

## **Quantifying multiple work-related psychosocial risk factors: Proposal for a composite indicator based on the COPSOQ II.**

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### ABSTRACT

**Purpose:** To determine national reference values for the Copenhagen Psychosocial Questionnaire (COPSOQ-II) across occupational sectors and develop a composite score to estimate the cumulative effect of multiple work-related stressors, in order to facilitate the implementation of occupational health directives on psychosocial risk assessment.

**Method:** Cross-sectional data was collected via an online questionnaire. The sample included 13104 individuals, and was representative of the general Hungarian adult working population in terms of gender, age, education and occupation. Mean scores were calculated for 18 scales on work environment and for 5 outcome scales of the COPSOQ II across 18 occupational sectors. We analyzed the association between a composite psychosocial risk score (CPRS), reflecting severity of exposure to multiple risk factors, and high stress, burnout, sleep troubles and poor self-rated health.

**Results:** We found occupation-related differences in the mean scores on all COPSOQ II scales. Scores on the “Stress” scale ranged from 47.9 to 56.2, with the highest mean score in accommodation and food services sector. Variability was greatest with respect to emotional demands (range: 40.3-67.6) and smallest with respect to role clarity (range: 70.3-75.7). The prevalence of negative health outcomes increased with the CPRS. Five risk categories were formed, for which the odds ratio of negative outcomes ranged from 1.6-56.5.

**Conclusions:** The sector-specific psychosocial risk profiles covering 18 work environmental factors can be used as a reference in organizational surveys and international comparisons. The CPRS proved to be a powerful predictor of self-reported negative health outcomes.

**Keywords:** psychosocial risk, work stress, burnout, sleeping troubles, composite score, occupational safety and health, COPSOQ

### INTRODUCTION

There is a strong body of evidence showing that stressful psychosocial environments – which are related to work content, work organization, and work-related interpersonal relationships – have a negative effect on employees’ mental health, physical health, and safety. This warranted the formulation of guidelines [1, 2] on occupational safety and health (OSH), which have been translated into regulations and legislation in most European countries and many countries outside of Europe. These regulations impose obligations on all companies to assess, prevent, and manage psychosocial hazards in the workplace regardless of the size of the company, field of activity or form of employment contract or relationship [3]. At present, the challenge is to implement existing policies and act on research findings at the enterprise level. There is a need at both the national and international level for tools and guidelines that would enable organizations, OSH practitioners, and inspectors to assess a variety of work-related health risks, and hence to plan interventions and monitor the risk management process [4, 5].

A variety of methods and tools are used to assess psychosocial risk at work. One of the most widely used instruments is the Copenhagen Psychosocial Questionnaire (COPSOQ), which was developed in Denmark by Kristensen and colleagues for the Danish National Institute of

Occupational Health [6]. The COPSOQ was intended to bridge the gap between research and practice; it was designed to be “theory based, but not attached to one specific theory” [6]. It draws not only on Karasek’s Demand-Control model [7] and Siegrist’s Effort-Reward Imbalance model [8, 9] but also on several other theories of work-related stress in order to provide a comprehensive overview of the psychosocial work environment. Therefore, the COPSOQ has a multidimensional structure that comprises various subscales, which will be presented in detail in the methods section of the present work.

The COPSOQ has been translated into more than 20 languages [10], and has been used in a wide variety of occupational sectors. Its revised version, the COPSOQ II has a long, medium, and short version [11-15]. Numerous studies have confirmed the utility of the COPSOQ as a means of assessing psychosocial environmental differences between workplaces and explaining work environment-related variance in positive emotional states, mental health [16], somatic symptoms [17] and sickness absence [18, 19]. The COPSOQ has also been shown to be useful in monitoring changes within an organization [20-22] or within a country as a result of economic changes [23, 24]. It has been used in international comparative studies as well [25].

Because the COPSOQ is a complex tool, there are several proposed ways to analyze and interpret the results of a COPSOQ-based survey [6, 26]. The most common method is the comparison of the scale means of a target group with the means of a reference group (e.g. the general workforce or other similar workplaces [21, 26]). Other commonly used methods include the examination of the distribution of the sample across categories determined for each subscale [15]; calculation of odds ratios for outcome indicators [18, 19, 15]; and (multivariate) analysis of the correlations among background and outcome variables [27, 19]. These varied methods of analysis allow for specific problem areas in the psychosocial work environment to be identified, and ultimately enable employers to fulfill their legal responsibilities to plan and monitor focused interventions.

However, OSH physicians, inspectors, and employers typically express their need to also have an indicator of the overall work-related psychosocial risk at organizational or unit level. To our knowledge, there is no established method based on the COPSOQ II or on any other similarly complex multiscale questionnaire providing a general indicator that would allow to identify employees at high risk or categorize a workplace as posing a low, moderate or high psychosocial risk for negative work-related health outcomes. A major difficulty in assigning workplaces to risk categories is that they are complex systems in which several stressors may be present simultaneously. Psychosocial stressors are often related, which makes it difficult to make predictions about the effects of individual risk factors on health. Another complication is that certain psychosocial stressors are fundamental to the nature of the role: in some occupations the physical demands or monotony of the work, whereas in others the emotional demands or unpredictability of the work are typical sources of stress. Clearly, stress is part of life and can be adaptive; it only becomes harmful when it is chronic and intense, and goes beyond the individual’s coping ability. This complexity however, makes it difficult to objectively determine what constitutes excessive, potentially harmful or avoidable risk.

The aim of our study, therefore, was to develop a new indicator to assess the cumulative effect of multiple psychosocial risk factors in order to facilitate the quantification of overall psychosocial risk at both the individual and the organizational levels. We propose a composite psychosocial risk score (CPRS) that is based on the number of COPSOQ II (medium version) scales where high intensity or chronicity of work related stressors is reported. We explored the utility of this CPRS in predicting adverse physical and mental health outcomes. We also defined distinct psychosocial risk categories considering the associations between the CPRS and the probability of certain adverse health outcomes. In a more traditional approach to aid risk assessment, we also calculated the mean values of the COPSOQ II scales for all occupational

sectors. These standards – based on a large, representative Hungarian working population sample – can serve as reference values for surveys determining the detailed psychosocial risk profile of various occupational groups, and for international comparisons as well.

## **METHODS**

### ***Subjects and data collection***

The study protocol was approved by the Regional and Institutional Committee of Science and Research Ethics at Semmelweis University (TUKEB No 195/2012). Data were collected using an online questionnaire accessed via a secure website. As an incentive to complete the questionnaire, respondents received immediate automatized feedback comparing their own results with the current national and sector-specific mean scores.

Several sampling strategies were used simultaneously to increase sample size. Information about the study and access to the online questionnaire were distributed via email, social media sites and websites of medical universities and non-profit organizations, and also through media coverages: online newspapers, public and commercial television and radio broadcasts. Data were collected between May 2013 and March 2014.

Over the whole data collection period, 19,280 persons started filling in the questionnaire and 13,932 (72.2%) respondents completed it. Eight hundred and twenty-eight questionnaires (6%) were excluded from the data set due to missing data or invalid answers. The data cleaning resulted in a database of 13,104 respondents who had a paid work for at least the 3 previous months. Demographic characteristics of the sample are summarized in Table 1.

### **Table 1. here**

The raking method of weight calibration was used to achieve representativity in terms of gender, age, education, and the 18 occupational sectors, based on data from the Hungarian Central Statistical Office [28]. Characteristics of the weighted sample are also presented in Table 1, while weighted descriptive data for the COPSOQ II – organized according to occupational groups – are provided in Table 2.

### ***Measure***

The Hungarian version of the COPSOQ II [29] was developed in consultation with the International COPSOQ Network [10]. The middle version of the questionnaire [11] was translated and linguistically validated in accordance with international guidelines [30]. The validation study indicated that the Hungarian version had adequate psychometric properties [29].

The Hungarian version of the COPSOQ II is comprised of 28 scales overall. Twenty-two predictor scales are grouped into five dimensions (“Demands at work”, “Influence and development”, “Interpersonal relations and leadership”, “Values at the workplace”, and “Offensive behaviors”). Some of the scales measure negative aspects of workplace psychosocial environment, such as work pace, emotional demands, or role conflict; we refer to these scales as “strain scales”. Other scales measure positive aspects of the psychosocial environment such as support, reward, justice, etc.; we refer to these as “resource scales”.

Psychosocial risk is positively associated with scores on strain scales and negatively associated with scores on resource scales.

The 5 outcome scales are “Stress”, “Burnout”, “Sleeping troubles”, “Self-rated health” and “Job satisfaction”. The “Work-family conflict” scale was considered as an intermediary variable [31].

### **Table 2. Here**

The COPSOQ II. scales in the study are listed in Table 2, showing the means, the number of items and the Cronbach’s alpha values for the present study, except for the four offensive behavior scales. For those scales (bullying, sexual harassment, threats of violence, physical violence) detailed results will be presented elsewhere, here we report only prevalence at the population level (see Figure 1) based on the international guidelines stating that any offensive behavior at the workplace is unacceptable [32].

Items are scored using four- or five-point Likert scales and all scale scores – means of the item responses – are transposed to a 0-100 range scale for comparability [11]. The score range of 75-100 in case of the strain scales and the range of 0-25 on the resource scales were considered as “high risk”, corresponding to the response options of “to a large” and “a very large extent” (strain scales) or “to a small” and “a very small extent” (resource scales). Report on an offensive behavior with any frequency was considered as “high risk” in accordance with previous studies [19].

The composite psychosocial risk score (CPRS) was calculated as the total number of strain, resource, and offensive behavior scales for which the respondent’s score was categorized as “high risk” (scales included in the CPRS score are shown on Figure 1). As there are 22 such scales, the CPRS can range between 0 and 22.

For the health outcome scales, a “problematic” range was also defined; high stress and high burnout were defined as the score range of 75-100. Sleeping troubles were considered a health problem if they occurred more often than “Some of the time” (score range 51-100). Responding “Fair” or “Poor” in response to the question about “Self-rated health” was taken as an indication of “poor health”.

### ***Statistical analyses***

Statistical analyses were carried out using SPSS Version 23.0. The sample was weighted according to the Deming-Stephan iterative proportionality fit model (raking method) [33], more specifically our sample was fitted to the data of 3,877,000 people (Hungarian working population). We calculated descriptive statistics (mean, standard deviation) and an indicator of internal consistency (Cronbach’s alpha). As the distribution of scores for the COPSOQ scales deviated from the normal distribution, we used the Kruskal-Wallis test to assess group difference. Risk was estimated using odds ratios.

## **RESULTS**

### ***Psychosocial risk profile of occupational sectors***

Means and standard deviations for all COPSOQ II scales and occupational sectors are presented in Table 2. The 18 occupational sectors were ranked based on the scores on the “Stress” scale being the primary outcome variable. The six highest scores for each scale were highlighted in

bold and underlined. Mean “Stress” score ranged from 47.9 to 56.2; the six most stressful occupational sectors were accommodation and food services; construction; commerce; manufacturing; transport and postal services; and health and social care sector. The same sectors were almost always characterized by similarly high ranks with respect to the other three health related outcome scales (Burnout, Sleeping troubles, and Self-rated health) as well. The psychosocial factors scored as the most stressful by the respondents were (high) “Work pace” (M = 63.0), (low) “Influence” (M = 36.8) and (lack of) “Justice and respect” (M = 39.3). The proportions of the sample who reported having been the victim of various forms of offensive behavior was as follows: bullying: 43.0%; sexual harassment: 9.1%; threats of violence: 10.8%; physical violence 1.7%.

The Kruskal-Wallis test indicated occupational sector differences ( $p < 0.001$ ) in the mean score for all scales (Table 2). Variability was greatest for “Emotional demands”, ranging from 40.3 in transport to 67.6 in health sectors (chi-squared = 1439.0) and smallest for “Role clarity”, ranging from 70.3 to 75.7 (chi-squared = 82.4). The variability in scores on the health outcome scales was relatively small, the differences between the highest and the lowest mean scores were less than 10 points (less than 0.5 SD; chi-squared: 102.2-145.5).

The results confirmed that some risk factors were strongly associated with certain type of occupations, for example “Emotional demand” scores were highest in the health and social care; education; and defense sectors. “Influence at work” was lowest in the transportation and postal services; public services; and defense sectors. More “Sleeping troubles” were reported in sectors where shift work is typical, such as manufacturing; health and social care; transportation and postal services; catering; and entertainment. Table 2 also shows that occupational sectors with high “Stress” and “Burnout” scores were also characterized by high scores on several predictor scales.

### ***The prevalence of high risk***

For each COPSOQ II scale, we determined the proportion of respondents in the high risk range. The population-level prevalence data are presented on Figure 1, which shows that some psychosocial risk factors such as low control, high work pace and bullying are widespread and very often perceived as a significant problem at work, whereas others are rarely reported as a problem. The prevalence data also imply that very often multiple risk factors are present simultaneously.

### **Figure 1. here**

The composite psychosocial risk score CPRS indicates the number of scales where high risk is reported as an estimate of the cumulative effect of multiple psychosocial stressors. The distribution of the CPRS is described in detail in Table 3. The data show that only 13.5% of respondents felt their work environment was free from significant psychosocial stressors, a further 16.4% reported one stressor, 13.1% reported two stressors, while 11.2% of the sample indicated the presence of 10 or more significant risk factors.

### **Table 3. Here**

### ***The cumulative effect of multiple psychosocial stressors on health outcomes***

We found a linear relationship between cumulative risk and the presence of psychological and/or physical symptoms of poor health (high stress, high burnout, sleeping troubles and poor health). Figure 2 illustrates the positive association between the prevalence of negative health outcomes and the number of stressors workers are exposed to. In Table 3, odds ratios for the cumulative effect of multiple psychosocial stressors on the probability of experiencing negative health outcome are reported. Only 4.0% of respondents in the “no risk” category reported “high stress”, which figure was 9.6% for those reporting exposure to one stressor, 13.74% with exposure to two stressors and not less than 86.1% among those reporting 15 or more risk factors. We found a very similar pattern in the case of the other three health outcome indicators (burnout, sleeping troubles, and poor health) as well (Table 3).

### **Figure 2. here**

Based on the patterns of increase in risk for poor health outcomes, five CPRS categories were established: No risk (0 stressors), Low risk (1-2 stressors), Moderate risk (3-6 stressors), High risk (7-10 stressors), and Very high risk (>10 stressors). The distribution of these categories was as follows: no risk: 13.5%; low risk: 29.5%; moderate risk: 32.7%; high risk: 16.1%; very high risk: 8.1%. Figure 3 presents odds ratios with 95% confidence intervals illustrating the increase of the risk of negative outcomes across the five CPRS categories, thus confirming the importance of the cumulative effect of stressors.

### **Figure 3. here**

## **DISCUSSION**

Based on our survey in a representative Hungarian population sample, we provided an overview of the sector-specific mean scores of the COPSOQ scales. These findings may be used as reference values for further studies. A similar database providing reference values for the major occupational groups is already available in Germany [14, 27] and studies with representative samples have also been carried out in Denmark [24, 11] and Spain [34, 15]. As our study confirmed the existence of significant differences in work-related psychosocial risk factors related to job content, these sector-specific scores can allow a more nuanced evaluation of the relative psychosocial risk at a specific workplace than the use of general working population values. For instance, in case of emotional demands – which has proven to be largely related to job content –, we found large differences between occupational sectors. In addition, striking similarities between Hungarian and German [14] workers were also identified: the “Emotional demands” scores among health and social workers were 67.6 in Hungary and in the 65.0-75.0 range in Germany, while in the manufacturing sector those values were 44.4 and 40.0, respectively. Comparable population-based studies conducted in Denmark [24] and Spain [34] also found similar variations in emotional demands between occupational groups. This patterning of the results confirms that some psychosocial stressors may be almost unavoidable in certain occupations. However, we would like to emphasize that this does not mean that stressors strongly associated with job content should not be considered as risk factors; rather, it highlights the importance of being aware of the risk and of managing such risks at the workplace level. Numerous studies have confirmed, for example, that high emotional demand is an important risk factor for burnout and sick leave in the case of health care workers [35, 21, 36].

A key question in occupational safety and health is the identification of clinically significant psychosocial risk. As the COPSOQ II has been constructed to assess such risk, all studies using it found linear relationships between scores on the psychosocial environment indicator scales and the health outcome scales; however, those correlations are weak to moderate [37, 29, 22]. It is also known that the various aspects measured are not independent from each other and it is difficult to define the independent effect of an individual factor [6]. In multivariate analysis of the COPSOQ variables, some individual scales were found to be stronger predictors of the negative health outcomes than others; work-family conflict for example was identified as the most powerful predictor [18, 37, 27]. The setback of this approach is that a powerful indicator can mask the effects of other variables. Moreover, in the particular case of the work-family conflict scale, it has been suggested as a mediator rather than a primary predictor variable [31], and this is how we treated it in our analysis (did not include it into the CPRS).

While the use of a multiscale profile has the advantage of providing a nuanced picture and enabling the identification of problem areas respectively planning of focused interventions and multivariate analysis allows to identify the most important risk factors; there is still a need expressed by employers and the OSH specialists to have a summary indicator at the end of a COPSOQ-based survey that answers questions like: ‘What is the overall psychosocial risk level at the workplace?’ and ‘Are there employees or certain employee groups being exposed to clinically significant psychosocial risk?’ To our knowledge, this is the first study to address these questions by suggesting a composite psychosocial risk score (CPRS) based on the number of high frequency or high intensity work-related psychosocial stressors. Each COPSOQ II scale included was considered of equal importance as weights for the individual scales could be defined only for specific (e.g., occupational) subgroups considering the large number of potential confounders (gender, national differences in occupational standards and working conditions, individual values and coping abilities etc.). We argue that if the individual’s score in an area reflects considerable difficulties then it is of real importance for him/her and might be reasonably considered as a risk factor for mental and / or physical health problems regardless of whether the specific problem is typical or rather exceptional among the employees of a given occupation.

The concept of considering the combined effect of several risk factors to provide a better estimate of overall risk is not new; it has been already used in the two most widely used models of work stress: Karasek’s buffer model [7, 38], which includes demand, control, and social support; and Siegrist’s imbalance model [8], which represents risk in terms of the ratio of effort to reward. The feasibility of devising a composite score to represent the combined effect of all risk factors has been confirmed in clinical settings as well. For example, risk for adult health problems was shown to be associated with the total number of childhood adversities experienced [39] and in the case of type 2 diabetes, several partially independent risk factors were shown to have an additive effect on the risk of complications [40].

Our results clearly indicate that the CPRS, which quantifies the cumulative effect of multiple work-related risk factors, was a powerful predictor of both mental and somatic health outcomes. Our findings also confirm our theoretical assumption that most jobs involve exposure to some stressors. Only 13.5% of the sample reported a stressor-free work environment, while 57% of the respondents identified 3 or more work-related stressors. Regarding categorization, we are aware that it always implies a loss of information; however, it has advantages for the everyday practice. Therefore, we argue for the use of risk categories based on the patterns observed in our large, population-based sample. Among those categorized as at high or very high risk (7 or more stressors reported), the prevalence of negative health outcomes was more than 40% on all measures. In our sample, 24% of the respondents fall into the high or very high risk category. This is in accordance with the joint report of the European Agency for Safety and Health at



Work (EU-OSHA) and the Eurofound [41] indicating that 25% of European workers experience work-related stress for all or most of their working time, and a similar proportion reports that work affects their health negatively. We propose that the percentage of workers in the high risk category can be an approximate indicator of the psychosocial risk at the given workplace. If this is above 25%, the organization or the unit is a very high risk workplace, where risk reduction measures are especially needed or eventually can be ordered by the labor inspectorates. The detailed psychosocial profile based on the consideration of each individual COPSOQ II scales provides the basis for planning and monitoring such interventions.

Some strengths of the present study include the large, population-based sample, the use of an internationally well-known, valid questionnaire, and the standard classification of job sectors all contributing to the generalizability of our findings. In addition, the online data collection has several advantages: it is independent of employers, ensures respondents' anonymity and enables responses to be given at any point during the window of availability. Studies suggest that this method of data collection has no negative effect on the accuracy of the questionnaire data, and that most people prefer computerized over paper-and pencil formats [42]. We also believe that providing respondents with immediate, automated feedback comparing their individual stress profile to the population and sector means acted as an incentive to provide accurate data. However, limitations of the present study also must be acknowledged. First, although the sample was large and contained a good number of respondents from all occupational sectors, it was not register-based. Further, the online survey could only be completed by individuals with access to the Internet (78% of the Hungarian adult population is estimated to use regularly the Internet [43] and we assume that this rate is even higher among active workers). Finally, the cross-sectional design of the survey does not allow us to draw conclusions about causality between stress factors and negative health outcomes; further research with longitudinal design is needed to investigate the predictive value of the CPRS categories.

### ***Practical implications***

Our study presents a new method of quantifying the cumulative effect of multiple work-related psychosocial risk factors allowing additional considerations in workplace surveys based on the COPSOQ II. The assignment of psychosocial risk categories provides useful information for employers, policymakers, and OSH inspectors at the enterprise level and for occupational health practitioners at the individual level. By publishing occupational sector-specific standards for the Hungarian working population, we provide reference values that can be used for organizational surveys as well as international comparisons.

### **Compliance with Ethical Standards**

Conflicts of Interest: The authors declare that they have no conflict of interest.

Ethical approval: All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.



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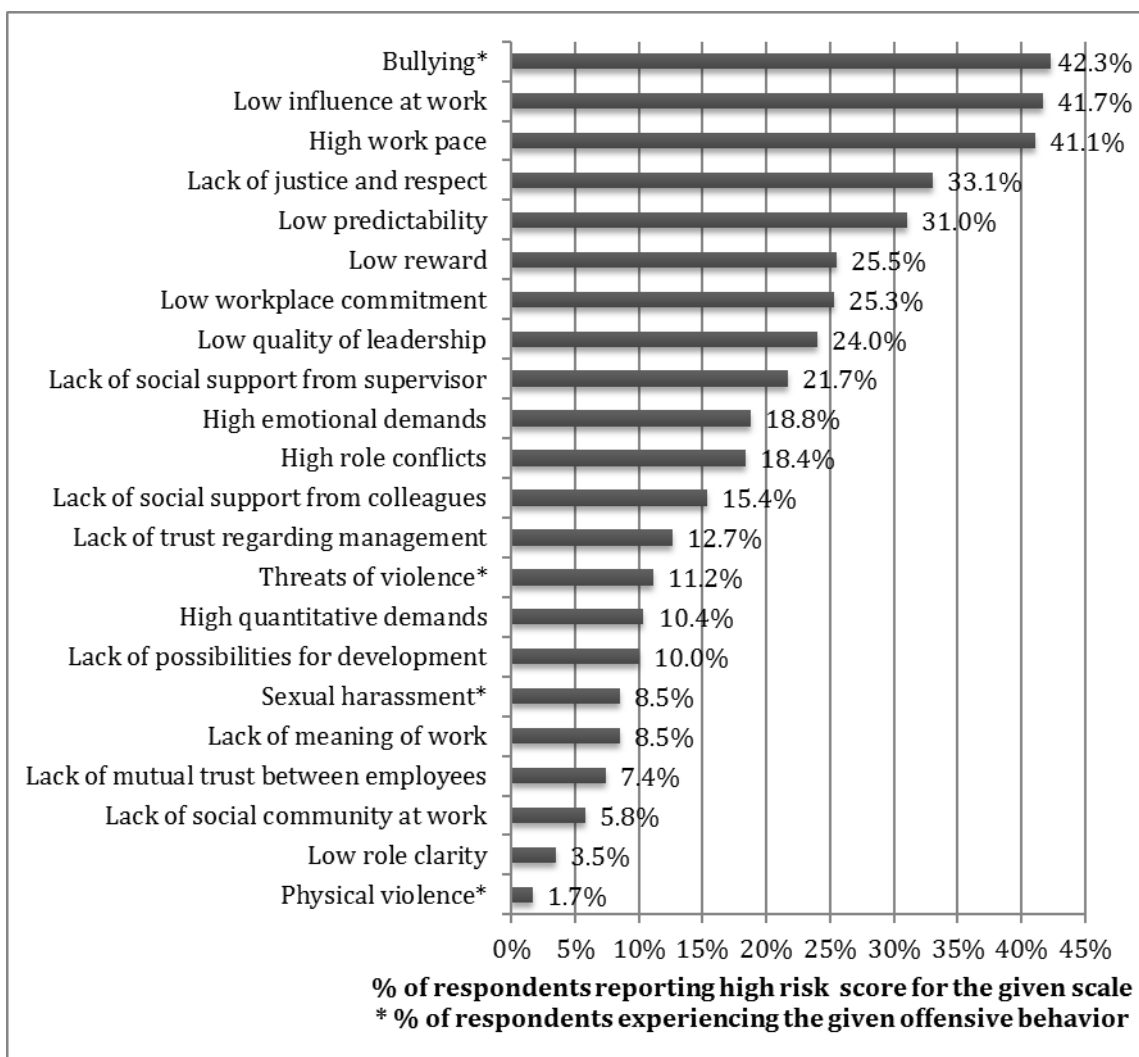
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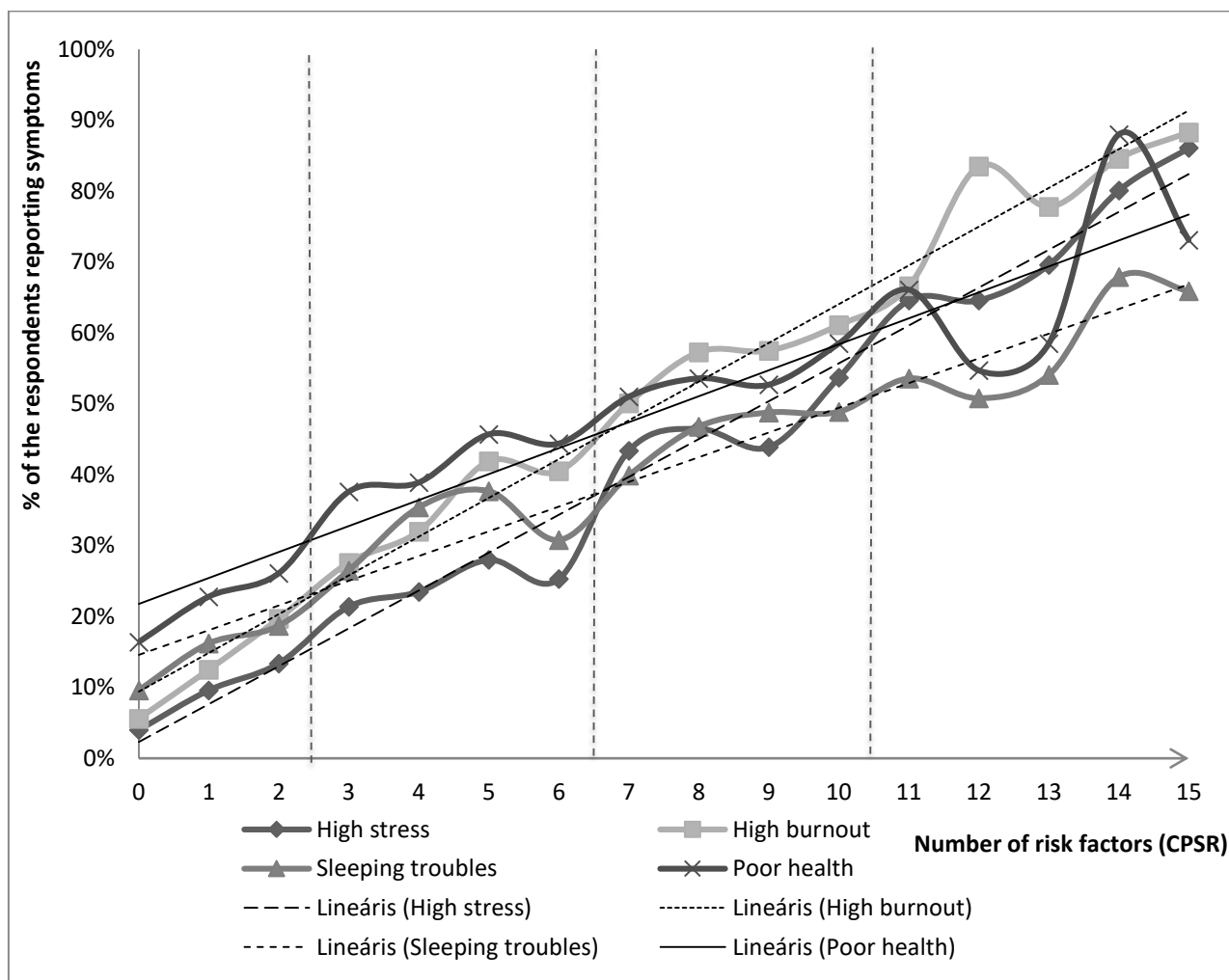
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**FIGURE 1. PREVALENCE OF HIGH RISK ON EACH OF THE COPSOQ II INDICATOR SCALES (N=13104)**



**FIGURE 2. CUMULATIVE RISK AND PREVALENCE OF NEGATIVE HEALTH OUTCOMES**

(the fitted ordinary least squares line confirm a linear correlation)



**FIGURE 3. RISK CATEGORIES AND PREVALENCE OF NEGATIVE HEALTH OUTCOMES:  
odds ratio (OR) compared to the „no risk (0 stressor)” category**

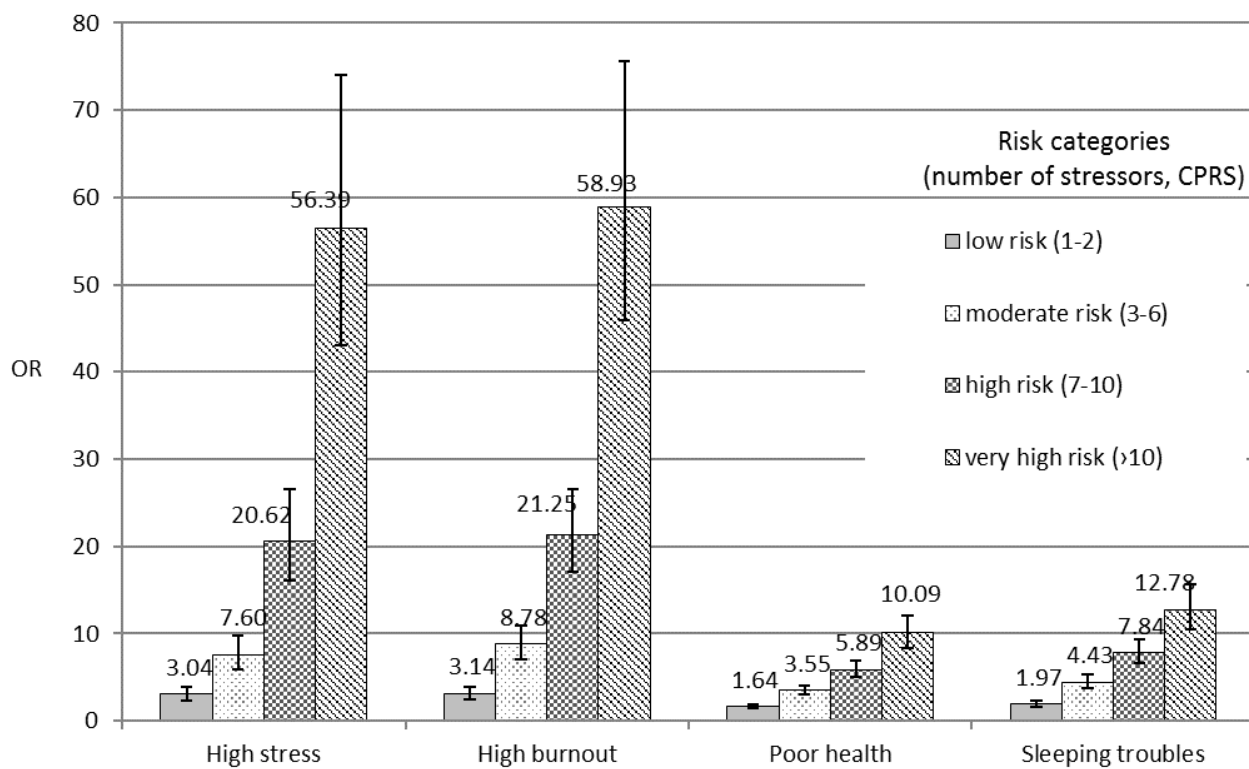




TABLE 1 DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

Demographic variable		started: N=19280		included: N=13104		weighted
		N	%	N	%	%
gender	women	11637	60.4	8323	63.5	53.7
	men	7642	39.6	4781	36.5	46.3
	missing	1	0.0	0	0.0	0.0
age group	18-29	6036	31.3	3675	28.0	17.0
	30-39	6346	32.9	4359	33.3	30.6
	40-49	3990	20.7	2857	21.8	26.0
	50-59	2447	12.7	1890	14.4	23.3
	≥60	460	2.4	323	2.5	3.1
	missing	1	0.0	0	0.0	0.0
level of education	primary (8 years)	242	1.3	105	0.8	10.8
	vocational or technical school (10-12 years)	4896	25.4	3224	24.6	28.8
	high school (12-13 years)	2852	14.8	1819	13.9	34.0
	university or college diploma	11260	58.4	7956	60.7	26.3
	missing	30	0.2	20	0.2	0.1
current position	unskilled worker	1330	6.9	780	6.0	15.4
	skilled worker	3427	17.8	2243	17.1	25.6
	leader without diploma	1043	5.4	719	5.5	10.7
	professional	6308	32.7	4351	33.2	20.3
	administrative	4178	21.7	2892	22.1	18.4
	middle manager	2023	10.5	1483	11.3	6.3
	upper manager	969	5.0	636	4.9	3.3
missing	2	0.0	0	0.0	0.0	
residence	capital	7943	41.2	5374	41.0	31.3
	chief town of a county	3693	19.2	2579	19.7	20.2
	town	5220	27.1	3509	26.8	32.9
	village	2423	12.6	1642	12.5	15.6
	missing	1	0.0	0	0.0	0.0
marital status	single	5796	30.1	3702	28.3	22.2
	common-law partner	4690	24.3	3132	23.9	22.7
	married	7009	36.4	4964	37.9	42.7
	divorced	1552	8.0	1147	8.8	10.8
	widow	232	1.2	159	1.2	1.6
	missing	1	0.0	0	0.0	0.0

**TABLE 2 PSYCHOSOCIAL RISK FACTORS ACROSS OCCUPATIONAL SECTORS: COPSOQ II SCALES MEANS AND PSYCHOMETRIC CHARACTERISTICS PART I**

(We highlighted with **bold underlined** the six highest risk scores\* for each scale.)

	Total sample		Outcomes					Demands at work			Influence and development			
	N	%	Stress	Burnout	Sleeping troubles	Self-rated health*	Job satisfaction*	Quantitative demands	Work pace	Emotional demands	Influence*	Possibilities for development*	Meaning of work*	Commitment to the workplace*
No of items	83		4	4	4	1	4	4	3	4	4	4	3	4
Cronbach alpha			0.91	0.91	0.87	-	0.83	0.82	0.89	0.71	0.79	0.76	0.81	0.84
CATERING	554	4.2	<b><u>56.2</u></b>	<b><u>61.8</u></b>	<b><u>40.5</u></b>	45.2	<b><u>47.9</u></b>	42.9	<b><u>71.8</u></b>	<b><u>52.5</u></b>	37.1	<b><u>56.8</u></b>	<b><u>61.9</u></b>	<b><u>45.3</u></b>
CONSTRUCT	831	6.3	<b><u>55.1</u></b>	<b><u>60.0</u></b>	37.8	<b><u>43.0</u></b>	<b><u>48.3</u></b>	<b><u>46.9</u></b>	62.9	47.2	42.4	65.2	68.5	47.0
COMMERCE	1918	14.6	<b><u>53.8</u></b>	<b><u>57.2</u></b>	<b><u>39.0</u></b>	<b><u>43.9</u></b>	51.6	43.8	62.0	51.8	39.9	59.8	65.1	49.4
MANUFACT	2710	20.7	<b><u>53.6</u></b>	<b><u>58.7</u></b>	<b><u>42.2</u></b>	<b><u>41.9</u></b>	<b><u>49.7</u></b>	42.3	<b><u>68.0</u></b>	44.4	<b><u>33.2</u></b>	<b><u>53.9</u></b>	<b><u>63.3</u></b>	<b><u>45.8</u></b>
POST-TRP	375	2.9	<b><u>53.4</u></b>	<b><u>58.3</u></b>	<b><u>41.3</u></b>	<b><u>42.3</u></b>	<b><u>45.5</u></b>	39.5	<b><u>64.6</u></b>	49.9	<b><u>26.4</u></b>	<b><u>52.7</u></b>	<b><u>62.9</u></b>	<b><u>45.2</u></b>
HEAL-SOC	899	6.9	<b><u>52.6</u></b>	<b><u>58.9</u></b>	<b><u>41.6</u></b>	<b><u>42.4</u></b>	<b><u>49.6</u></b>	43.6	<b><u>65.3</u></b>	<b><u>67.6</u></b>	34.7	64.4	74.3	51.7
ADMIN	451	3.4	52.4	55.3	37.0	45.6	55.0	42.6	60.9	50.2	37.4	<b><u>58.1</u></b>	64.4	51.9
PUBLIC	595	4.5	52.3	56.0	38.8	<b><u>44.3</u></b>	51.9	<b><u>49.1</u></b>	<b><u>63.3</u></b>	<b><u>53.1</u></b>	<b><u>30.1</u></b>	<b><u>58.4</u></b>	<b><u>62.6</u></b>	<b><u>45.4</u></b>
FINANCE	317	2.4	51.9	54.7	35.8	47.3	55.8	<b><u>47.1</u></b>	<b><u>64.7</u></b>	50.8	<b><u>33.6</u></b>	62.7	66.2	51.3
DEFENCE	509	3.9	51.7	53.7	36.7	47.0	<b><u>46.0</u></b>	41.8	60.6	<b><u>60.3</u></b>	<b><u>30.7</u></b>	59.1	<b><u>61.9</u></b>	<b><u>42.3</u></b>
STORE-TRP	508	3.9	51.5	53.2	35.1	48.0	52.1	41.1	60.0	40.3	<b><u>32.3</u></b>	<b><u>51.0</u></b>	<b><u>62.0</u></b>	<b><u>43.7</u></b>
ENTERTAIN	212	1.6	51.2	55.0	<b><u>39.8</u></b>	48.1	55.8	42.6	55.0	<b><u>54.8</u></b>	43.8	64.5	71.2	54.8
AGRIC	677	5.2	51.1	53.2	37.1	46.1	57.2	40.1	60.4	42.1	43.4	59.4	70.3	53.5
SCIENCE	450	3.4	50.2	54.9	32.8	50.8	59.5	<b><u>51.3</u></b>	60.6	45.9	43.8	71.2	71.9	56.3
IT-COM	352	2.7	49.5	53.9	32.4	50.2	57.8	<b><u>48.6</u></b>	62.3	44.5	42.9	66.5	65.8	54.6
EDUC	1063	8.1	49.4	55.6	37.0	45.1	53.1	<b><u>48.0</u></b>	57.7	<b><u>63.7</u></b>	39.6	68.4	73.8	54.5
ENERGY	367	2.8	48.0	53.0	35.1	48.6	55.0	41.1	56.6	43.7	34.3	58.0	66.3	51.3
SERVICE	313	2.4	47.9	52.2	33.1	46.1	56.5	37.6	55.0	47.0	41.2	59.1	68.1	55.2
Total	13104	100.0	52.4	56.8	38.6	44.7	51.7	43.9	63.0	50.7	36.8	59.7	66.4	49.1
Mean Range			47.9 - 56.2	52.2 - 61.8	32.4 - 42.2	41.9 - 50.8	45.5 - 59.5	37.6 - 51.3	55.0 - 71.8	40.3 - 67.6	26.4 - 43.8	51.0 - 71.2	61.9 - 74.3	42.3 - 56.3
Total SD			24.4	24.8	25.9	21.8	21.7	21.2	23.3	22.1	23.7	22.5	23.9	26.3
SD Range			22.4 - 27.1	22.9 - 26.3	22.9 - 27.6	18.8 - 23.0	17.5 - 23.5	18.8 - 23.5	21.4 - 25.4	18.8 - 23.5	19.3 - 26.4	19.2 - 23.9	20.9 - 26.5	22.2 - 28.7
Kruskal-Wallis Chi-Square			102.2	147.3	132.4	145.6	249.9	260.4	424.4	1439.0	449.4	632.4	424.1	260.6
Asymp. Sig.			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001

\* on the resource scales marked with \* lower scores indicate higher risk

Table 2 continued

	Interpersonal relations and leadership								Values at the workplace			Work-family conflict
	Predictability*	Rewards* (recognition)	Role clarity*	Role conflicts	Quality of leadership*	Social support from supervisor*	Social support from colleagues*	Social community at work*	Trust regarding management*	Mutual trust between employees*	Justice and respect*	
No of items	2	3	3	4	4	3	3	3	4	3	4	4
Cronbach alpha	0.72	0.87	0.71	0.69	0.87	0.85	0.85	0.78	0.76	0.67	0.83	0.84
CATERING	47.3	49.3	73.2	<b>55.2</b>	<b>47.4</b>	<b>51.7</b>	<b>51.2</b>	<b>67.9</b>	54.8	<b>55.6</b>	<b>39.1</b>	<b>57.2</b>
CONSTRUCT	<b>44.2</b>	49.8	72.1	<b>55.6</b>	49.8	52.2	<b>51.1</b>	<b>68.7</b>	53.2	59.8	39.7	<b>55.5</b>
COMMERCE	47.6	49.0	73.2	53.2	47.6	52.9	54.3	70.9	53.8	58.7	41.3	51.4
MANUFACT	<b>41.7</b>	<b>42.2</b>	<b>70.4</b>	<b>55.2</b>	<b>43.8</b>	<b>48.7</b>	<b>50.6</b>	<b>66.0</b>	<b>48.7</b>	<b>54.5</b>	<b>35.0</b>	50.7
POST-TRP	<b>40.1</b>	<b>39.4</b>	<b>70.8</b>	<b>58.6</b>	<b>42.0</b>	<b>45.4</b>	<b>50.2</b>	69.4	<b>42.2</b>	<b>56.1</b>	<b>29.6</b>	<b>52.3</b>
HEAL-SOC	<b>43.0</b>	<b>43.9</b>	72.0	<b>56.3</b>	<b>47.4</b>	<b>49.8</b>	52.2	<b>68.2</b>	<b>50.3</b>	<b>56.5</b>	<b>34.8</b>	<b>52.1</b>
ADMIN	50.5	51.4	<b>70.8</b>	53.0	50.7	54.6	56.7	69.6	55.6	<b>55.8</b>	44.0	49.0
PUBLIC	<b>39.6</b>	<b>47.7</b>	<b>70.8</b>	52.3	47.7	53.1	<b>51.0</b>	<b>67.9</b>	<b>51.3</b>	<b>55.3</b>	<b>36.2</b>	49.5
FINANCE	49.4	51.7	73.0	49.6	53.3	58.0	54.3	69.0	57.1	61.5	45.8	49.4
DEFENCE	<b>37.3</b>	<b>43.7</b>	<b>70.7</b>	<b>60.6</b>	<b>46.4</b>	<b>51.9</b>	53.7	69.4	<b>45.0</b>	59.0	<b>30.8</b>	48.7
STORE-TRP	45.0	<b>45.7</b>	71.3	52.3	<b>45.5</b>	<b>51.5</b>	<b>49.6</b>	<b>64.7</b>	<b>52.5</b>	57.3	40.0	50.0
ENTERTAIN	49.6	52.8	71.5	50.4	48.1	52.1	53.9	69.8	54.2	57.9	41.9	<b>52.7</b>
AGRIC	48.8	53.8	75.7	46.4	52.6	58.3	55.1	73.5	56.8	60.0	45.0	51.4
SCIENCE	52.5	57.1	72.9	48.6	54.4	57.7	53.5	71.8	60.6	63.7	47.5	50.7
IT-COM	48.7	54.9	<b>70.3</b>	52.2	52.9	58.9	56.3	72.5	57.9	64.3	47.2	51.8
EDUC	45.7	52.3	71.0	53.8	50.5	52.4	51.9	68.7	56.0	58.8	41.2	<b>53.3</b>
ENERGY	47.5	48.8	72.2	52.8	49.0	52.4	51.3	69.1	53.1	58.1	43.3	44.8
SERVICE	52.0	57.3	75.3	47.4	51.6	57.8	56.6	73.7	59.3	62.8	46.4	45.3
Total	45.1	48.0	71.9	53.7	47.9	52.3	52.5	68.9	52.6	57.8	39.3	51.3
Mean Range	37.3 - 52.5	39.4 - 57.3	70.3 - 75.7	46.4 - 60.6	42.0 - 54.4	45.4 - 58.9	49.6 - 56.7	64.7 - 73.7	42.2 - 60.6	54.5 - 64.3	29.6 - 47.5	44.8 - 57.2
Total SD	25.2	26.3	19.8	20.0	25.5	26.4	22.0	21.7	21.3	20.0	22.2	27.8
SD Range	20.9 - 27.6	23.7 - 27.5	18.1 - 20.8	18.5 - 22.4	22.9 - 27.5	24.3 - 27.6	19.6 - 24.5	19.8 - 23.2	19.0 - 23.6	17.4 - 22.9	17.9 - 24.4	25.7 - 29.8
Kruskal-Wallis Chi-Square	275.0	381.1	82.4	267.4	179.4	175.4	106.1	134.6	415.9	191.4	485.1	88.1
Asymp. Sig.	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001

**Abbreviation of the 18 occupational sectors based on the categorization of the Hungarian Statistical Office**

ADMIN: Administrative and support service; AGRIC: Agriculture; forest; game and fisheries management; CATERING: Accommodation and food service; COMMERCE: Wholesale and retail trade; repair of motor vehicles; real estate; CONSTRUCT: Construction; DEFENCE: Defence (jurisdiction; military; fire service); EDUC: Education; ENERGY: Energy; mining; water and waste management; ENTERTAIN: Arts; entertainment; sport and recreation; FINANCE: Financial and insurance activities; HEAL-SOC: Human health; social work activities; IT-COM: IT and communication; MANUFACT: Manufacturing; POST-TRP: Passenger transport; postal services; PUBLIC: Public administration; social security; SCIENCE: Professional, scientific and technical activities; SERVICE: Other services (politics; NGOs, repair; beauty; undertaking etc.); STORE-TRP: Transportation and storage;

Table 3 Cumulative psychosocial risk scores and the prevalence of negative health outcomes (percentages % \*\* and odds ratios OR\*\*\*)

CPRS*	Total		High stress		High burnout		Sleeping troubles		Poor health	
	N=13104	100%	% of resp**	OR (CI)***	% of resp**	OR (CI)	% of resp**	OR (CI)	% of resp**	OR (CI)
<b>0</b>	1767	13.5	4.0	1.00 (1.00-1.00)	5.6	1.00 (1.00-1.00)	9.6	1.00 (1.00-1.00)	16.4	1.00 (1.00-1.00)
<b>1</b>	2148	16.4	9.6	2.55 (1.93-3.36)	12.5	2.41 (1.90-3.07)	16.2	1.81 (1.49-2.20)	22.8	1.51 (1.28-1.78)
<b>2</b>	1721	13.1	13.4	3.69 (2.80-4.86)	19.7	4.14 (3.28-5.24)	18.7	2.16 (1.77-2.64)	26.1	1.81 (1.53-2.15)
<b>3</b>	1439	11.0	21.4	6.51 (4.98-8.52)	27.6	6.42 (5.08-8.10)	26.5	3.39 (2.78-4.12)	37.6	3.08 (2.60-3.64)
<b>4</b>	1114	8.5	23.5	7.35 (5.58-9.67)	32.0	7.94 (6.26-10.08)	35.4	5.14 (4.21-6.28)	38.9	3.25 (2.72-3.89)
<b>5</b>	946	7.2	28.0	9.30 (7.05-12.26)	41.9	12.12 (9.53-15.42)	37.7	5.69 (4.64-6.99)	45.7	4.31 (3.59-5.18)
<b>6</b>	793	6.0	25.3	8.11 (6.01-10.80)	40.5	11.45 (8.94-14.67)	30.8	4.18 (3.36-5.20)	44.4	4.08 (3.37-4.95)
<b>7</b>	682	5.2	43.4	18.32 (13.82-24.28)	50.1	16.94 (13.16-21.80)	39.9	6.25 (5.01-7.79)	51.0	5.31 (4.34-6.51)
<b>8</b>	532	4.1	46.5	20.79 (15.52-27.84)	57.3	22.62 (17.34-29.51)	46.8	8.27 (6.55-10.43)	53.6	5.91 (4.76-7.36)
<b>9</b>	484	3.7	43.9	18.71 (13.89-25.19)	57.5	22.81 (17.39-29.91)	48.8	8.94 (7.04-11.35)	52.7	5.70 (4.56-7.13)
<b>10</b>	416	3.2	53.7	27.74 (20.43-37.67)	61.1	26.40 (19.90-35.03)	48.9	9.10 (7.02-11.54)	58.5	7.22 (5.68-9.18)
<b>11</b>	362	2.8	64.6	43.67 (31.69-60.18)	66.6	33.54 (24.90-45.18)	50.8	9.71 (7.49-12.59)	66.1	9.95 (7.66-12.93)
<b>12</b>	272	2.1	64.6	43.55 (30.87-61.42)	83.5	84.94 (58.16-124.04)	58.5	13.22 (9.91-17.64)	54.7	6.17 (4.67-8.15)
<b>13</b>	135	1.0	69.6	54.77 (35.38-84.78)	77.8	58.93 (37.44-92.76)	54.1	11.06 (7.61-16.07)	58.5	7.20 (4.96-10.44)
<b>14</b>	156	1.2	80.1	96.32 (60.84-152.48)	84.6	92.61 (57.31-149.65)	67.9	19.92 (13.74-28.88)	88.0	37.49 (22.53-62.38)
<b>≥15</b>	137	1.0	86.1	148.35 (86.49-254.46)	88.3	127.34 (72.78-222.80)	65.9	18.19 (12.37-26.76)	73.1	13.92 (9.30-20.83)

\* CPRS: Composite Psychosocial Risk Score is the number of COPSOQ II scales categorized as „high risk” based on the responses of the respondents.

\*\* percentage of the respondents for each CPRS score reporting the given negative health outcome (eg. 53.7% of those with CPRS=10 reported high stress, while only 4.0% of those with CPRS=0).

\*\*\* The odds ratio and confidence intervals are determined for each CPRS score in comparison to the „no risk factor” (CPRS=0) condition.