the body mass index (BMI) is calculated[52)].

All centers, with the exception of the Dutch group which does not participate in the cardiovascular part of the study, participate in an external quality control system, in order to measure validity and precision of biochemical measures.

Follow-up

A. Sickness absence

The absence data will be monitored in calendar days. For reasons of standardization all

Table 1 Screening periods and sample sizes of the participating centers.

Center	Start of screening	End of screening	Sample size	Occupational groups
Belgium, Ghent (Flemish)	17/11/94	31/10/98	n = 11405 F = 2175 M = 9230	Occupational groups from several organizations
Belgium, Brussels (French)	09/02/95	31/01/98	n = 10014 F = 2909 M = 7105	Occupational groups from several organizations
France, Lille	15/01/96	01/11/97	n = 1650 F = 256 M = 1394	Occupational groups from several organizations
Italy, Milano	22/05/91	31/03/97	n = 4850 F = 3112 M = 1738	Occupational groups from the municipality of Milano
Spain, Barcelona	20/06/94	20/05/96	n = 1438 F = 505 M = 933	Population survey (City of Barcelona)
Sweden, Gothenburg	1) 01/02/93 2) 15/09/94	15/06/94 15/12/95	1) n = 798 M = 798 2) n = 1428 F = 872 M = 556	Population surveys (City of Gothenburg)
Sweden, Malmö	17/02/92	28/02/94	n = 6528 F = 3747 M = 2781	Population surveys (City of Malmö)
The Netherlands, Leiden/Amsterdam	01/03/94	15/03/95	n = 884 F = 202 M = 682	Occupational groups from several organizations
Total	01/03/94	15/03/95	n = 38995 F = 13778 M = 25217	

F : Females M : Males

participating centers are comparable using spells of a duration of more than 14 days. Absence will be registered for a follow-up of one year, starting from the moment the subject enters the study. The absence indices are illustrated in the 'Manual of Operations' [52].

B. Coronary events

The primary outcome is fatal and non-fatal myocardial infarction. Four types of coronary events are discerned: (1) definite acute myocardial infarction, (2) possible acute myocardial infarction or coronary death, (3) ischaemic cardiac arrest with successful resuscitation not fulfilling criteria for definite or possible myocardial infarction, and (4) fatal cases, whether sudden or not, with insufficient data. Diagnostic criteria for the four categories are described in the 'Manual of Operations' [52], as well as in the MONICA project[41], which in this study we often refer to for standardization.

Statistics: *power calculations*:

1. Sickness absence

The power calculations for sickness absence of more than 14 days are based on the assumption of a one-year incidence of 10% in both males and females, aged 35-39 years. Under this assumption the study has a power of 90% to detect relative risks between quartile 4 and quartile 1 for a given job stress scale of respectively 1.12 and 1.18 in our samples of males and females.

2. Incidence of CHD in males

Incidence of the first major coronary event

is based on the Belgian Heart Disease Prevention Project[53] and the MONICA study[42]. Taking into account the 'healthy worker effect', the current Acute Myocardial Infarction Incidence (AMI) is assumed to be 3/1000 subjects yearly, or 9/1000 subjects over 3 years. Under the assumption that the risks of AMI in four quartile groups of a given job stress scale are linearly related and that the risk of AMI in the highest quartile (Q4) relative to the lowest quartile (Q1) is given as a Relative Risk (RR), the expected Incidence Rate (IR) for the total number of male subjects aged 35–54 years needed to detect a relative risk (IRQ1/ IR Q4) of 1.6 with a power of 80 % is estimated to be 32,416.

Discussion

The inclusion of eight different centers in this multicenter study is a challenge both at the level of standardization and the time window. Indeed, the table shows that the length and end of screening were quite different in the eight centers with the Belgian centers finishing last in the initial screening but contributing the most important number of subjects.

With respect to the level of standardization, we think that it is rather high both for the questionnaire and the biological measures. Indeed, for the latter a blood pressure measure was done according to the Monica study protocole in which six of the eight centers participated. With respect to blood cholesterol, all centers had an internal quality control as well as an external, and for most of them it is the WHO Prague laboratory, a laboratory which is the external reference center.

Event collection and transmission to Brussels are done in a standardized way both for sickleave and incidence of coronary heart disease.

This is probably the largest study testing the Karasek Model simultaneously in relation with sickness absence and incidence of coronary heart disease.

Concerning the first working hypothesis the Jace study because of its high level of standardization, incorporating organization of samples from the Northern, Middle and Southern parts of Europe and a large variance across and within occupations will provide ample opportunity to look into the correspondence of different occupational stress scores for the JCQ-scales, compare their variances and compare the results when linking these risk scores to a variety of dependent measures.

Concerning the working hypotheses relating sickleave relating the demand-control model to sickleave of ≥ 15 days will, if confirmed, be a trigger concerning the possibilities of job content restructuration at the European Union level.

Finally, the third working hypothesis linking independently the job strain or one of its components to the risk of coronary disease would induce a challenge in the multifactorial prevention of coronary disease by adding to modifications of the classical risk factors the possible decrease of job stress as an added preventive measure.

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