

OCCUPATIONAL ACCIDENTS AS INDICATORS OF INADEQUATE WORK CONDITIONS AND WORK ENVIRONMENT

Petar Babović

Occupational accidents due to inadequate working conditions and work environment present a major problem in highly industrialised countries, as well as in developing ones. Occupational accidents are a regular and accompanying phenomenon in all human activities and one of the main health related and economic problems in modern societies.

The aim of this study is the analysis of the connections of unfavourable working conditions and working environment on occupational accidents.

Occurrence of occupational accidents was monitored in two groups of workers in the period of ten years. The exposed group comprised 1854 male workers occupationally exposed to harmful effects (noise, chemical noxae, unfavourable microclimate factors, poor lighting) and special work demands (work in shifts, production quota work, night work). The control group comprised 1380 male workers who had not been exposed to the same working demands and professional noxae in the given period of time.

In the period of ten years the number of workers having occupational accidents was statistically significantly higher in the exposed group than in the control one. The total number of accidents in the exposed group was 382/1850 (20.6%), while in the control group it was 124/1380 (8.98%); $p < 0.01$. Accidents while commuting to and from work were similar in both groups, but the difference in accidents at work place is significant (13.9% in the exposed) and (1.95% in unexposed) group; $p < 0.01$.

Unfavourable working conditions and working environment present significant factors that have impact on occupational accidents, thus occupational accidents can be considered as indicators of inadequate working conditions and working environment. *Acta Medica Medianae* 2009; 48(4):22-26.

Key words: occupational accidents, occupational harmful effects, noise, chemical noxae, microclimate

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Introduction

Occupational accidents are a regular and accompanying phenomenon in all human activities and one of the main health related and economic problems in modern societies. Their consequences affect not only the injured workers, but their families, working organisation and the society as a whole. Health damage, decrease or loss of working ability, material expenses for sickness leave, medical treatment, rehabilitation, invalidity, decreased life activities, family dysfunction, dysfunction in working process, decrease in productivity and quality of work caused by occupational accidents make the problem of professional traumatism a very serious and actual one (1-3). It is considered that occupational accidents are the leading cause of death in population up to 37 years of age, and

the third leading cause in overall population, after cardiovascular and malignant diseases (2-4).

According to the Law on Contributions for Pensions and Disability Insurance in the Republic of Serbia (5), occupational accidents are considered to be accidents that happen to insured persons in the course of work in the premises or outside the premises which the workers can be exposed to in the course of work, that are caused by sudden and short mechanical, physical or chemical activity, sudden changes of body postures, sudden body pressures or some other changes of physiological conditions of the body. Occupational accidents are considered to be any kind of accident that happen while commuting to and from work, when the purpose of travel is work-related, when the injury is related to health protection and rehabilitation rights, rights for employment and rights for professional retraining.

Impairment of physical integrity can cause death, minor or severe organ damage, a disease or physical pain (6,7,8,9). Due to mental and physical integrity disturbance, mental and physical status can be impaired with long term or time-limited consequences (10-14).

Monitoring the causes of professional traumatism in the period of several years can

indicate the seasonal, daily and other rhythm in occurrence of occupational accidents, thus making the basis to inform the workers about the dangers they are exposed to during their work, and in that way they can be decreased (15).

Aim

The aim of this study was the analysis of the connections between unfavourable impacts of working conditions and working environment on occupational accidents occurrence..

Methods

In the last ten year period occupational accidents were monitored in two groups of workers. The exposed group comprised 1854 male workers occupationally exposed to harmful effects (noise, chemical noxae, unfavourable microclimate factors, poor lightening) and special work demands (work in shifts, production quota work, night work). The control group comprised 1380 male workers who had not been exposed to the same

working demands and professional noxae in the given period of time.

All the workers were asked the questions about their age, years of service, professional qualification, marital status, work, personal, family and social history, anthropometric measures were conducted and body mass indexes were calculated.

Statistical significance in the difference among the examined parameters between the exposed and the control groups were calculated by Student's T-test and χ^2 test.

Results and discussion

The workers in exposed group were exposed to unfavourable microclimate factors, noise, chemical noxae and inadequate lightening (Table 1).

The exposed and control groups were of approximately similar structure in comparison to some factors that can have an impact on occurrence of occupational accidents (professional qualification, marital status, level of nourishment) (Table 2).

Table 1. Occupational harmful factors in the workers in exposed group

type of professional noxae		measured values ($\bar{x} \pm \text{sd}$)	allowed values
Microclimate	Air temperature $^{\circ}\text{C}$	Zimi $11,3 \pm 3,4$ Leti $27,5 \pm 4,8$	15-22
	Relative air humidity (%)	$60,3 \pm 19,8$	30-60
	Air-flow speed (m/s)	$0,48 \pm 1,7$	Up to 0,5
Noise(dB)			Up to 85
Chemical noxae	Carbon monoxide (mg/m^3)	$49,7 \pm 9,3$	Up to 55
	Sulphuric acid (mg/m^3)	$1,37 \pm 0,8$	Up to 1,0
	Sulphur dioxide (mg/m^3)	$4,7 \pm 1,4$	Up to 5,0
	Zinc oxide (mg/m^3)	$7,8 \pm 2,9$	Up to 10,0
	Copper sulphate (mg/m^3)	$0,83 \pm 0,37$	Up to 1,0
	Magnesium sulphate (mg/m^3)	$5,1 \pm 1,3$	Up to 6,0
	Xylol (mg/m^3)	$345,8 \pm 123,8$	Up to 435,0
	Chlorine (mg/m^3)	$2,8 \pm 0,7$	Up to 3,0
Dust (mg/m^3)		Air-flow speed (m/s)	Up to 10,0
Lightening (Lux)			80-150

Table 2. Characteristics of workers in the control and exposed group

		Exposed group		Control group		p
		Number	%	Number	%	
Professional qualification	Unskilled	387	20,8	295	21,4	n.s.
	Skilled	457	24,6	347	25,1	n.s.
	Secondary education	554	29,9	401	29,1	n.s.
	Higher education	337	18,2	229	16,6	n.s.
	University education	119	6,4	108	7,8	n.s.
Marital status	Single	468	25,2	339	24,5	n.s.
	Married	897	48,4	655	47,5	n.s.
	Divorced	347	18,7	268	19,4	n.s.
	Widower	142	7,7	118	8,5	n.s.
Levels of nourishment	Undernourished	467	25,2	353	25,5	n.s.
	Normally nourished	914	49,2	667	48,3	n.s.
	Obese	473	25,5	360	26,1	n.s.

n.s.=difference is not statistically important

Table 3. Age and work experience of workers in the exposed and control group

	Exposed group	Control group	p
Age	49,8±8,9	50,1±7,8	n.s.
Years of work experience	27,6±4,8	28,2±5,9	n.s.

Table 4. Presence of a disease in the workers of the exposed and control group

	Exposed group		Control group		p
	Number	%	Number	%	
Neurosis	465	25,1	331	23,9	n.s.
Arterial hypertension	668	36,1	485	35,1	n.s.
Diabetes	92	4,9	67	4,8	n.s.
Ocular diseases	91	4,9	68	4,9	n.s.
Diseases of gastrointestinal system	112	6,1	84	6,1	n.s.
Pulmonary diseases	455	24,5	332	24,1	n.s.
Heart diseases	19	10,2	14	10,1	n.s.
Hearing impairment	321	17,3	249	18,1	n.s.
Rheumatoid diseases	81	4,4	57	4,1	n.s.

Table 5. Number of workers having occupational accidents in the exposed and control group

	Exposed group (N=1850)		Control group (N=1380)		p
	Number	%	Number	%	
Occupational accidents	258	13,9	27	1,95	<0,01
Commuting accidents to and from work	124	6,7	97	7,02	n.s.
Total number of accidents	382	20,6	124	8,98	<0,01

The workers from the exposed group were approximately of the same age and had approximately the same work experience (Table 3).

There was no statistically significant difference in the presence of diseases in workers in the exposed or control group (Table 4).

In the last ten years in the exposed group there were statistically significantly more workers having occupational accidents in comparison to the control one. (Table 5).

The total number of accidents in the exposed group was 382/1850 (20.6%), while in the control group it was 124/1380 (8.98%); $p < 0.01$. The number of commuting accidents to and from work was similar in both groups, but the difference in occupational accidents was significant (13.9% in exposed and 1.95% in unexposed group) $p < 0.01$.

Discussion

Ethiology of occupational accidents is a multicaused one. The causes can be grouped into two major groups: causes with dominant human factor and causes related to work and living environment.

When human factor is involved, the following characteristics of workers are important: age – the youngest workers are most frequently injured due to psychological characteristics of their age, such as imprudence, instability, difficult adaptation to certain norms (16-18), work experience (19-20), adaptation to new surroundings, new job, the

need to fulfill the norm and personal affirmation at a new post contribute in accidents; sex – the possibilities of getting injured are not the same for males and females; impact of a disease, especially in workers with epilepsy, the crisis of consciousness, syncopal states and vertiginous syndrome. Even the trivial illnesses such as headache, toothache can disturb concentration and contribute to the occurrence of accidents (17)

Factors from working and living environment that have negative impact on workers and lead to temporary decrease of work ability are numerous.

Condition of machinery, tools and devices is of greatest importance among the factors in work environment, as well as the conditions under which the tasks are performed and prevention measures that are applied. So called open tools, unprotected mobile parts of the machinery, pointed and sharp tools are of extreme danger.

Work environment factors are of special importance. The important notice made in this paper is that work environment conditions can lead to more frequent occupational accidents in exposed workers. The workers in exposed and control group were approximately of the same structure in comparison to other factors that can contribute to occurrence of occupational accidents. The only difference among them was the presence of poor work conditions and work environment conditions in workers from the exposed group that were statistically significantly more often injured at work in comparison to the

control group. Unfavourable work conditions can be a direct cause of injuries in workers that work in open air and that are exposed to bad weather conditions. Unfavourable microclimate factors in working premises (especially humidity and temperature) can influence the psycho-physical state of workers. Lighting is the most common cause of accidents and decreased lighting is important as well as flickering and flashing lighting. Noise is an important factor that can cause fatigue and misunderstanding of given warnings. Vapour and gas can lead to accidents if the material is inflammable and explosive. Aerosoles and dust decrease visibility. Dust, vibrations, ultrasound, infrasound can lead to fatigue and thus to more often injuries of workers. Carbon monoxide is of special importance

and it leads to hypoxia of the central nervous system, with difficult movement coordination, rapid fatigue, difficulties in judgement and slow psychomotor skills as a consequence. The other chemical noxae detected in this paper cause the changes in the nervous system in workers that lead to more frequent occurrence of occupational accidents.

Conclusion

Unfavourable work and environment conditions are the important factors that have an impact on occurrence of occupational accidents. Occupational accidents can be considered as indicators of inadequate work conditions and work environment conditions.

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POVREDE NA RADU KAO INDIKATORI NEADEKVATNIH USLOVA RADA I RADNE SREDINE

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Povrede na radu usled neadekvatnih uslova rada i radne sredine predstavljaju veliki problem kako u visoko industrijalizovanim tako i u nerazvijenim zemljama. Povrede na radu su redovna i prateća pojava svake ljudske delatnosti i jedan od glavnih zdravstvenih, ekonomskih i privrednih problema modernog društva.

Svrha ovog istraživanja je analiza povezanosti nepovoljnih uticaja rada i radne sredine na pojavu povreda na radu.

Praćena je pojava povreda na radu u proteklom desetogodišnjem periodu kod dve grupe radnika. Ekspozovanu grupu činilo je 1854 radnika muškog pola, koji su u ispitivanom periodu bili izloženi profesionalnim štetnostima (buka, hemijske nokse, nepovoljni mikroklimatski faktori radne sredine, nepovoljno osvetljenje) i posebnim zahtevima rada (rad u smenama, rad u normi, noćni rad). Kontrolnu grupu je činilo 1380 radnika muškog pola, koji u posmatranom periodu nisu bili izloženi ovim zahtevima posla i profesionalnim noksama.

U proteklom desetogodišnjem periodu u ekspozovanoj grupi je registrovan statistički značajno veći broj radnika sa povredama na radnom mestu nego u kontrolnoj grupi. Ukupan broj povreda u ekspozovanoj grupi iznosio je 382/1850 (20.6%), dok je u kontrolnoj grupi iznosio 124/1380 (8.98%); $p < 0.01$. Povrede na putu od kuće do posla i obratno bile su slične u obe grupe, ali je razlika u povredama na radnom mestu značajna (13.9% u ekspozovanoj) i (1.95% u neekspozovanoj) grupi; $p < 0.01$.

Nepovoljni uslovi rada i radne sredine predstavljaju značajne faktore koji utiču na pojavu povreda na radu, te se povrede na radu mogu smatrati indikatorima neadekvatnih uslova rada i radne sredine. *Acta Medica Medianae 2009; 48(4):22-26.*

Ključne reči: *povrede na radu, profesionalne štetnosti, buka, hemijske nokse, mikroklima*