AGE DIFFERENCES IN OCCUPATIONAL INJURIES IN THE CONSTRUCTION INDUSTRY

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Occupational injuries at construction sites are identified as a major problem throughout the world. The purposes of this study are to estimate the number and average annual rate of occupational traumatic injuries and to estimate the age differences in transition period between 1993s and 2003s in construction industry. The most prevalence of injuries was registered in 1994 (4.55%) and in 2003 s (4.38%). The number of injured workers under the 20 years of age decreased in the examined period (from 22.2% in 1993s to 4.6% in the 2003s). The number of injured worker over the 51 years of age increased in the examined period (from 0.9% in 1993s to 17.8% in 2003 s). Closed fractures (24.1%), open fractures (14.6%) and dislocated fractures (10.9%) were the most common type of injuries in the examined period. These types of injuries were the most frequently presented at the workers over the 51 years of age. Falls from height, falls on same level and traffic accidents were the most common causes of occupational injuries in the examined period. Falls from height and falls on the same level were the most common presented at the workers over the 51 years of age. Traffic accidents were the most common cause of occupational injuries among the workers under the 30 years of age. Severity ratio of occupational injuries raised by the age of injured workers. Severity ratio of injuries raised in the examined period (from 60.6 in 1993s to 82.7 in the 2003s). Traumatic occupational injuries are a specific and significant problem in construction industry in the transition period. *Acta Medica Medianae 2004; 43 (4): 25–30.*

Key words: *occupational injuries, workers, transition, construction industry, age*

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Introduction

Accidents at construction sites are identified as a major problem throughout the world. According to reports published by the Construction Industry Institute (CII), injuries and fatalities occur in the construction industry at a rate more than 50% higher than all other industries. Each work day, three or four construction workers die from injuries on the job in the U.S. at a rate of 18.6 per 100000 full-time workers, totaling more than 900 deaths per year (1). In 1993, despite employing only 5% of the industrial workforce, construction accounted for 14% of all work-place deaths and 9% of all disabling injuries (2). Thousands of people are killed annually in occupational accidents in construction industry, and the number of disabling injuries is also a staggering figure. Construction employees in many countries incurred approximately 46% annual injury of all occupational injuries (3,4).

The economic impact of accidents and accident insurance on project costs, in addition to criteria used to evaluate and enhance contractor safety performance, were examined by many researchers. The Business Round Table issued a report on improving construction safety performance, explaining the economic impact of construction accidents, and owner influence on the contractor's safety program (5). Direct and indirect costs of construction accidents are described as significant inefficiency by the industry funded CII, costing the industry an estimated $ 7 billion to $ 17 billion annually (6). The cost of accidents and injuries has risen from a level of 6.5% of construction costs in 1982 to between 8% and 15% to 1998. The overall human, social, and financial toll of traumatic occupational injury is enormous, rivaling the burden imposed by such health threats as cancer and cardiovascular disease (7,8,9).

Aim

The purposes of this study are to estimate the number and average annual rate of occupational traumatic injuries and to estimate the age differences in transition period between 1993s and 2003s in construction industry.

Material and methods

The number of occupational injuries in construction industry followed by absence from work

has been estimated in the transition period between 1993s and 2003s. To identify occupational injuries that have occurred in construction industry, data were collected from the safety departments. The number of injured workers, injury type, injury description, type of project and injury results were collected from each accident document. An injury was defined as occupational if it occurred while working for compensation, on or off employer premises, while arriving or leaving work, on a break if on employer premises or working as a volunteer. All injuries, which have resulted in at least one day's absence from work after the day of the injury, formed the basis of the analyses. When the injury occurs, data are entered by management representatives of the safety department and the plants medical staff. The data set includes information on employee characteristics, characteristics of the workplace and event, description of the injury (injury type and body part injured) and outcome (lost days, days on which employees reported to work but were assigned to light or alternative duties). All injuries analyzed must have met one or more of the following conditions: medical treatment required restriction of work or motion, transfer to another job or resulted in death. The circumstances of each incident were reviewed using variables in the database, including the narrative description of „how the injury occurred", the nature of the injury, the injured workers job title, and recommendations to prevent future occurrences. External cause of injury in database was based on codes from the International Classification of Diseases (10), excluding only suicide and medical misadventure. Injuries were classified in terms of the general environment in which they occur, the general mechanisms of injury (motor vehicle collisions, falls etc.), or the contributing behavioral of human factor. There was great difficulty in gathering the data and tracing the information needed for a specific accident, because most records were incomplete. The majority of records describe the accident, the name of injured person and the companys name, but fail to report the victims personal information, accident consequences and circumstances. The safety engineer describes the necessary safety precautions to avoid a similar accident, but does not mention the type of safety procedures on site when the accident occurred.

For annual injury rate calculation the number of injured workers was divided by average number of employed workers in that year and multiplied by 1000.

For severity ratio calculation the number of calendar lost days resulting from occupational injuries was divided by total number of lost day cases. Statistical analysis was performed.

Results

Epidemiology of the injuries in the construction industry in the period between 1993s and 2003s was shown on the Table 1. The most prevalence of injuries was registered in 1994 (4.55%) and in 2003s (4.38%). Distribution of injuries by the age of injured workers shows that the most injuries occurred to workers under the 30 years (Table 2). The number of injured workers under the 20 years of age decreased in the examined period (from 22.2% in 1993s to 4.6% in the 2003s). The number of injured worker over the 51 years of age increased in the examined period (from 0.9% in 1993s to 17.8% in 2003 s) (Table 3). Closed fractures (24.1%), open fractures (14.6%) and dislocated fractures (10.9%) were the most common type of injuries in the examined period (Table 4). These types of injuries were the most frequently presented at the workers over the 51 years of age (Table 4). Falls from height, falls on same level and traffic accidents were the most common causes of occupational injuries in the examined period. Falls from height and falls on the same level were the most common presented at the workers over the 51 years of age. Traffic accidents were the most common cause of occupational injuries among the workers under the 30 years of age (Table 5). Severity ratio of occupational injuries raised by the age of injured workers (Table 6). Severity ratio of injuries raised in the examined period (from 60.6 in 1993s to 82.7 in the 2003s) (Table 7).

Table 1. Epidemiology of the injuries in the construction industry in the examined period

Years	Number of exposed workers	Number of injured workers	Percent of injured workers
1993	2401	62	2.58
1994	2107	96	4.55
1995	2006	86	4.28
1996	1894	79	4.17
1997	1772	24	1.35
1998	1525	14	0.91
1999	1389	25	1.79
2000	1400	49	3.5
2001	1340	47	3.5
2002	1314	43	3.27
2003	1345	59	4.38

Table 2. Occupational injuries in regard to the age of workers

Age	Injured workers	Percent of injured workers
Under 20	108	18.5
21-30	111	19.0
31-40	71	12.2
41-50	109	18.7
51-60	101	17.3
Over 60	84	14.4
Total	584	100.0

Discussion

Construction sites are very complex and dynamic by nature, creating the potential for hazards which change constantly, so what was safe yesterday may no longer be safe today. As in many countries, safety has always been a major issue and often a problem in the construction industry in Serbia. Thus, safety precautions should be followed and controlled by

Table 3. Epidemiology of occupational injuries in regard to the age of workers

Years	Age (Years)												
	Under 20		21–30		31–40		41–50		51–60		Over 61		Total
	N	%	N	%	N	%	N	%	N	%	N	%	
1993	24	22.2	23	20.7	1	1.4	10	9.2	1	0.9	3	3.6	62
1994	28	25.9	20	18.0	21	29.6	19	17.4	2	1.9	6	7.1	96
1995	17	15.7	19	17.1	16	22.5	15	13.8	11	10.9	8	9.5	86
1996	15	13.9	25	22.5	5	7.0	17	15.6	10	9.9	7	8.3	79
1997	5	4.6	4	3.6	3	4.2	2	1.8	5	4.9	5	5.9	24
1998	2	1.8	2	1.8	2	2.8	2	1.8	2	1.9	4	4.8	14
1999	1	0.9	1	0.9	1	1.4	2	1.8	10	9.9	10	11.9	25
2000	5	4.6	3	2.7	7	9.8	8	7.3	15	14.8	11	13.1	49
2001	4	3.7	5	4.5	5	7.0	12	11.0	12	11.9	9	10.7	47
2002	2	1.8	2	1.8	5	7.0	9	8.2	15	14.8	10	11.9	43
2003	5	4.6	7	6.3	5	7.0	13	11.9	18	17.8	11	13.1	59
Total													

Table 4. Classification of occupational injuries according to type of injury

Type of injury	Under 20		21–30		31–40		41–50		51–60		Over 61		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Abrasions	2	1.8	1	0.9	9	12.7	1	0.9			1	1.2	14	2.4
Contusions	8	7.4	4	3.6	2	2.8	6	5.5	2	1.9	3	3.6	25	4.3
Puncture wounds	9	8.3	8	7.2	8	11.3							25	4.3
Cuts	10	9.2	3	2.7	20	28.2					1	1.2	34	5.8
Lacerations	17	15.7	5	4.5	5	7.0							27	4.6
Closed fractures	22	20.4	27	24.3	4	5.6	30	27.2	30	29.7	28	33.3	141	24.1
Open fractures	15	13.9	11	9.9	3	4.2	19	17.4	20	19.8	17	20.2	85	14.6
Dislocated fractures	10	9.3	11	9.9	1	1.4	14	12.8	15	14.8	13	15.5	64	10.9
Sprains			14	12.6	2	2.8							16	2.7
Strains			10	9.0	10	14.1	8	7.3					28	4.8
Traumatic haemarthroses	4	3.7	5	4.5	2	2.8	7	6.4	9	8.9	5	5.9	32	5.5
Ruptures of joints and ligaments	5	4.6	8	7.2	1	1.4	10	9.2	11	10.9	7	8.3	42	7.2
Tears of joints and ligaments	2	1.8	2	1.8	4	5.6	8	7.3	8	7.9	5	5.9	29	4.9
Traumatic amputations	2	1.8	1	0.9			3	2.7	3	2.9	2	2.4	11	1.9
Ruptures and tears of internal organs	2	1.8	1	0.9			3	2.7	3	2.9	2	2.4	11	1.9
Total	108	100	111	100	71	100	109	100	101	100	84	100	584	100

Table 5. Cause of occupational injuries

Cause	Under 20		21–30		31–40		41–50		51–60		Over 61		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Fall from height	22	20.4	19	17.1	11	15.5	33	30.3	30	29.7	27	32.1	142	24.3
Fall on same level	15	13.9	10	9.0	18	25.3	24	22.0	32	31.7	29	34.5	128	21.9
Compressed by equipment	12	11.1	14	12.6	7	9.9	11	10.1	9	8.9			53	9.1
Being caught between mechanical object and equipment	5	4.6	8	7.2	3	4.2	3	2.7	11	10.9	8	9.5	38	6.5
Traffic Accident	42	38.9	44	39.6	15	21.1	4	3.7	3	2.9			108	18.5
Electrocution			5	4.5	2	2.8	2	1.8					9	1.5
Struck by objects			4	3.6	5	7.0	5	4.6	4	3.9	8	9.5	26	4.4
Collision					1	1.4	14	12.8	5	4.9	12	14.3	32	5.5
Struck by flying or falling objects	5	4.6	1	0.9	3	4.2	9	8.3	7	6.9			25	4.3
Contact with temperature extreme	4	3.7	1	0.9	2	2.8	1	0.9					8	1.4
Collapse or destruction of structure	1	0.9	2	1.8	1	1.4	1	0.9					5	0.9
Contact with caustics and toxic substances	1	0.9	2	1.8	2	2.8	1	0.9					6	1.0
Eruption or explosion	1	0.9	1	0.9	1	1.4	1	0.9					4	0.7
Total	108	100	111	100	71	100	109	100	101	100	84	100	584	100

Table 6. Severity ratio of occupational injuries

Age	Severity ratio
Under 20	65.4
21–30	65.2
31–40	64.2
41–50	65.9
51–60	81.5
Over 60	83.9
Total	70.7

Table 7. Severity ratio of injuries in construction industry by the years

Years	Severity ratio
1993	60.6
1994	64.9
1995	65.3
1996	65.8
1997	67.9
1998	69.6
1999	71.5
2000	79.7
2001	80.7
2002	82.3
2003	82.7

competent person at the site and should be organized from scratch for each new project. To understand the risk factors of occupational injuries and to develop prevention and control strategies, it is essential to know about and learn from past occupational injuries. Here we report on the epidemiology of occupational accidents and injuries occurring in construction industry in the transition period from 1993s to 2003s.

The data from literature showed that the highest injury incidence rates are among the younger workers (11,12,13,14,15,16). It has been well documented that age and accident rates are negatively related (17), probably because the older workers are more experienced on the job and have greater job knowledge, patience, and skills than younger counterparts. When injuries do occur, older workers are usually more severely hurt, and fatalities occur more frequently among older workers. Some of the possible reasons why younger workers may be at increased of work related injury are limited job knowledge, training, and skills, and perhaps less sense of responsibility. Young workers may be at increased risk for injuries in the workplace because they are often new to a job, inexperienced, commonly unaware of their legal rights as workers. Compared with older workers, young workers tend to move in and out of the workforce and are usually employed on part time (18). Youth employment also tends to be seasonal, peaking during the summer months. The seasonal and sporadic nature of youth employment, along with frequent job changes, make it difficult for young workers to obtain the sustained mentoring and experience needed to perform their job safety. It has been well established that age is associated with employee work well being and specifically with job satisfaction (19). These factors all point to the importance of safety attitudes in performing safety at work. In general,

older workers tend to be better adjusted to work, as reflected in job satisfaction. Older workers could be more knowledgeable and experienced, displaying more positive attitudes to safety, and possibly more committed to work and willing to comply with safety regulations than younger workers. Older workers are more satisfied with job and more likely to asses general housekeeping and checking of safety equipment. Older workers could be more knowledgeable and experienced display more positive attitudes to safety, and possibly more committed to work than younger workers. Older workers are quite capable of learning safety regulations and safety system of work, and are willing to comply with safety regulations. Perhaps it is attributable to the fact that job knowledge structures increase with age and compensate for declines in ability.

The literature data shows that the risk of occupational related traumatic injury is inversely related to worker age and educational level (17,20). The results of our study are not in accordance with the results from the literature. Our study shows the prevalence of occupational injuries in the years of transition. These results showed that in transition period raised the prevalence of occupational injuries among the older workers and decreased the prevalence of occupational injuries among the young workers.

In transition period many workers had been losing their job and had been transferred to another job. Many workers loose their own job in electronic, ruber, textile and other industries and have to find new job in construction industry. In the transition period the most number of older workers have been losing their job or have been transferred to another job. It is a great problem for all, especially for old workers who had not job experience for new job. Lack of work experience can be the contributing factor in the development of occupational injuries at older workers.

Leading causes of injuries were falls from height, falls on some level and traffic accidents. These results are the similar with the literature data (21,22). Traffic accidents are the significant cause of occupational injuries, which is according to the literature data (23).

Relevant training the new worker received and timely accurate education are needed to prevent occupational injuries. As new workers on another job the older workers display positive attitudes to safety training program (24). Efforts to prevent occupational injuries among new workers will benefit from action by employers, regulatory agencies, the community at large, and young workers themselves. Employers can develop safety training programs that address young workers potential lack of experience and skills in recognizing and responding to hazards. School to work programs has traditionally been focused on high skill jobs rather than the types of workplaces where youths are more likely to gain employment. The requirements for becoming a skilled worker include meeting physical requirements for vision, hearing and coordination, participating in industrial vehicle training, and passing a test of knowledge and ability for job. As part of every employee's safety training, each employee should be made aware of the hazards associated with that job. Safe working practices and rules should be clearly explained to workers and enforced when appropriate. To help supervisors know and understand the safety rules they are responsible for enforcing. Safety talks are part of the ongoing safety.

Our results showed that the risk and severity of occupational related traumatic injury is inversely related to worker age, which is similar to the literature data (20).

Conclusion

Traumatic occupational injuries are the specific and significant problem in construction industry in the transition period. Injury rates in transition period are highest among the older workers with less job experience in the new job. In experience may be risk factor for occupational injuries. The severity of occupational related traumatic injury raised by the worker age. The lack of construction accidents statistics and data hides the roots of the safety problem in transition period.

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POVREDE NA RADU U GRAĐEVINARSTVU U ODNOSU NA STAROST RADNIKA

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Povrede na radu u građevinarstvu su značajan problem u svetu. Ciljevi ove studije su bili da se ispita broj i indeks povreda na radu u odnosu na starost radnika u periodu tranzicije, između 1993. i 2003. godine u građevinarstvu. Najveća prevalencija povreda na radu je zabeležena 1994. godine (4.55%) i u 2003. godini (4.38%). Broj povređenih radnika mlađih od 20 godina opada u ispitivanom periodu (od 22.2% u 1993. godini na 4.6% u 2003. godini). Broj povređenih radnika starijih od 51. godine raste u ispitivanom periodu (od 0,9% u 1993. godini na 17.8% u 2003. godini). Zatvorene frakture (24.1%), otvorene frakture (14.6%) i frakture sa dislokacijom (10.9%) su najčešći tipovi povreda u ispitivanom periodu. Ovi tipovi povreda su najčešći kod radnika starijih od 51. godine. Padovi sa visine, padovi na istom nivou i saobraćajne nezgode su najčešći uzroci povreda na radu u ispitivanom periodu. Padovi sa visine i padovi na istom nivou su najčešći uzroci povreda kod radnika starijih od 51. godine. Saobraćajne nezgode su najčešći uzroci povreda na radu kod radnika mlađih od 30 godina. Indeks težine povreda raste sa starošću povređenih radnika. Indeks težine povreda raste u ispitivanom periodu (od 60.6 u 1993. godini na 82.7 u 2003. godini). Povrede na radu su specifičan i značajan problem u građevinarstvu u periodu tranzicije. *Acta Medica Medianae 2004; 43 (4): 25–30.*

Ključne reči: *povrede na radu, radnici, tranzicija, građevinarstvo, starost*