THE HEALTH RISKS CONNECTED WITH MONOTONOUS WORK BY COMPUTERS


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ABSTRACT

The health risks of computer workers caused by the repetitive work and work in static posture have physical and physiological character. The computer workers (191) health status in offices and educational institutions was investigated using questionnaires based on Kiva questionnaire and Workability Index. The results show that the computer workers assess their health status considerably high. They are optimistic in solving the problem that the monotonous work with computers will continue and believe that their health status in the future will stay in the same level using the steadily enhancing rehabilitation means. The most injured regions of the body were the right wrist and the neck. The novelty of the study consists in the graphical co-analysis of different groups of questions presented to the workers that gives the possibility to assess the physiological and psychological factors in complex. The rehabilitation means have to be developed and the possibility for rehabilitation must be made available to the greatest possible number of workers.

Key words: computer workers, musculoskeletal disorders, occupational stress

INTRODUCTION

The interaction between the human body and the work environment is complex and four important systems (central nervous, automatic nervous, endocrine and immune) of the person are involved into this network (Raja et al., 1996). The human body responds to stressors by activating the nervous system and specific hormones. The hypothalamus signals the adrenal
glands to produce more of the hormones adrenaline and cortisol and release them into the bloodstream. These hormones speed up heart rate, breathing rate, blood pressure, and metabolism. There are a great number of hazards in the work environment to which the human body is sensitive like physical overload or monotonous work. These hazards in the work environment also affect office workers and can damage the peripheral and central nervous system (Tint et al., 2011). Job stress by computer workers can cause frustration, depression, stomach problems, muscle and psychological tension (Malinska, M., Bugajska, J., 2010).

Working with computers presents ergonomic risks due to static postures that are maintained for a long time, repetitive and sometimes forceful (Brauer et al., 2010; Mueller and Hassenzahl, 2010; Nag et al., 2009; Šmite and Ancane, 2010; Zakerian and Subramaniam, 2009). The overuse syndrome caused by physical overload include such common lesion as the channel bursitis, mono-and polyneuropathies, compression etc. (Orsila et al., 2011). The most important work activities (typing, writing, using a computer mouse) by computers cause repetitive strain injuries affecting the upper and lower extremities.

The use of electronic equipment in the work environment has increased in recent decades. The result is that the complaints of unusual fatigue, headaches and eyestrain from the side of the individuals working with computers are likely to increase for many times (Bako-Biro et al., 2004; Uchino et al., 2008).

The complaints of workers in the customer service are connected with stress. A new combined method with subjective and objective measures to assess psychological risks at work and improve workers’ health and well-being is presented by Panari et al. (2012). This integrated method entitled St.A.R.T. (Stress Assessment and Research Toolkit) was used by Panari: it is important to integrate the self-related assessment of stressors with objective measures for a better understanding of workers’ conditions in the workplace. The
understanding of workers’ stress in the workplace is attracting growing interest in occupational health psychology. Increased levels of stress compromise the immune system reduce cardiovascular functioning, influence blood pressure and hormone excretion and increase of risk of accidents. Psychological risk factors have been defined as aspects related to the planning, organization and management of the job, social contexts, physical, social or psychological damage (Panari et al., 2012).

The emotional side of a person and the physical side are closely connected (Šmite and Ancane, 2010); low back pain as a musculoskeletal disorder is connected with the physical and emotional factors.

Basing on the literature, there are connections between the indoor climate and psychosocial factors: by some authors (Lahtinen et al., 2002) many of the effects of the physical environment on health are mediated by its direct physical and chemical impact. However, anxiety and fear concerning the hazards in the physical environment are examples of indirect effects, in which well-being is mediated through psycho-physiological processes. Occupational stress can function as a modifying factor between environmental factors and symptoms, increasing individual sensitivity to physical environmental exposure. In the process, the stress can also be a result of physical environmental exposure that causes fear and anxiety, and thus increase the symptoms.

Every worker has to be provided with the possibility to control his/her own preferred microenvironment. Inability to control one’s working conditions aggravates string emotions and possible interpersonal conflict situations. The productivity is reduced under poor working conditions (Tanabe, 2004).

The results of analysis of repetitive work (ART tool) show that the intensity of work for workers totally engaged in info-technology is high, but in some way monotonous, therefore
health problems like musculoskeletal disorders are very common (Tint et al., 2011). The rehabilitation from the stress and musculoskeletal disorders is also important. Workers with lower health, lower work-related well-being or lower work ability are at risk for ending up in unstable temporary employment or unemployment (Wagenaar, et al., 2012).

One of the stress indicators is cortisol (Fukui and Yamashita, 2003). In the study of Visnola et al. (2010) it is indicated that the art therapy (music, colours etc.) had a great influence on the stress level of investigated people. The state of anxiety decreased significantly ($P < 0.05$). So the art therapy is considered as a preventive measure for employees to handle the stress situations. Supplementary breaks and exercises are needed for office workers to prevent the musculoskeletal disorders (Galinsky et al., 2007).

MATERIAL AND METHODS

The questionnaire for investigation of the computer workers health risks in their everyday work was compiled. The number of investigated computer workers was 192. As the basis for the questionnaire were taken: Kiva questionnaire (Näsman, 2012; Tuomivaara et al., 2012) and Work Ability Index questionnaire (Tuomi, 1998).

Kiva questionnaire characterizes the wellbeing of workers at work. The ratings were given in 10 points scale (1- not at all, 10-yes, very much). The KIVA questionnaire has 7 questions concerning the meaningful of job, the relationships with the employers and the fellow workers etc.

Work Ability Index (WAI) is determined on the basis of the answers to a series of questions which take into consideration the demands of work, the worker’s health status and resources. The worker completes the questionnaire before the interview with an occupational health professional who rates the responses according to the instructions.
RESULTS

1. The summary from the questionnaires

A total 192 people working with personal computers (PC) answered the questionnaire. The main results are presented in Table 1. For the analysis 181 correctly filled questionnaires were used. Among the respondents there were 69 men (the average age of 40.8) and 121 women (the average age of 45.6 years). The average length of working with PC for respondents was 9.5 years. The workers were divided into two groups: 125 people working with PC up to 10 (inclusive) years and 56 people working with computers over 10 years. The respondents were predominantly with the higher education and married.

Table 1

Work Ability Index questionnaire showed that both groups evaluated at an average of 8 points (1-10 point scale) their current level of performance compared to the best level of life. The both groups rated their performance considering the physical and mental work load fairly good (4.4).

In the 1st group (working with a PC up to 10 years) the musculoskeletal disorders were observed by 67 (53.6%) people, among them 59 diagnoses of MSDs were given by the physicians, the cardiovascular disturbances were observed by 26 people (20%), 13 people of them had the diagnose from the physicians; visual disturbances occurred in 20 (16%) persons (15 of them physician-diagnosed). The problem of overweight in the 1st group occurred in 25 (20%) people, 22 cases of them were diagnosed by the doctor. The diabetes occurred in two people.

In the 2nd group there were musculoskeletal disorders observed by 28 people (50%), 23 of them the diagnose of MSD was given by the physician; the cardiovascular disorders were observed by 25 (45%) people, 10 of them diagnosed by the physician; visual disturbances occurred in 13 (23%) people, 7 cases of them were diagnosed by the medical doctor. The
number of overweight persons in this group was 14 (25%) and all of them also had got the warning from the medical doctor.

Evaluating the impact of the health status on the workability, 69 (55%) of the people from the 1st group gave the mark 6 (there were no obstacles for continuing their job); 44(35%) of the people gave 5 points (that means they are able to perform the professional tasks, but there were some signs of disease). 6 persons gave 4 points (from10) (they have to reduce the work pace sometimes) and 1 person gave 3 points as he thought that he has to change the work pace.

For the 2nd group, the results were as follows: 24 people (43%) gave 6 points; 23 persons (41%) 5 points; 6 persons 4 points and 1 person 3 points.

Both groups had sick leave maximum of 9 days during last 12 months.

Based on the current state of health, both groups (93% of the respondents) believed that they are almost certainly able to continue with the current job after two years. In the 1st group 3% of respondents and in the 2nd group 7% were not confident of that.

Both groups of respondents (below and above 10 years of service) uniquely rated their mental resources: they enjoyed their everyday activities, quite often they had been active and they were optimistic about the future. However, statistics showed that people who have worked under 10 years with PC, evaluated their mental resources a little lower.

Kiva questionnaire (scale 1-10) revealed that in the 1st group the people enjoyed the coming to work (assessed by 6.7 points); with 8.2 points was assessed the importance of the work for them; the work process was evaluated by 8.0 points; the relationships with co-workers with 8.5 points and with the employer with 7.4 points. Confidentiality of continuing with the same employer was assessed with 7.4 points and 6.8 points were given to the possibility to influence on their work process.

The 2nd group enjoyed the coming to work by 7.3 points; with 8.5 points was assessed the
importance of the work to the respondents, with 8.3 points was assessed the possibility to control the work process; the relationships with the co-workers was assessed with 8.5 points and with the employer with 7.1 points. The respondents gave 6.8 points to the confidentiality to continue with the same employer; 6.8 points was given to the possibility to influence their own work process.

2. The graphical co-analysis

The graphical co-analysis means that different relationships were formed between the results-groups and the assessment of them by pairs was carried out. The results are given in figures 1-4.

Fig. 1.

The results of Kiva questionnaire (Fig. 1a) are on a relatively high level: the average rating of seven Kiva questions was 7.6. The employees enjoyed the coming to work during the last week; they assessed the work important to them; they had the control over their work process; the relationship with colleagues was good; the direct superior acted good; the staff was assure that that they will continue their work for the same employer and the workers also good influence on their own work process. The work stress (Fig. 1b) was felt by 1/3 to „some extent“ and 1/3 „only a little“; „rather much“ and „very much“ stress was felt only by 10% of respondents.

Fig. 2.

The most of the employees announced (Fig. 2a) that they were able to recover after the work-day or work shift. The majority of workers were enthusiastic about their work and felt themselves strong and powerful in the workplace. More than a half of employees felt that their health status compared to the contemporaries was „good“ or „rather good“. Overall, the workers were slightly more satisfied with their job than with their current life. At the same time, both the satisfaction with the job and the current life was relatively high. As it was concluded from the Kiva questionnaire, the satisfaction with the job was relatively high, so the other questions concerning the welfare had the same result.
Predominantly the workers could use their knowledge and skills in the workplace. Generally, the work was not one-sided. Approximately a half of the workers had the periods in the work that were too complicated; 40% of workers felt the situations that produced negative emotions. More than 2/3 of the respondents were in hurry to get the job done and the same number of workers had to stop the ongoing work because of the urgent activity. Generally, the amount of the information given by the employers to the employees concerning the work environment was „sufficient“ and about ½ of the workers assessed the number of discussions among the parties also „sufficient“. The work had mainly clearly defined by the employer’s goals (Fig. 2b).

*Fig. 3.*

More than a half of the employees (Fig. 3a) could not influence the issues concerning themselves in the workplace. At the same time more than a half of respondents could determine their work pace, they felt that their work was important and they worked independently.

Most of the employees felt that the work was sufficiently guided by the employers, the decisions at the workplace were made according to the accurate information and the decisions were coherent. So, the employees were satisfied with their employers and the decisions made by them (Fig. 3b).

*Fig. 4.*

Only 1/3 of the respondents assessed the work atmosphere tense, competitive and self-centred (Fig. 4a). Most of the workers thought that the work environment is rather encouraging and supportive for new ideas. Psychological violence was felt by the fifth of the employees. Generally, the relationship between the fellow workers was good; they offered help and support to each other if necessary, evaluated each other’s work, considered their work important and the family also appreciated the respondents’ work (Fig. 4b).

3. The assessment of the musculoskeletal disorders
During the medical examinations of 34 randomly selected computer workers were questioned about the pain in different regions of the body (Table 2). The most injured was the neck (mentioned by 22 or 65% of the workers) with the highest severity of pain (4.18 in 10 point scale).

The work is repetitive for computer workers, but the movements, made by the right and left hand, are different. The probability of developing the carpal-syndrome disease is high for info-technology workers who use the mouse. As the number of musculo-skeletal disorders has increased caused by the work with computers, the rehabilitation methods are very important.

**Table 2**

**DISCUSSION**

Despite the stress sometimes felt by the workers, time pressure, work interruption and intense periods in the work, the respondents were satisfied with their jobs. This was demonstrated both by Kiva and WAI questionnaires. The respondents had sufficient latitude to work, relationships with colleagues were good and the workplace atmosphere was good also; despite of some shortcomings in the organizational factors the employees were satisfied with the management. Work stress was felt by the 2/3 of the respondents „only a little“ or „to some extent“. In small doses, stress is good - such as when it helps to conquer the fear or gives extra endurance and motivation to get something done.

Based on the data given in Table 1, it might be concluded that the number of visual disturbances has increased as the people begin to use the computers in the younger age. The analogous disturbing phenomenon was observed in the assessment of the health status of the workers: the 2nd group of the respondents (working with computers under 10 years) assessed their health status worse. The health status assessed “good”: accordingly by 55% of people in the 1st group and 43% in the 2nd group.
The work in the offices is monotonous and the workload might be high. The risk scores for right and left hand are different. The interior architect has to follow the ergonomic principles of workplaces from the beginning of the building use. The expectation of having to remain in a sitting position when working with computers should be diminished. The rehabilitation is necessary for young and ageing workers.

The authors of the present study suggest the following: the complex treatments of these syndromes include active and passive methods of physiotherapy. The active part is organized by the physiotherapist. Systematic application of physical education, exercise therapy improves the functional capacity of the organism to physical stress. The role of the physical therapist in the occupational health team is to ensure that an optimum work environment exists for the prevention of injury and for the rehabilitation of work-related impairment, activity limitation, and participation restrictions. There are also physical therapies which influence the tissues metabolic activity and have positive influence on the repairing process. These are massage, physical agents therapies and water immersion therapy.

For measurement of fatigue in skeletal muscles, the device MYOTON-3 (Vain and Kums, 2002) used by Roja et al. in 2009 for assessment of fire-fighting workers work physical work severity is possible to use also for computer workers.

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REFERENCES

personal computers on perceived air quality, SBS symptoms and productivity in office. 


### Table 1

THE MAIN HEALTH COMPLAINTS OF COMPUTER WORKERS

<table>
<thead>
<tr>
<th>Health complaint</th>
<th>1st group (length of service with PC ≤ 10 years), % of respondents</th>
<th>2nd group (length of service with PC &gt; 10 years), % of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Musculoskeletal disorders</td>
<td>53.6</td>
<td>50.0</td>
</tr>
<tr>
<td>Cardiovascular disturbances</td>
<td>20.0</td>
<td>45.0</td>
</tr>
<tr>
<td>Visual disturbances</td>
<td>16.0</td>
<td>23.0</td>
</tr>
<tr>
<td>The problem of overweight</td>
<td>20.0</td>
<td>25.0</td>
</tr>
<tr>
<td>The health status good</td>
<td>55.0</td>
<td>43.0</td>
</tr>
</tbody>
</table>

### Table 2

THE PAIN REGIONS AND THE SEVERITY OF PAIN OF RANDOMLY SELECTED COMPUTER WORKERS

<table>
<thead>
<tr>
<th>Pain region</th>
<th>Number of workers (34)</th>
<th>Severity of pain (0-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>22</td>
<td>4.18</td>
</tr>
<tr>
<td>Shoulder, right</td>
<td>15</td>
<td>3.80</td>
</tr>
<tr>
<td>Shoulder, left</td>
<td>14</td>
<td>2.80</td>
</tr>
<tr>
<td>Elbow, right</td>
<td>2</td>
<td>4.71</td>
</tr>
<tr>
<td>Elbow, left</td>
<td>2</td>
<td>2.12</td>
</tr>
<tr>
<td>Wrist, right</td>
<td>7</td>
<td>4.57</td>
</tr>
<tr>
<td>Wrist, left</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Back</td>
<td>16</td>
<td>4.31</td>
</tr>
</tbody>
</table>
Figure 1
Figure 3
Legends to figures

Fig. 1. Kiva (a, left) and feeling of stress (b, right).

Fig. 2. Well-being (a, left) and work demands (b, right).

Fig. 3. Possibility to control work (a, left) and management and supervision (b, right)

Fig. 4. Work atmosphere (a, left) and psychological violence (a, left).