



## Correlation of sociodemographic variables and interpersonal sources of stress at work among miners

### Odnos sociodemografskih varijabli i interpersonalnih izvora stresa na radu kod rudara

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#### Abstract

**Background/Aim.** Some professions are somewhat more exposed to stress and have been the subject of research for a long time, and research of occupational stress among employees at workplaces with a special health risk is of a special significance. That is the case with miners. The aim of the study was an assessment of the relation between the sociodemographic variables and interpersonal sources of stress at work among miners. **Methods.** The study was designed as a cross-sectional study and covered 170 respondents, classified into two groups: a study group comprised of miners ( $n = 142$ ) and a control group ( $n = 28$ ) comprised of administrative workers. The research was conducted at the Occupational Medicine Service of the Health Center Zvečan and at the Institute of Occupational Medicine in Niš. The questionnaire on the basic sociodemographic indicators of respondents, the Intrapersonal and Interpersonal Related Stressors Questionnaire (IRS), the Work Ability Index Questionnaire (WAI), the General Health Questionnaire (GHQ), the Copenhagen Burnout Inventory (CBI) and the Questionnaire on the stressors were used in this research. **Results.** Statistically, the miners consumed alcohol significantly more than the respondents from the control group (68.30% vs. 25.00%;  $p < 0.001$ ). Relative to age, there was a statistically significant difference in the subscales: demands ( $p = 0.037$ ), control ( $p = 0.010$ ), relations ( $p = 0.009$ ) and change ( $p = 0.008$ ). The control score values increased

with age. The relations values were highest among the oldest respondents. The values of change decreased with age. Relative to exposed years of service (ERS), there was a statistically significant difference in the subscale relations; the miners with ERS longer than 15 years had a statistically significantly higher relations score ( $p = 0.003$ ). The values of subscales control ( $p < 0.001$ ), manager support ( $p = 0.010$ ), relations ( $p < 0.001$ ) and work role ( $p < 0.001$ ) were statistically significantly lower among the miners compared to the control group. The values of subscales peer support ( $p = 0.002$ ) and change ( $p < 0.001$ ) were statistically significantly higher among the miners compared to the control group. **Conclusion.** The results indicate the correlation of sociodemographic variables with interpersonal sources of stress at work among the miners. The following prevention measures are proposed: adequate professional orientation, professional selection, professional adaptation, organizational measures, progressive development of knowledge and skills, development of good interpersonal relationships, strengthening the family-organization-company relation, relaxation techniques at the workplace, stress control, application of physiological techniques, application of cognitive techniques.

#### Key words:

miners; sociological factors; interpersonal relations; stress, psychological; risk factors; occupational exposure; surveys and questionnaires.

#### Apstrakt

**Uvod/Cilj.** Neke profesije su nešto više izložene stresu i već duže vreme su predmet istraživanja, a poseban značaj ima istraživanje profesionalnog stresa kod zaposlenih na radnim mestima sa posebnim rizikom po zdravlje, što je slučaj sa rudarima. Cilj rada bio je procena odnosa sociodemografskih varijabli i interpersonalnih izvora stresa na radu

kod rudara. **Metode.** Istraživanje je dizajnirano kao studija preseka i njime je obuhvaćeno 170 ispitanika, svrstanih u dve grupe: ispitivana grupa, koju su činili rudari ( $n = 142$ ) i kontrolna grupa ( $n = 28$ ) koju činili administrativni radnici. Istraživanje je sprovedeno u Domu zdravlja Zvečan, u Službi medicine rada u Zvečanu i u Institutu za medicinu rada u Nišu. U istraživanju su korišćeni: Upitnik o osnovnim sociodemografskim pokazateljima ispitanika, Upitnik o interper-

sonalnim i intrapersonalnim stresorima, Upitnik indeksa radne sposobnosti, Upitnik opšteg zdravlja, *Copenhagen Burnout Inventory* i Upitnik o stresorima. **Rezultati.** Rudari su statistički značajno češće konzumirali alkohol u odnosu na ispitanike kontrolne grupe (68,30% vs. 25,00%;  $p < 0,001$ ). U odnosu na starosne grupe postojala je statistički značajna razlika u supskalama: zahtevi ( $p = 0,037$ ), kontrola ( $p = 0,010$ ), relacija ( $p = 0,009$ ) i promena ( $p = 0,008$ ). Vrednosti skora kontrola rastle su sa starošću. Vrednosti skora relacije bila je najveći kod najstarijih ispitanika. Vrednosti skora promena opadale su sa starosti. U odnosu na efektivan radni staž (ERS) postojala je statistički značajna razlika u supskali relacije; rudari sa ERS dužim od 15 godina imali su statistički značajno veći skor relacije ( $p = 0,003$ ). Vrednosti supskala kontrola ( $p < 0,001$ ), podrška rukovodioca ( $p = 0,010$ ), relacije ( $p < 0,001$ ) i radna uloga ( $p < 0,001$ ) statistički je bila značajno manja kod rudara u odnosu na kon-

trolnu grupu. Vrednosti supskala podrška kolega ( $p = 0,002$ ) i promene ( $p < 0,001$ ) statistički bila je značajno veća kod rudara u odnosu na kontrolnu grupu. **Zaključak.** Rezultati ukazuju na povezanost pojedinih sociodemografskih varijabli sa interpersonalnim izvorima stresa na radu kod rudara. Predlažu se sledeće mere prevencije: adekvatna profesionalna orijentacija, profesionalna selekcija, profesionalna adaptacija, organizacione mere, postepeno razvijanje znanja i sposobnosti, razvijanje dobrih međuljudskih odnosa, jačanje veza porodica-organizacija-preduzeće, tehnike relaksacije na radnom mestu, kontrola stresa, primena fizioloških tehnika, primena saznanjih tehnika.

**Ključne reči:**  
rudari; socijalni faktori; međuljudski odnosi; stres, psihički; faktori rizika; profesionalna izloženost; ankete i upitnici.

## Introduction

Studies oriented at identifying dangers and risks at the workplace and working environment which can cause injury at work and/or occupational disease are always actual. These studies must be continuous, because some dangers are not known enough, workplace hazards change and new ones appear. One of the most serious workplace dangers is stress. Some professions are somewhat more exposed to stress and for a long time they are the subject of research, such as managers, pilots, flight controllers, rescuers, journalists, actors, miners, construction workers, health workers, etc. The study of occupational stress among employees at workplaces with a special health risk is of great importance, which is the case with miners<sup>1-3</sup>. According to the European Agency for Safety and Health at Work (EU-OSHA) study, workplace stress is present in almost every third employee in the European Union (EU). Stress at work in the EU includes 28% of employees, or 41.2 million people. The result of occupational stress is 50%–60% of all lost working days, but also about 5 million accidents at work and a loss of at least 20 billion euros per year. In the EU, 12 million people complained that they were offended by management staff (8%); 6 million (4%) complained of physical violence, and 3 million (2%) of sexual abuse<sup>4,5</sup>.

The aim of this study was to examine the connection of the Interpersonal Relationship Scale (IRS) subscales with other examined scores, which follow the types of stressors, impact of stress at work on the general health condition of miners, occupational burnout and their working ability through appropriate tests, and to evaluate the correlation of sociodemographic variables and interpersonal sources of stress at work at miners.

## Methods

The study covered 170 respondents. There were two groups of respondents: the tested group ( $n = 142$ ), consisting of miners, and the control group ( $n = 28$ ), consisting of administrative staff of the company that deals with the installing of quality standards. Unlike miners, administrative workers do not have contact with risks and they work a steady job

without stress. The research was designed as a cross-sectional study. The criteria for inclusion in the study were: for the tested group – the Trepča Mines miners who come to the periodical control examinations at the Occupational Medicine Service of the Health Center Zvečan, and for the control group – administrative workers who come to the examinations at the Institute of Occupational Medicine in Niš. The oral consent of participating in the research obtained from all respondents. The respondents who refused to participate were excluded from the study. After giving the consent to participate in the study, the respondents were explained the goals and purpose of the research. After the questionnaire was distributed and a brief explanation was given, the respondents filled in the questionnaire themselves, or with the help of a nurse, or researcher. The respondents were guaranteed privacy through their anonymous and voluntary participation. The research was conducted at the Occupational Medicine Service of the Health Center Zvečan, before miners' periodical control examinations, and at the Institute of Occupational Medicine in Niš, from February to April 2017. Researchers used the Questionnaire on basic sociodemographic indicators of respondents, the Interpersonal Relationship Scale Questionnaire – IRS, the Work Ability Index Questionnaire – WAI, the General Health Questionnaire – GHQ, the Copenhagen Burnout Inventory – CBI and the Questionnaire on stressors.

*The Questionnaire on basic sociodemographic indicators of respondents* contains general information, basic information about sex, age, marital status, habitation, type of work, eventual use of alcohol, cigarettes and sedatives, etc.

*The IRS* is used for evaluating interpersonal sources of stress at work. The respondent should read each claim carefully and mark the answer that best describes how much each event is present at his workplace. The scale has 42 items, and the response format is the Likert five point scale (“almost never”, “rarely”, “sometimes”, “often” and “almost always”). It contains seven subscales that evaluate various sources of stress in the organization, such as: job demands, control, manager support, peer support, relations and working atmosphere, work role and change.

The WAI is a standardized questionnaire of the Finnish Institute of Occupational Health. It is used to test the working ability in relation to job demands. The WAI is expressed numerically and calculated according to the instructions of the Finnish Institute of Occupational Health. The questionnaire contains seven items: 1. subjective assessment of current work ability compared to the best work ability in life (grade 1–10); 2. subjective assessment of work ability in relation to the physical and mental requirements of the work position (grade 1–10); 3. number of diagnosed diseases (injuries, diseases of the musculoskeletal system, diseases of the cardiovascular and respiratory system, psychological disorders, neurological and sensory diseases, gastrointestinal system diseases, urogenital system diseases, tumors, endocrine diseases, blood diseases, etc.); 4. subjective determination of the disease impact on work (grade 1–6); 5. sick leave during the previous year (scale 1–5; 5 – no sick leave at all; 4 – a maximum of 9 days; 3 – 10–24 days; 2 – 25–99 days; and 1 – 100–365 days); 6. personal forecast of work ability for the next two years; 7. questions about mental health and satisfaction. The score ranges from 7 to 49 points. A higher score indicates better work ability. According to the number of points, WAI is ranked in four categories: poor (7 to 27 points), indicating poor working ability; good, (from 28 to 36 points), meaning moderate working ability; very good (from 37 to 43 points), marking good working ability; excellent (from 44 to 49 points), for excellent working ability.

The GHQ measures the sense of tension, depression, inability to defend, anxiety based insomnia, lack of self-confidence and self-esteem and other symptoms of mental disorders. There are four variants of this questionnaire, and the GHQ-12 variant used in this study is recommended for measuring psychological distress. The test contains 12 items (points) that offer four responses (better than usual, same as usual, less than usual, much less than usual). In this study, the bimodal scoring method (0–0-1-1) was used in accordance with the official manual. The maximum score (number of points on the test) is 12, and the possible range is 0–12. A score of 4, or more, means a possible presence of mental distress, and a score of 8, or more, indicates certain presence of various symptoms of stress-related psychological disorders.

The CBI is a questionnaire that has been in use since 2004. It consists of 19 items and includes three scales: personal burnout, occupational burnout and client burnout. In this research, a part of the scale related to occupational burnout will be used and it consists of 7 questions, to which the respondents can choose one of the five offered answers. For the first three questions, the respondents choose one of the following possible answers: a very high level, a high level, here and there, low level and very low level. For the other four questions the following answers are offered: always, often, occasionally, rarely and never/almost never.

The *Questionnaire on stressors* assesses the causes of stress on specified work position, i.e., the respondent is asked to explain 37, the most frequently represented offered stressors. The questions are answered by marking the number of offered answer that best describes the respondent's opinion on the existence of an appropriate stressor, using the

scale for rating from 1 to 5. In this case, 1 means not stressful at all, 2 marks rarely stressful, 3 indicates sometimes stressful, 4 – stressful and 5 – extremely stressful.

#### *The statistical data analysis*

Data is presented in the form of an arithmetic mean and standard deviation, i.e., in the form of absolute and relative numbers. The comparison of continuous variables between two or more groups was conducted using the ANOVA (Analysis of variance), or the Kruskal-Wallis test, depending on the data distribution. The comparison of continuous variables between the two groups was performed by the Student *t*-test, or the Mann-Whitney *U* test, depending on the data distribution. The comparison of categorical variables was done by the  $\chi^2$  test or the Fisher's exact test. The correlation of the tested subscales was tested by the Pearson's correlation coefficient. The multiple linear regression analysis was used to test the effects of sociodemographic and clinical parameters on the IRS score subscales. The hypothesis was tested with a threshold of significance of  $p < 0.05$ . The data analysis was performed using the SPSS 16.0 software package.

#### **Results**

The average age of miners was  $46.00 \pm 11.68$  years of age (min 22, max 64 years) and the average age of the control group respondents was  $46.19 \pm 8.98$  years of age (min 31, max 66 years). There was a statistically significant difference in the structure by sex between miners and control group ( $p < 0.001$ ). Most miners were married (71.80%). Most of them had two children (36.60%) and lived in a rented apartment (50.00%). Cigarettes were consumed by one-third of miners (33.80%), 68.30% consumed alcohol, and 9.60% consumed sedatives (Table 1). The subjects in the control group had statistically significantly more children than the miners (29.60% vs. 9.20%,  $p = 0.011$ ). The miners were statistically significantly more likely to live in a rented apartment compared to the control group (50.00% vs. 10.70%;  $p < 0.001$ ). The control group respondents statistically significantly more often lived in their apartment than the miners (78.60% vs. 34.50%;  $p < 0.001$ ). The miners were statistically significantly more likely to consume alcohol than those of the control group (68.30% vs. 25.00%;  $p < 0.001$ ). The length of years of service was uniform compared to the examined groups ( $p = 0.659$ ).

Relative to the age groups, there were statistically significant differences in the subscales: demands ( $p = 0.037$ ), control ( $p = 0.010$ ), relations ( $p = 0.009$ ) and change ( $p = 0.008$ ). The respondents aged 45–54 years had the lowest score of demands, while the youngest respondents had the highest demands score. The values of control score increased with age. The values of relations score were the highest among the oldest respondents. The values of change decreased with age. Relative to the total years of service (URS), there were statistically significant differences in the subscales manager support ( $p = 0.020$ ) and relations ( $p = 0.008$ ). The score of manager support was statistically significantly higher in the respondents with fewer years of

service, while the relations score was statistically significantly higher in the respondents with more years of service. Relative to the exposed years of service (ERS), there was a statistically sig-

nificant difference in the subscale relations, the miners with the ERS longer than 15 years had the statistically significantly higher relations score ( $p = 0.003$ ) (Table 2).

Table 1

Demographic characteristics			
Parameter	Miners	Control group	<i>p</i>
Sex (male/female), n	142/0	19/9	< 0.001 <sup>1</sup>
Age (years), mean ± SD	46.00 ± 11.68	46.19 ± 8.98	0.734 <sup>2</sup>
Marriage, n (%)			
single	11 (7.70)	4 (14.80)	0.453 <sup>1</sup>
married	102 (71.80)	21 (77.80)	0.911 <sup>1</sup>
cohabitation	12 (8.50)	0	0.219 <sup>3</sup>
divorced	11 (7.70)	0	0.270 <sup>3</sup>
widower	2 (1.40)	1 (3.70)	0.419 <sup>1</sup>
Number of children, n (%)			
without children	46 (32.40)	7 (25.90)	0.583 <sup>1</sup>
1 child	13 (9.20)	8 (29.60)	0.011 <sup>1</sup>
2 children	52 (36.60)	11 (40.70)	0.957 <sup>1</sup>
3 children	27 (19.00)	1 (3.70)	0.051 <sup>3</sup>
4 children	4 (2.80)	0	1.000 <sup>3</sup>
Type of housing, n (%)			
with parents	22 (15.50)	3 (10.70)	0.770 <sup>3</sup>
own apartment	49 (34.50)	22 (78.60)	< 0.001 <sup>1</sup>
rented apartment	71 (50.00)	3 (10.70)	< 0.001 <sup>1</sup>
Consume, n (%)			
cigarettes	48 (33.80)	8 (28.60)	0.750 <sup>1</sup>
alcohol	97 (68.30)	7 (25.00)	< 0.001 <sup>1</sup>
sedatives	14 (9.60)	2 (7.10)	0.923 <sup>1</sup>
URS (mean ± SD)	15.00 ± 7.35	18.21 ± 11.73	0.659 <sup>4</sup>
ERS (mean ± SD)	13.00 ± 7.63		

URS – total years of service; ERS – exposed years of service.

<sup>1</sup> $\chi^2$  test; <sup>2</sup>Student *t*-test; <sup>3</sup>Fisher's exact test; <sup>4</sup>Mann-Whitney test.

Table 2

#### Analysis of subscales of Interpersonal relationship scale (IRS) according to the sociodemographic characteristics

Parameter	Demands mean ± SD	Control mean ± SD	Manager support mean ± SD	Peer support mean ± SD	Relations mean ± SD	Work role mean ± SD	Change
Age category (years)							
< 25	23.20 ± 4.09	12.80 ± 1.64	21.40 ± 2.19	19.20 ± 1.92	11.40 ± 2.79	12.50 ± 1.00	16.20 ± 1.78
25–34	22.74 ± 3.88	14.70 ± 2.78	21.26 ± 3.51	21.04 ± 4.02	11.13 ± 2.47	12.74 ± 2.00	16.17 ± 1.82
35–44	22.77 ± 3.73	15.89 ± 3.20	22.39 ± 4.89	23.12 ± 3.82	11.00 ± 3.50	12.43 ± 2.43	14.58 ± 2.10
45–54	20.61 ± 2.88	16.16 ± 2.65	21.81 ± 5.37	20.55 ± 4.74	12.73 ± 4.11	12.66 ± 2.84	14.46 ± 1.79
55–64	22.56 ± 3.32	16.92 ± 3.31	21.05 ± 4.90	20.86 ± 4.98	13.71 ± 3.46	12.11 ± 2.99	14.76 ± 2.17
<i>p</i> -value <sup>1</sup>	0.037	0.010	0.800	0.084	0.009	0.884	0.008
Marriage							
single	22.95 ± 3.91	16.51 ± 3.68	21.59 ± 3.81	20.16 ± 4.17	12.16 ± 3.68	12.43 ± 2.34	14.92 ± 2.74
married	21.82 ± 3.33	15.73 ± 2.83	21.67 ± 5.05	21.73 ± 4.55	12.29 ± 3.64	12.47 ± 2.68	14.92 ± 1.78
<i>p</i> -value <sup>2</sup>	0.117	0.178	0.922	0.061	0.857	0.936	0.999
Number of children							
without children	21.56 ± 2.99	15.96 ± 3.34	21.60 ± 4.28	20.80 ± 4.18	12.29 ± 3.98	12.37 ± 3.68	14.64 ± 1.87
with children	22.41 ± 3.73	15.94 ± 3.00	21.68 ± 4.96	21.55 ± 4.64	12.24 ± 3.48	12.50 ± 2.55	15.05 ± 2.15
<i>p</i> -value <sup>2</sup>	0.149	0.975	0.925	0.341	0.943 <sup>3</sup>	0.793 <sup>3</sup>	0.254 <sup>3</sup>
Type of housing							
with parents	22.19 ± 4.40	15.05 ± 2.67	21.45 ± 4.78	19.57 ± 4.51	12.45 ± 3.65	12.35 ± 2.72	15.20 ± 2.38
own apartment	21.67 ± 2.96	16.02 ± 2.58	21.75 ± 5.09	21.57 ± 4.01	12.41 ± 3.52	12.63 ± 2.97	14.96 ± 1.87
rented apartment	22.44 ± 3.61	16.15 ± 3.50	21.64 ± 4.53	21.53 ± 4.73	12.28 ± 3.76	12.38 ± 2.29	14.81 ± 2.12
<i>p</i> -value <sup>3</sup>	0.621	0.405	0.961	0.165	0.913	0.898	0.806
URS (years)							
≤ 15	21.68 ± 3.68	15.83 ± 3.48	22.57 ± 4.74	21.59 ± 4.43	11.45 ± 3.40	12.25 ± 2.50	14.94 ± 2.24
> 15	22.61 ± 3.31	16.06 ± 2.68	20.71 ± 4.57	21.03 ± 4.56	13.07 ± 3.70	12.68 ± 2.65	14.90 ± 1.89
<i>p</i> -value <sup>3</sup>	0.117	0.666	0.020	0.468	0.008	0.332	0.900
ERS (years)							
≤ 15	22.07 ± 3.81	15.82 ± 3.36	22.05 ± 4.70	21.30 ± 4.35	11.52 ± 3.38	12.41 ± 2.47	15.02 ± 2.14
> 15	22.25 ± 3.01	16.15 ± 2.63	20.98 ± 4.76	21.32 ± 4.74	13.46 ± 3.74	12.55 ± 2.78	14.75 ± 1.94
<i>p</i> -value <sup>3</sup>	0.762	0.514	0.205	0.977	0.003	0.764	0.442

URS – total years of service; ERS – exposed years of service; SD – standard deviation;

<sup>1</sup>ANOVA; <sup>2</sup>*t*-test; <sup>3</sup>Mann-Whitney test; <sup>4</sup>Kruskal-Wallis test.

**Table 3****Connection of the IRS subscales with other examined scores**

Subscales	WAI		GHQ		Stressors		CBI	
	r	p	r	p	r	p	r	p
Demands	0.062	0.466	0.279	0.001	0.491	<0.001	0.066	0.438
Control	-0.064	0.454	0.033	0.698	0.111	0.188	0.041	0.630
Manager support	0.118	0.168	-0.140	0.103	-0.196	0.021	-0.217	0.011
Peer support	0.143	0.095	-0.277	0.001	-0.019	0.825	-0.186	0.030
Relations	-0.231	0.007	0.350	< 0.001	0.094	0.274	0.349	< 0.001
Work role	-0.082	0.338	-0.019	0.825	0.183	0.032	0.117	0.172
Change	0.035	0.683	-0.099	0.248	-0.037	0.663	-0.009	0.919

WAI – Work Ability Index; GHQ – General Health Questionnaire; CBI – Copenhagen Burnout Inventory.  
r – correlation coefficient.

The correlation analysis showed that the WAI score was statistically significantly related to the relations subscale ( $r = -0.231$ ;  $p = 0.007$ ). The GHQ score was related to the demands subscale ( $r = 0.279$ ;  $p = 0.001$ ), the peer support subscale ( $r = -0.277$ ;  $p = 0.001$ ) and the relations subscale ( $r = 0.350$ ;  $p < 0.001$ ). The stressors scale was associated with the demands subscale ( $r = 0.491$ ;  $p < 0.001$ ), manager support subscale ( $r = -0.196$ ;  $p = 0.021$ ) and the work role subscale ( $r = 0.183$ ;  $p = 0.032$ ). The CBI scale correlated with the manager support scale ( $r = -0.217$ ;  $p = 0.011$ ), peer support subscale ( $r = -0.186$ ;  $p = 0.030$ ) and the relations subscale ( $r = 0.349$ ;  $p < 0.001$ ) (Table 3).

There was a statistically significant influence on the demands subscale regarding age (Beta = -0.385;  $p = 0.002$ ), URS (Beta = 0.363;  $p = 0.039$ ), GHQ scale (Beta = 0.304;  $p = 0.002$ ), and stressors (Beta = 0.440;  $p < 0.001$ ). The stressors had the strongest impact on this subscale. There was a statistically significant influence on the control subscale regarding age (Beta = 0.705;  $p < 0.001$ ) and marital status (Beta = -0.224;  $p = 0.010$ ). There was a statistically significant influence on the manager support subscale regarding URS (Beta = 0.455;  $p = 0.029$ ) and CBI (Beta = -0.242;  $p = 0.045$ ). There was a statistically significant influence on the peer support subscale regarding GHQ (Beta = -0.303;  $p = 0.010$ ). None of the tested parameters had a statistically significant influence on the relations subscale. There was a statistically significant influence on the work role subscale regarding the age (Beta = -0.320;  $p = 0.031$ ), GHQ (Beta = -0.252;  $p = 0.035$ ) and stressors (Beta = 0.220;  $p = 0.019$ ). There was a statistically significant influence on change subscale regarding age (Beta = 0.364;  $p = 0.017$ ) (Table 4).

The values of the subscale demands were equal in comparison to the examined groups ( $p = 0.848$ ). The values of the subscales control ( $p < 0.001$ ), manager support ( $p = 0.010$ ), relations ( $p < 0.001$ ) and working role ( $p < 0.001$ ) were statistically significantly lower in the miners compared to the control group (Table 5, Table 6, Figure 1). The values of subscales peer support ( $p = 0.002$ ) and changes ( $p < 0.001$ ) were statistically significantly higher among the miners compared to the control group.

**Table 5****Subscale values relative to the examined groups**

IRS subscale	Miners mean $\pm$ SD	Control group mean $\pm$ SD	$p^1$
Demands	22.14 $\pm$ 3.52	21.88 $\pm$ 2.82	0.848
Control	15.94 $\pm$ 3.10	20.65 $\pm$ 3.93	< 0.001
Manager support	21.65 $\pm$ 4.73	23.35 $\pm$ 3.07	0.010
Peer support	21.31 $\pm$ 4.49	18.50 $\pm$ 2.66	0.002
Relations	12.26 $\pm$ 3.63	14.92 $\pm$ 2.35	< 0.001
Work role	12.46 $\pm$ 2.58	15.85 $\pm$ 2.20	< 0.001
Change	14.92 $\pm$ 2.06	11.92 $\pm$ 2.54	< 0.001

IRS – Interpersonal Relationship Scale; <sup>1</sup>Mann-Whitney test; SD – standard deviation.

**Table 6****Subscale values relative to examined groups (male controls)**

IRS subscale	Miners mean $\pm$ SD	Male control mean $\pm$ SD	$p^1$
Demands	22.14 $\pm$ 3.52	22.35 $\pm$ 2.78	0.771
Control	15.94 $\pm$ 3.10	21.53 $\pm$ 4.17	< 0.001
Manager support	21.65 $\pm$ 4.73	24.12 $\pm$ 2.50	0.002
Peer support	21.31 $\pm$ 4.49	19.41 $\pm$ 2.32	0.009
Relations	12.26 $\pm$ 3.63	14.35 $\pm$ 1.84	< 0.021
Work role	12.46 $\pm$ 2.58	15.24 $\pm$ 2.08	0.001
Change	14.92 $\pm$ 2.06	11.53 $\pm$ 2.55	< 0.001

IRS – Interpersonal Relationship Scale; SD – standard deviation; <sup>1</sup>Mann-Whitney test.

**Discussion**

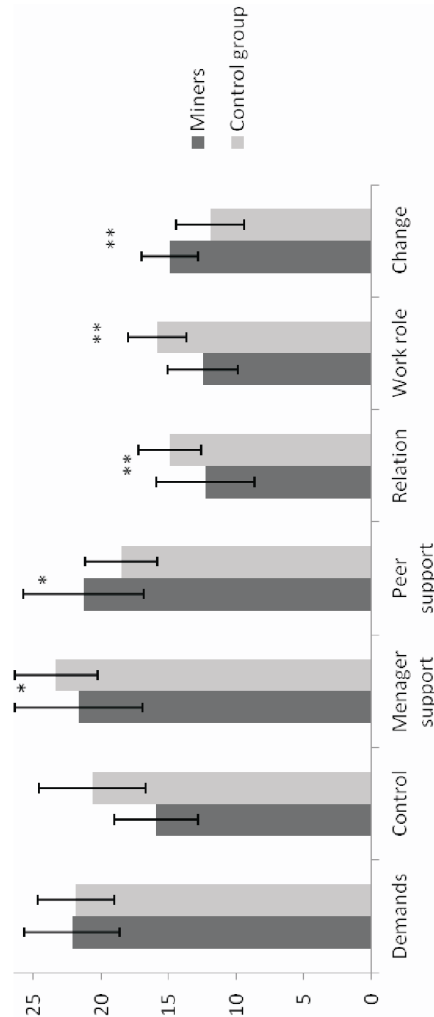
The miners belong to a group of workers who work at the workplaces with increased health risks and are exposed to a large number of stress factors during their work. On one hand, there are complex work tasks and often poor working conditions with the presence of physical and chemical harmful noxae, and on the other, there is a demand for almost absolute precision, corresponding effect and achievement of

**Table 4**

**Multiple regression analysis of factors associated with Interpersonal Relationship Scale (IRS)**

Parameter	Demands			Control			Manager support			Peer support			Relations			Work role			Change		
	B	Beta	p	B	Beta	p	B	Beta	p	B	Beta	p	B	Beta	p	B	Beta	p	B	Beta	p
Age	-0.117	-0.385	0.002	0.189	0.705	0.000	0.102	0.251	0.093	-0.049	-0.127	0.396	0.030	0.097	0.503	-0.072	-0.320	0.031	-0.065	-0.364	0.017
URS	0.174	0.363	0.039	-0.132	-0.313	0.113	-0.295	-0.455	0.029	-0.112	-0.184	0.380	0.061	0.124	0.540	0.043	0.120	0.564	0.096	0.340	0.106
ERS	-0.052	-0.113	0.530	-0.059	-0.146	0.475	0.112	0.179	0.404	0.222	0.378	0.079	-0.012	-0.025	0.906	0.036	0.105	0.622	-0.055	-0.201	0.356
WAI	0.044	0.116	0.193	0.007	0.020	0.845	0.005	0.010	0.924	0.020	0.041	0.712	0.004	0.010	0.920	-0.031	-0.111	0.317	-0.014	-0.064	0.556
GHQ	0.311	0.304	0.002	-0.054	-0.060	0.585	0.071	0.052	0.655	-0.400	-0.303	0.010	0.223	0.212	0.058	-0.189	-0.252	0.036	-0.079	-0.131	0.263
Stressors	0.108	0.440	0.000	0.019	0.088	0.307	-0.043	-0.131	0.153	0.035	0.112	0.218	-0.019	-0.076	0.389	0.039	0.220	0.019	-0.002	-0.015	0.869
Marriage	-0.363	-0.046	0.542	-1.546	-0.224	0.010	-0.436	-0.041	0.657	1.703	0.169	0.064	-0.429	-0.053	0.551	0.069	0.012	0.898	0.175	0.038	0.682
Children	0.752	0.070	0.340	0.371	0.039	0.639	1.162	0.081	0.361	0.367	0.027	0.759	0.693	0.063	0.462	0.204	0.026	0.771	0.533	0.085	0.344
CBI	-0.013	-0.082	0.409	-0.011	-0.077	0.497	-0.052	-0.242	0.045	-0.009	-0.042	0.719	0.026	0.157	0.177	0.028	0.237	0.054	0.015	0.165	0.174
R <sup>2</sup>	0.619	<0.001		0.440	0.001		0.347	0.050	0.377	0.050	0.377	0.426	0.426	0.002	0.329	0.092	0.092	0.301	0.301	0.182	0.182
Adjusted R <sup>2</sup>	0.383			0.194			0.121		0.142		0.142	0.181	0.181		0.108		0.108		0.027		0.027

B – unstandardized regression coefficient. Beta – standardized regression coefficient; URS – total years of service; ERS – exposed years of service; WAI – Work Ability Index; GRQ – General Health Questionnaire; CBI – Copenhagen Burnout Inventory.



**Fig. 1 – The Interpersonal Relationship Scale (IRS) subscales relative to examined groups (\*p < 0.05; \*\*p < 0.001).**

work results that are standardized and related to economic compensation, whereby any mistake can lead to the severe consequences for the health and life of workers. The miners have a worse social status and most of them do not have an adequately resolved housing issue, which is one of the stressful factors.

Relative to the age groups, there is a statistically significant difference in the IRS subscales demands, control, relations and changes. In the demands subscale, the higher the score, the higher the job demands, and this research shows that the minimum score is related with the respondents aged 45–54, and the highest with the youngest respondents. In the subscale control, the higher the score, the more control over own work, and in our research the value of the control score increases with age. The impact of stress on human health and labor productivity has been studied for many years and studies showed that the level of stress increases as job demands increase and the decision-making level decreases, whereby stress at work is not the result of only one factor, but the sum of increased demands and low level of decision-making, or control<sup>6,7</sup>. The high job demands with a small work control are considered as high work stressors<sup>8,9</sup>. Older employees have more problems with accepting the permanent changes and new requirements in the field of informatics application in their everyday work activities. The rapid deprivation of knowledge, skills and techniques at work is a widespread phenomenon, which tails many professions. Workers are required to continuously monitor business and technology innovation and adopt them quickly. Mismatch between job requirements and individual potentials, i.e., too low, or too high job demands, jobs that are below, or above individual potentials, frustrate and make the perpetrator dissatisfied, and that mismatch as such can be the source of stress<sup>10,11</sup>. In the subscales relations and working atmosphere, the higher the score, the worse the relations and the working atmosphere are, and the values of the relations are highest among the oldest respondents. In the changes subscale, the higher the score, the more the stressors related to changes at work there are, and this research shows that the values of the changes score decrease with age.

The organizational and financial issues are at a high level as stress factors, which is confirmed by various studies<sup>12</sup>. In addition, modern technologies enable electronic monitoring, i.e., continuous control of employees' work using cameras, which besides the undoubted benefits for efficient and quality work, also represents another difficult requirement for most employees. Abuse at work, or mobbing, is very actual in recent years. An unclear working role arises when a worker does not have adequate information about what he/she is expected to do, and the scope and type of work responsibilities can also be unclear. Disturbed employee relations and frequent conflicts cause the inevitable stressful effects manifested by various symptoms<sup>13–15</sup>. In this research, in the manager support subscale, the higher score, the more manager support there is; in the peer support subscale, the higher the score, the more peer support is present; and in the work role subscale, the higher the score, the more stressors related to the work role there are. The length of

years of service is uniform compared to both examined groups. Relative to the total years of service (URS), there are the statistically significant differences in the subscales manager support and relations, and the manager support score is statistically significantly higher in the respondents with fewer years of service, while the relations score is statistically significantly higher in the respondents with more years of service, and the higher relations score, the worse working atmosphere is. Relative to the exposed years of service (ERS), there is a statistically significant difference in the subscale relations, the miners with the ERS longer than 15 years have a statistically significantly higher relations score, which indicates the poor relations and working atmosphere in this group of respondents, as confirmed by some studies<sup>16–19</sup>.

The correlation analysis showed that the WAI score is statistically significantly related to the relations subscale, and the higher WAI score means better working ability, in the older respondents and ones with the ERS longer than 15 years. The GHQ score is related to the demands subscale, the peer support subscale and the relations subscale. The GHQ was used in this research to measure the psychological distress and presence of various symptoms of stress-related psychical disorders, and the more score, the greater presence of these symptoms is, which is associated with the increased demands at work, peer support, relations with colleagues and working atmosphere. The CBI scale correlates with the manager support scale, peer support subscale and the relations subscale. The occupational burnout is associated with the poor manager support, poor peer support and poor work relations and working atmosphere. The stressors scale is associated with the following subscales: demands, manager support and work role. The age, URS, GHQ scale and especially stressors have a statistically significant influence on the demands subscale. The age and marital status have a statistically significant influence on the control subscale. The URS and CBI have a statistically significant influence on the manager support subscale. The GHQ has a statistically significant influence on the peer support subscale. None of the tested parameters has a statistically significant influence on the relations subscale. The age, GHQ and stressors have a statistically significant influence on the work role subscale. Furthermore, the age has a statistically significant influence on the changes subscale. These results coincide with the results of other authors<sup>19–22</sup>.

The values of the demands subscale are uniform in comparison to the tested groups. The values of the subscales control, manager support, relations and working role, are statistically significantly lower among the miners compared to the control group. The values of the subscales peer support and changes are statistically significantly higher in the miners compared to the control group. The most common causes of stress at the workplace are a fear of losing the job, overstrain, the short deadlines, a lack of manager support, the inability to control their own time and output, or influence the work methods, the sense of alienation from the management, feeling of overwhelming exploitation or dormancy, idling, monotony, numerous physical, biological and chemical ef-

fects<sup>9</sup>. Job satisfaction and good interpersonal relations can have protective treatment on the stress impacts<sup>13-15</sup>. As the workplace related demands (work standardization, longer working hours, shift work and work at night), the quality of social life aggravates, and the economic status is lower than the status of some other professions. The social component is also disturbed, less time remains for the quality development of family relations, satisfying their interpersonal needs and needs that are not related to professional engagement<sup>19-21</sup>. It was shown that the miners are statistically significantly more likely to consume alcohol than those of the control group. Smoking, excessive alcohol and coffee drinking, drug use, poor appetite, high need for food, physical passivity, excessive sports activity and overwork are the result of wrong reaction to stress<sup>22-24</sup>.

### Conclusion

The results indicate the correlation of some sociodemographic variables and interpersonal sources of stress at work among miners. Relative to the age groups, there is a statistically significant difference in the subscales demands, control, relations and changes. The youngest respondents have the highest score, while the minimum score is noted in those aged 45–54 years, and the stress level increases as job demands increase and the level of decision-making decreases.

The value of the control and relations score increases with age, and the value of the change score decreases. Relative to the total years of service, the manager support score is statistically significantly higher in the respondents with less years of service, while the relations score is statistically significantly higher for those with more years of service. The miners with the exposed years of service longer than 15 years have a statistically significantly higher relations score. The values of the control, manager support, relations and working role subscales are statistically significantly lower among miners compared to the control group. The values of the subscales peer support and changes are statistically significantly higher among the miners compared to the control group.

The following prevention measures are proposed: adequate professional orientation, professional selection, professional adaptation, organizational measures, progressive development of knowledge and skills, development of good interpersonal relationships, strengthening the family-organization-company relation, relaxation techniques at the workplace, stress control (personal strategy, organizational strategy, change of lifestyle, i.e. changes in habits related to nutrition, physical activity, smoking, alcoholism, etc.), application of physiological techniques (meditation, resting, spiritual entertainment, i.e., theater, cinema, TV, concerts, etc.), application of cognitive techniques (positive attitude, self-command, acceptance of what cannot be changed).

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