

# The Demand–Control Model and myocardial infarction in the working population of Kaunas men

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**Introduction.** Psychosocial factors at work affect the employees' health. The problem the researchers meet with is the sensitivity of the method to detect specific adverse psychosocial work characteristics. The objective of our study was to test the eligibility of the Swedish version of the Demand–Control model in the investigation of the psychosocial factors at work and the risk of myocardial infarction in working men of Kaunas. **Subjects and methods.** We conducted the epidemiological case-control study among Kaunas men 24–64 years old. The case group contained 203 events of first myocardial infarction treated in all Kaunas hospitals. Controls (n = 287) were randomly selected from the study base without signs of ischemic heart disease. We used the short Swedish version of the Demand–Control questionnaire. The information on sociodemographic characteristics, behavioral, physiological risk factors was obtained during a face-to-face interview.

**Results.** Low job control had a significant effect on the first myocardial infarction risk in the 25–64 year old male population of Kaunas (OR = 1.68; 95% CI 1.12–2.53 after adjustment for age, smoking, arterial hypertension and obesity). Job strain was a main myocardial infarction risk factor in the occupational category of plant and machine operators and assemblers (OR = 4.06; 95% CI 1.44–11.49 after adjustment for age, smoking, arterial hypertension and obesity).

**Conclusions.** The Demand–Control model is a context specific model in the investigation of psychosocial work environment, which enables the researchers to disclose the real situation in a workplace in welfare societies as well as in the countries of the previous Soviet Block.

**Key words:** demand–control model, myocardial infarction, case-control study, working population, job strain

## INTRODUCTION

Psychosocial aspects of the work environment appear to have a bearing on employee's well-being and health (1). Work-related stress is considered to be one of the underlying causes of coronary heart disease (2) and depression (3). Research efforts have been focused on assessing the role of specific work characteristics that may be stressful and on trying to identify factors that can affect the stress and health relationship by mitigating the harmful effects of stress (4).

There are two basic dimensions in the demand-control model: job demands and job control (5). By combining these two dimensions, four main types of jobs can be found. "High strain jobs" are characterised by high demands and low control, and "low strain jobs" are characterised by low demands and high control. The "active jobs" have high demands and high control, whereas "passive jobs" have low demands and

low control. According to the model, the high strain jobs will give rise to negative health outcomes. Low job control as a separate dimension of the psychosocial work environment might be a risk factor for coronary heart disease and myocardial infarction (6).

In Lithuania, differences in the risk of the first myocardial infarction among occupational categories have been found elevated in a population-based case-control study. Legislators, senior officials and managers, plant and machine operators and assemblers were found to be at increased myocardial infarction risk (7). There is some evidence that traditional coronary heart disease risk factors (smoking, arterial hypertension and hypercholesterolaemia) may only partly explain the risk of myocardial infarction (8). The search for new coronary risk factors encouraged us to carry out the present study.

The aim of the present study was to test the eligibility of the demand–control model in the investiga-

tion of psychosocial factors at work and first myocardial infarction risk in the 25–64-year-old male population in Kaunas.

## MATERIALS AND METHODS

We conducted an epidemiological case-control study among 25–64-year-old men of Kaunas city in 2000–2001. The group contained first hospitalised non-fatal myocardial infarction patients (code I21 according to the International Classification of the Diseases), controls were randomly selected from the study base. Cases and controls were interviewed using a standardised questionnaire about the demographics, psychosocial characteristics, behavioural, physiological risk factors, occupational and residential exposures. The short Swedish version of the Demand–Control Questionnaire was used to describe the psychosocial work environment. Five questions addressed job demands and six questions job control. Job strain was derived as the ratio of job demands to control. The International Standard Classification of Occupations was used to classify the occupations into 10 occupational categories.

We used SPSS 10.0 software for Windows for the statistical analysis.

Table 1. Odds ratios and 95% confidence intervals for myocardial infarction risk in relation to job characteristics in 25–64-year-old men in Kaunas

Variable	Adjusted for age		Fully adjusted*	
	OR	95% CI	OR	95% CI
<b>Job demands</b>				
Low	1.0			
High	0.65	0.45–0.94	0.64	0.43–0.95
<b>Job control</b>				
High				
Low	1.99	1.36–2.92	1.68	1.12–2.53
<b>Job strain</b>				
Low				
High	1.08	0.75–1.55	1.04	0.70–1.52

\* Adjusted for age, smoking, arterial hypertension, obesity.

\*\* Job strain; ratio of job demands to control.

OR = odds ratio, 95% CI = 95% confidence intervals.

Table 2. Logistic regression analysis of the relation between myocardial infarction and job characteristics (worst quartile versus remaining 3 quartiles) within the subpopulation of plant and machine operators (8th ISCO category)

Adjustment factor	Job demands		Job control		Job strain*	
	OR	95 % CI	OR	95 % CI	OR	95 % CI
Age	1.33	0.34–5.21	2.17	1.00–4.71	2.91	1.23–6.98
Age, smoking, arterial hypertension, obesity	1.11	0.22–5.52	2.87	1.13–7.27	4.06	1.44–11.49

\*Job strain – ratio of job demands to control.

OR = odds ratio, 95% CI = 95% confidence intervals.

## RESULTS

The results of the case-control study among 25–64-year-old population of Kaunas men indicated that psychosocial work characteristics measured in the process of dichotomisation at the median scores showed a certain effect on the first myocardial infarction risk. The mean scores for job demands were 10.6 (0.16) for cases and 11.3 (0.12) for controls; for job control they were 13.2 (0.18) for cases and 14.2 (0.18) for controls. The mean scores for job strain were 0.82 (0.01) in the cases group and 0.93 (0.01) in the control group. High demands at work had no influence on the first myocardial infarction risk (OR = 0.65; 95% CI 0.45–0.94 after adjustment for age) (Table 1). Job strain had no effect, either (OR = 1.08; 95% CI 0.75–1.55). However, low job control was a significant myocardial infarction risk factor in the 25–64-year-old Kaunas male population (OR = 1.99; 95% CI 1.36–2.92). After adjustment for smoking, arterial hypertension and obesity the odds ratio decreased, remaining at a statistically significant level (OR = 1.68; 95% CI 1.12–2.53), showing some mediating effect of the standard ischemic heart disease risk factors on the relationship between low job control and myocardial infarction risk.

The logistic regression analysis within the 8th occupational category of plant and machine operators and assemblers indicated that age-adjusted odds ratio for job demands was 1.33; 95% CI 0.34–5.21 (Table 2) and for job control 2.17; 95% CI 1.00–4.71. The effect of job strain was the highest (OR = 2.91; 95% CI 1.23–6.98 after adjustment for age). The adjustment for standard risk factors (smoking, arterial hypertension and obesity) did not decrease the odds ratio estimates substantially, showing an independent effect of the psychosocial work characteristics on the first myocardial infarction risk.

## DISCUSSION

We tested the eligibility of the demand–control model in the investigation of the psychosocial work environment and its possible influence on first myocardial infarction risk in the 25–64-year-old male population of the Kaunas city and found that low job control had a significant effect (adjusted OR = 1.68;

95% CI 1.12–2.53). However, there were no effects of high job demands and job strain (adjusted OR = 0.64; 95% CI 0.43–0.95 and OR = 1.04; 95% CI 0.70–1.52, respectively). Our results are consistent with the findings from the Czech Republic, another country from the previous Soviet Block, indicating that jobs characterised as “high strain” had no significant effect on first myocardial infarction risk (7). The explanations have been found in the organisational structure of the Soviet work environment, which could be shortly described as “they pretend they pay us and we pretend we work”. Low job control as a separate risk factor predicted coronary heart disease in the Whitehall II study on British Civil servants (9), though the majority of studies in Western societies showed the strongest effect of job strain in the risk of ischemic heart disease (10).

We examined whether the psychosocial factors at work have an effect on myocardial infarction risk within the occupational categories classified according to the International Standard Classification of Occupations (1991, Geneva). Of the 8th occupational category (plant and machine operators and assemblers) cases, 81.5% were professional drivers. We found that in the logistic regression analysis within the 8th occupational category the myocardial infarction odds ratio associated with a high job strain ratio was 4.06 (95% CI 1.44–11.49) after adjustment for age, smoking, arterial hypertension and obesity. We also found that within the 8th occupational category the effect of low job control remained stable (Table 2).

In Western societies, the relationship between occupations and job characteristics has been described in national surveys, for instance in Sweden and the USA. Maps have been published to illustrate the relative positions of different occupations in relation to job control and psychological demands (11, 12). They are based on psychosocial work environment in highly industrialised societies. Machine-paced occupations, including assemblers, are in the job strain group. In our case-control study we tried to find the answer whether differences in psychosocial factors within the occupational category of plant and machine operators and assemblers might affect the myocardial infarction risk. We found that in the logistic regression analysis within the 8th ISCO category the effect of low job control was significant. Job strain, evaluated as the ratio of job demands to control (job strain ratio), increased the first myocardial infarction risk threefold and after adjustment for age and standard risk factors four-fold (4.06, 95% CI 1.44–11.49). It is well known that repetitive work holds low control and that the level of epinephrine in assembly workers is increased (13), thus showing the arousal of the sympathetic nervous system, indicating stress.

Our study confirmed that the Demand–Control model is a context-specific model as it enables the

researchers to disclose the psychosocial work environment in welfare societies and in the post-transitional countries. Though the psychosocial work characteristics in these two economic formations are quite different, the high sensitivity of the model enables to reveal the real situation in the workplace. As we showed in our study, low job control was a risk factor for the first myocardial infarction in the 25–64-year-old male population in Kaunas; job stress appeared to be a risk factor within the occupational category of plant and machine operators and assemblers. The specifics of the occupation of professional drivers (they comprised 81 percent of the occupational category of plant and machine operators and assemblers) is the same in welfare societies and in the post-transitional countries (14). Occupational exposure of professional drivers is the same and includes sedentary job type, shift work, irregular working hours, high-pacing conditions that cause stress. The concomitant denial of job strain, in combination with low availability of social attachment during the work, could contribute to maintenance of maladaptive behaviour (smoking, low physical activity) in professional drivers (15). Acting together, all these risk factors could explain why the driving profession is a high myocardial infarction risk occupation.

## CONCLUSIONS

1. The Demand–Control Model is a context-specific model in the investigation of psychosocial work environment, which enables to disclose the real situation in the workplace in the welfare societies as well as in the countries of the former Soviet Block.
2. Low job control was an important myocardial infarction risk factor in the working population of Kaunas men.
3. Job strain was a significant myocardial infarction risk factor in the occupational category of plant and machine operators and assemblers.

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## APPENDIX

### Items in the job strain questionnaire Demands

1. Do you have to work very fast?
2. Do you have to work very intensively?
3. Does your demand too much effort?
4. Do you have enough time to do everything?
5. Does your work often involve conflicting demands?

### Control

1. Do you have the possibility of learning new things through your work?
2. Does your work demand a high level of skill or expertise?
3. Does your job require you to take the initiative?
4. Do you have to do the same thing over and over again?
5. Do you have a choice in deciding HOW you do your work?
6. Do you have a choice in deciding WHAT you do at work?

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#### REIKALAVIMŲ BEI KONTROLĖS MODELIS IR MIOKARDO INFARKTAS TARP DIRBANĖIŲJŲ KAUNO VYRŲ

##### S a n t r a u k a

**Ávadas.** Psichologiniai ir socialiniai veiksniai darbe turi átakos dirbanėiŲjŲ sveikatai. Daþna tyrinėtojų problema – jautraus metodo pasirinkimas siekiant iðaiðkinti neigiamus psichologinius ir socialinius veiksnius darbe. MûsŲ darbo tikslas buvo iðtirti reikalavimŲ bei kontrolės modelio trumposios ŲvedŲ versijos tinkamumà ryðiui tarp psichologiniŲ ir socialiniŲ veiksniŲ darbe ir miokardo infarkto rizikos atskleisti.

**Tiriamieji ir darbo metodai.** Atlikome epidemiologinà atvejis-kontrolė tyrimà tarp 25–64 metŲ Kauno vyrŲ. Á atvejŲ grupė pateko 203 pirmuoju miokardo infarktu sirgę darbingŲ amþiaus vyrai, gydyti ávairiose Kauno miesto ligoninėse. Kontrolinė grupė (287) sudarė atsitiktinai parinkti to paties amþiaus vyrai be iðeminės Ųirdies ligos poþymiŲ. Naudojome reikalavimŲ bei kontrolės klausimyno trumpjà ŲvedŲ versijà. Tiesioginės apklausos metu buvo surinkta informacija apie socialinius ir demografinius, elgsenos, darbo bei fiziologinius rizikos veiksnius.

**Rezultatai.** Maþa galimybė kontroliuoti savo darbà buvo svarbus rizikos veiksnys tarp 25–64 dirbanėiŲjŲ Kauno vyrŲ, 1,68 karto didinantis pirmojo miokardo infarkto rizikà. Tuo tarpu darbo átampa buvo lemiamas rizikos veiksnys árengimŲ ir maðinŲ operatoriŲ bei surinkėjŲ profesinei grupei. Dėl jo átakos pirmojo miokardo infarkto rizika padidėjo 4 kartus, atsilyvelgiant á amþiŲ, rûkymo, arterinės hipertenzijos ir nutukimo poveikà

**Iðvados.** ReikalavimŲ bei kontrolės modelis yra specifinis psichologinės ir socialinės darbo aplinkos tyrimo metodas, padedantis tyrinėtojams atskleisti tikrà neigiamos aplinkos poveikà sveikatai tiek socialinio gerbūvio, tiek buvusios Sovietinės átakos Ųalyse.

**Raktaþodþiai:** reikalavimŲ bei kontrolės modelis, miokardo infarktas, atvejo-kontrolės studija, dirbanėiŲjŲ populiacija, darbo átampa