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Psychosocial factors at work and myocardial infarction among men in Kaunas, Lithuania

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Objectives The association between job demand and job control and first nonfatal myocardial infarction was studied among the 25- to 64-year-old male population in Kaunas, Lithuania.

Methods A translation of the Swedish version of the demand–control questionnaire was used. Both psychosocial work characteristics as independent risk factors and the possible effects of traditional risk factors (smoking, arterial hypertension, overweight) were analyzed in a case–control study among 203 men diagnosed in 2001–2002 with a first nonfatal myocardial infarction (cases) and 287 men randomly selected as controls. A logistic regression analysis was used to estimate the odds ratio for developing myocardial infarction in relation to self-reported job demand and job control. Possible confounders (age, marital status, education, type of occupation, smoking, blood pressure, body mass index) were controlled.

Results The adjusted odds ratio was 0.56 [95% confidence interval (95% CI 0.37–0.85)] and 1.53 (95% CI 1.04–2.38), for demand and control, respectively. That for workers with low demand and low control was 1.89 (95% CI 0.99–3.60) as compared with low demand and high control. The risk of myocardial infarction for men in passive jobs (low demand and low control) was twofold that of the other respondents.

Conclusions The association between low job control and the risk of myocardial infarction was found to be consistent with research in western populations. In contradiction, however, to findings in western studies, low demand, rather than high demand proved to be a risk factor for 25- to 64-year-old men. Employees in passive jobs had the highest risk.

Key terms case–control study; job control; job demand; psychosocial job category; demand–control questionnaire; logistic regression; male population; risk assessment; risk factor.

It has been widely acknowledged that specific profiles of psychosocial work characteristics can put employees at risk of coronary heart disease (1). One of the major models for psychosocial factors at work is the demand–control model, which was developed by Karasek & Theorell (2) and has been tested in various studies in modern western societies (3). According to this model, job strain, the combination of high psychological work demand and low decision latitude, affects the risk of myocardial infarction due to interaction between the two components (4–7). The Whitehall II study on British civil servants showed, however, that low job control was associated with an increased risk of future coronary heart disease independently of psychological demands

(8, 9). The results of a population-based case–control study in Sweden indicated that jobs characterized by both low decision latitude and high job strain (low decision latitude in combination with high psychological demand) may be associated with an increased risk of acute myocardial infarction (10). In addition, negative changes in inferred decision latitude and self-reported job strain were important indicators of myocardial infarction risk for men under 55 years of age in the Stockholm Heart Epidemiology Program (11).

Data on the role of the psychosocial work environment with respect to the risk of myocardial infarction in the countries of central and eastern Europe, and in the newly independent countries of the former Soviet

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Union are scarce. A population-based case-control study in the Czech Republic showed that men in passive (low demand and low control) jobs had the highest risk of myocardial infarction, whereas those with jobs characterized by high demand and low control had a more modestly increased risk status (12). We found some studies on socioeconomic factors, perceived control over life, and self-reported health in Russia (13) and seven postcommunist countries (14). These studies showed an association between self-rated health and several socioeconomic and psychosocial factors (ie, perceived control over life, material deprivation, attitude towards economic changes, and types of social support network). The educational differences in self-rated health were smaller in seven postcommunist countries than in western countries. The cross-sectional study on psychosocial work characteristics and self-rated health in four postcommunist countries (Poland, Czech Republic, Hungary, and Lithuania) demonstrated that, with respect to the demand-control model of job strain, no significant interaction terms were observed; in contrast, only low job control was strongly associated with poor health (15).

The working population in the countries of the former Soviet Union did not "suffer" from high demands. A comparative cross-sectional survey of 50-year-old men in Vilnius, Lithuania, and Linköping, Sweden, demonstrated that, not only was the mean level of control at work lower in Vilnius, but also that the mean level of psychological demand was lower. [The mean score for job demand among Vilnius men was 12.7 (SD 0.2) and that for Linköping men was 13.3 (SD 0.2), $P=0.025$; the scale range for psychological demand being 5 to 20 (16)]. In the Czech study it has been mentioned that the effect of a regime in which "they pretend to pay us and we pretend to work", low demand may have been bad for health (12). We believe that very low incomes, the lack of possibilities to gain more, and no rewards for efforts were the main reasons for passive work behavior in the postcommunist societies.

The situation for job demand and low income has not changed considerably in today's Lithuania. Consequently, the associations between psychosocial work characteristics and myocardial infarction may differ between western and former communist working populations. The lack of findings on the role of job strain elements with respect to the risk of myocardial infarction in postcommunist societies encouraged us to carry out our present study. We believe the Karasek & Theorell model to be a suitable model with which to discover potential differences in the psychosocial work environment and their impact on ischemic heart disease between social welfare countries and countries in a transition market economy.

The aim of our study was to evaluate the role of the psychosocial work environment with respect to the risk

of developing a first nonfatal myocardial infarction in the 25- to 64-year-old male population in Kaunas, Lithuania, a country in a transition market economy, using the demand-control model. It was tested whether these psychosocial work characteristics are independent risk factors for myocardial infarction, in addition to the possible effects of traditional risk factors (smoking, arterial hypertension, overweight).

Study population and methods

Kaunas is the second largest city of Lithuania, a former communist country in a transition market economy, with an area of 132 square kilometers and a population of about 400 000, subdivided into 12 districts. The base population for the study comprised all 25- to 64-year-old men residing in the city. All surviving patients with a first myocardial infarction that occurred from 1 October 2000 to 30 September 2002 were eligible for the study. The risk of myocardial infarction in different psychosocial job categories was studied using a case-control design.

Identification of the cases and controls

All able-bodied surviving patients with a first myocardial infarction treated in Kaunas hospitals were considered eligible for this case-control study. The criteria for inclusion were that the participants had to be currently employed wage earners under 64 years of age at the time of inclusion. The persons with a clinical diagnosis coded I21 according to the 10th revision of the International Classification of Diseases (ICD-10) in the hospital register were considered cases. Altogether 257 men with a first-time myocardial infarction were registered as cases. Of these, 210 (81.7%) were interviewed at the hospital during their first hospitalization week; no one refused to participate in the study. The control group was a random nonhospitalized sample of men between 25 and 64 years of age, stratified into 5-year age categories. The controls were eligible if a clinical diagnosis of ischemic heart disease or angina pectoris had not been recorded in their medical documents and they did not report chest pain or revealed other evidence of ischemic heart disease during the interview. Altogether 439 controls were selected, 108 (24.6%) of whom refused to participate and 15 (3.4%) of whom had chest pain complaints and a history of ischemic heart disease. Altogether 316 controls were included in the study (response rate 71.9%). After we excluded those with missing data on occupation and also the unemployed (7 cases and 29 controls), 203 cases (78.9% of all registered) and 287 controls remained who had been working

full-time for at least 1 year (65.4%) and who had a complete set of data (ratio 1:1.4).

Occupational status and risk factors

The cases and controls were interviewed by trained physicians in their local hospitals, using identical standardized questionnaires, which included information on occupation, demographic factors, socioeconomic conditions, psychosocial factors at work, and health behavioral factors. Data on history of elevated arterial blood pressure, diagnosed by a physician, was taken from the records. Arterial hypertension was defined as either blood pressure exceeding 140/90 mm Hg or treatment for hypertension. The subjects underwent anthropometric measurements, such as height and weight. The body mass index (BMI) was calculated as the ratio of weight to height squared (kg/m^2). If the BMI exceeded 27, the person was classified as overweight (17). The participants were characterized for smoking as "nonsmokers", "smokers", and "former smokers". Those who had stopped smoking <2 years before inclusion in the study were considered current smokers. Education was categorized into ≤ 8 years of schooling, secondary, and university. The International Standard Classification of Occupations (ISCO) (18) was used to classify occupations into 10 occupational categories.

Table 1. Potential myocardial infarction risk factors for the cases and controls (2001–2002).

Risk factors	Cases (203)		Controls (287)	
	N	%	N	%
Age				
25–49 years	50	24.6	99	34.5
50–64 years	153	75.4	188	65.5
Marital status				
Married	178	87.7	252	87.8
Single	25	12.3	35	12.2
Education				
University	54	26.6	69	24.0
Secondary	120	59.1	163	56.8
≤ 8 years	29	14.3	55	19.2
Type of occupation				
Blue-collar	134	66.0	199	69.3
White-collar	69	34.0	88	30.7
Smoking				
Nonsmoker	20	9.8	68	23.7
Current smoker	155	76.4	170	59.2
Former smoker	28	13.8	49	17.1
Blood pressure				
<140/90 mm Hg	109	53.7	220	76.7
$\geq 140/90$ mm Hg	94	46.3	67	23.3
Body mass index				
≤ 27.0 kg/m^2	65	32.0	146	50.9
> 27.0 kg/m^2	138	68.0	141	49.1

The distribution of possible risk factors for myocardial infarction among the cases and population controls is shown in table 1.

Psychosocial work environment

Data regarding psychosocial job demand and control was obtained by means of a translation of the Swedish version of the Karasek demand–control questionnaire [19]. Five items addressed demands, and six items focused on job control. Each question had four response categories for frequency ranging from "never" to "always". The scoring was directed in such a way that high scores meant greater demand and more decision latitude. Each of the five questions on psychological demand ("Do you have to work very fast?", "Do you have to work very intensively?", "Does your work demand too much effort?", "Do you have enough time to do everything?", "Does your work often involve conflicting demands?") was scored from 1 to 4. The fourth question had the direction opposite to the others, so we reversed the score for item 4. Using the sum of the scores for the five questions meant that the total score could range from 5 to 20. The questionnaire contained four questions on skill discretion with one of them (the fourth) also scored in the opposite direction ("Do you have the possibility of learning new things through your work?", "Does your work demand a high level of skill or expertise?", "Does your job require you to take the initiative?", and "Do you have to do the same thing over and over again?") and two questions on authority over decisions ("Do you have a choice in deciding HOW you do your work?" and "Do you have a choice in deciding WHAT you do at work?"). After all the items were recoded in the same direction, the scores for the scale of job control were calculated as the sum of the item scores (ranging from 6 to 24). There were no missing values due our use of face-to-face interviews.

The internal reliability was 0.63 for job demand and 0.76 for job control according to Cronbach's alpha. The two latter variables were significantly correlated (Pearson correlation 0.32).

Median scores for the whole population were 11 for job demand and 14 for job control. Dichotomization at the median of the scores was performed in such a way that the scores below the median for job demand (<11) and job control (<14) were assessed as "low".

We classified the participants into four job categories corresponding to Karasek's grouping: low strain (low work demand and high control), passive (low work demand and low control), active (high work demand and high control), and high job strain (high work demand and low control). There were 31, 73, 58, and 41 persons, respectively, in each quadrant in the case group, and 45, 60, 117, and 65 persons, respectively, in the control group.

Statistical methods

The distribution of the possible risk factors for myocardial infarction was evaluated for the cases and controls. For each variable, the odds ratio (OR) with its 95% confidence interval (95% CI) was estimated. The risk of first myocardial infarction in relation to job characteristics was evaluated after adjustment for potential confounders in a multiple logistic regression analysis. The potential confounders included in the models were age (≥ 50 years versus < 50 years), smoking (current smokers, former smokers versus nonsmokers), history of arterial hypertension ($\geq 140/90$ mm Hg versus $< 140/90$ mm Hg), overweight (> 27 kg/m² versus ≤ 27 kg/m²). They were entered into the logistic regression analysis as categorical covariates. The adjusted odds ratios, along with their 95% confidence intervals, for each risk factor relative to the reference category were assessed, and the independent effect of a risk factor on the risk of myocardial infarction was accordingly assessed.

We used SPSS 10.0 for Windows (SPSS Inc, Chicago, IL, USA) in the statistical analysis.

Results

The mean score for job demand was 10.58 (SD 2.22) for the cases and 11.26 (SD 2.06) for the controls; for job control the corresponding values were 13.22 (SD 2.56) for the cases and 14.23 (SD 3.13) for the controls. The differences in the means were tested with the use of a t-test ($P < 0.001$). After dichotomization at the median score for job demand and control we found that low job demand, as well as low job control, was related to a risk of myocardial infarction among the 25- to 64-year old Kaunas working male population (table 2).

The adjusted estimate for the odds ratio for high demand was 0.56 (95% CI 0.37–0.85). Job control was inversely related to the risk of myocardial infarction (adjusted OR 1.53, 95% CI 1.04–2.38). When job demand and control were combined according to the job strain model, we found no increased risk for jobs characterized by high demand and low control. However, men in passive jobs (low demand and low control) had the highest risk of myocardial infarction (adjusted OR 1.89, 95% CI 0.99–3.60) as compared with the low strain job category (low demand–high control). The effect of traditional risk factors in the model remained stable. The adjusted odds ratio was 3.26 (95% CI 1.82–5.85) for smoking, 2.63 (95% CI 1.71–4.06) for arterial hypertension ($\geq 140/90$ mm Hg versus $< 140/90$ mm/Hg), and 1.95 (95% CI 1.29–2.95) for overweight (BMI > 27 kg/m² versus ≤ 27 kg/m²).

In table 2, it is also shown that men in passive jobs (low demand and low control) had a twofold greater risk

of myocardial infarction than all the other respondents. The adjusted odds ratio for passive jobs was 2.33 (95% CI 1.49–3.66).

Discussion

We investigated the role of psychosocial work characteristics with respect to the risk of first nonfatal myocardial infarction and conducted a case–control study among 25- to 64-year-old men in Kaunas, Lithuania, a country in a transition market economy.

Our results suggest that psychosocial work characteristics (low demand and low control), as well as traditional risk factors (smoking, arterial hypertension, and overweight) had independent effects on an increased risk of myocardial infarction among 25- to 64-year-old men in Kaunas. In western countries, an inverse gradient for the risk of ischemic heart disease has been repeatedly demonstrated, but, in our study, education and occupation type (white collar, blue collar) were unrelated to myocardial infarction. One of the intriguing outcomes of our study was that it was not high demand, but, rather, low demand that was related to myocardial infarction.

Possible limitations of our study include a diagnostic bias with respect to myocardial infarction. Data collection, coding, selection, and recall bias have also been discussed elsewhere (20). As we included only surviving cases of first myocardial infarction in the study, our sample was not necessarily representative of all first episodes of myocardial infarction. Only 2.6% of first myocardial infarction cases died in the hospital. Among

Table 2. Risk of first myocardial infarction in relation to job characteristics among 25- to 64-year-old men in Kaunas (2001–2002).

Variable	Cases (N=203)		Controls (N=287)		Adjusted OR ^a 95% CI	
	N	%	N	%		
Job control						
High	89	43.8	162	56.4	.	.
Low	114	56.2	125	43.6	1.53	1.04–2.38
Job demands						
Low	104	51.2	105	36.6	.	.
High	99	48.8	182	63.4	0.56	0.37–0.85
Job characteristics						
Low demand–high control	31	15.3	45	15.7	.	.
Low demand–low control	73	36.0	60	20.9	1.89	0.99–3.60
High demand–low control	58	28.6	117	40.8	0.73	0.38–1.39
High demand–high control	41	20.1	65	22.6	0.63	0.35–1.14
Low demand–low control ^b	–	.	–	.	2.33	1.49–3.66

^a Adjusted for age, marital status, education, type of occupation, smoking, blood pressure, and body mass index.

^b Compared with all other respondents.

25- to 64-year-old men, the prehospital mortality for first myocardial infarction is low (80.6/100 000 population). Nevertheless, the study results can only be generalized to nonfatal, hospitalized, first myocardial infarctions. Recall bias could occur in the self-reported information on the psychosocial work environment as well. One potential source of recall bias is the fact that the members of the case group were interviewed after the myocardial infarction. We cannot exclude the occurrence of two types of recall bias. First it is possible that the employees who had experienced an infarction reported more positive work characteristics because they wanted to resume work (positive bias). Second, employees who have had a myocardial infarction may attribute this bad incident to their work situation and, accordingly, report worse job characteristics (negative bias). To shed more light on the possibility of recall bias, we repeated the interview among a sample of 50 myocardial infarction cases 2 months after the first interview and compared the results with those obtained during the first hospitalization week. The differences in the means for job demand and control in the test-retest procedure were statistically nonsignificant [10.68 (SD 2.12) and 10.24 (SD 2.18), $P=0.31$ for job demand; 13.43 (SD 2.23) and 13.62 (SD 2.25), $P=0.67$ for job control]. The test-retest reliability was high—kappa 0.90 for job demand and 0.93 for job control.

In our study, we found a consistent association between low job demand and low job control and myocardial infarction risk. Men in passive jobs had a two-fold increase in the risk of myocardial infarction. Several investigations in western societies have shown that low job control, either independently or in combination with high job demand, is associated with an increase in the risk of ischemic heart disease and myocardial infarction (4–11). Belkic and her co-workers, in a recently published review including 17 longitudinal, 9 case-control, and 8 cross-sectional studies concluded that, among men, there is strong consistent evidence of an association between job strain and cardiovascular disease risk (21). To our knowledge, only one study has thus far been conducted in a postcommunist country. In a Czech case-control study, it was shown that low control at work and low levels of work demand were strongly related to the risk of myocardial infarction among men, independently of other risk factors (12). Our results are consistent with those in the Czech Republic, demonstrating a significant association between low job control and passive jobs and the risk of first nonfatal myocardial infarction among 25- to 64-year-old men in the general population.

In contradiction to what has generally been found in most western studies, in our study it was low job demand that proved to be an independent risk factor for myocardial infarction. It is not easy to explain this

finding theoretically, but one might speculate that, following Antonovsky's theory on the sense of coherence (22, 23), low demand combined with low income (rewards) may cause frustration and stress, which in the long run may lead to or contribute to disease. Unfortunately, it was not possible to investigate the effect of income further due to response bias.

We investigated the role of risk factors (smoking, arterial hypertension, obesity) of ischemic heart disease in the relation between psychosocial factors at work and an increased risk of myocardial infarction. In our study the undoubted role of the traditional risk factors was shown in the logistic regression analysis with the statistically significant odds ratios for smoking, arterial hypertension, and overweight. When adjusted for these traditional risk factors, the odds ratios for job demand and job control remained statistically significant (table 2). The results from the Whitehall II study also indicated that the associations between psychosocial work characteristics and the incidence of ischemic heart disease cannot be entirely explained by confounding from traditional risk factors (24).

In conclusion, our study showed that the relation between psychosocial factors at work in terms of job demand and job control is not restricted to western societies; instead it also applies to central and eastern European societies that are currently subject to rapid socioeconomic transformation. However, in contradiction to the classical demand-control theory, it was low demand (not high demand) that was related to myocardial infarction in our study.

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