J Occup Health 2008; 50: 70–74

Short Communication

Direct Medical Costs and Working Days Lost due to Non-Fatal Occupational Injuries in Denizli, Turkey

Mustafa SERINKEN[1], Ozgur KARCIOGLU[2], Mehmet ZENCIR[3] and Ibrahim TURKCUER[1]

[1]Department of Emergency Medicine, Pamukkale University, School of Medicine, [2]Department of Emergency Medicine, Bakirkoy Dr. Sadi Konuk Research and Training Hospital and [3]Department of Public Health, Pamukkale University, School of Medicine, Turkey

Key words: Occupational injuries, Medical costs, Working days lost

Occupational accidents are avoidable and cause a great impact on productivity and on the economy, as well as great suffering. Death tolls are four to five times higher in developing countries than in developed countries. Every year, millions of workers suffer injuries and thousands experience deaths in developing regions[1)].

Little data can be found in the literature regarding OI in developing countries and their costs along with average working days lost (Brazil[2, 3)], Poland[4)], Malaysia[5)], Lebanon[6)], Taiwan[7)], Nicaragua[8)], China[9, 10)]).

Employment statistics for March 2007 state that the sectors with the most intensive employment figures in Turkey are services, agriculture, industry and construction. The Social Security Institution (SSK) is the biggest state-run institution established to manage the social security issues of Turkish workers. Unregistered workers constitute up to 46.2% of the total working population in March 2007. SSK databases cite that 73,923 OI occurred in 2005. These were highest in the metal and machinery sector, 10,283 incidents (13.9%), followed by the construction sector with 6,483 (8.7%) and coal mining with 6,011 (8%). The male-to-female ratio of OI in Turkey is 21.1 with the highest rate of women injured in the textile industry. The weighted average age of victims is 29 for women and 31 for men[11)].

Populated by 850,000 people, Denizli is one of the outstanding industrialized cities of western Turkey and has a high rate of OI. The predominance of the textile industry in the city affects the male-to-female OI ratio (7.7 vs 21.1 in Turkey)[11)].

More than 1,500 admissions due to OI are recorded in the health facilities annually in Denizli[11)]. Three big hospitals operate in the city, including one University-based research hospital. This hospital received approximately one third of all OI recorded to have occurred in the city. The University hospital has 24-h coverage regarding advanced interventions for OI such as reimplantation and microsurgery, which the other two hospitals do not have.

Medical costs of OI represent a neglected area of research in Turkey. Furthermore, health institutions lack reliable and regularly updated medical registries with respect to OI. The present study aimed to clarify the current situation of OI in the middle-sized industrialized city of Denizli in west Turkey.

Materials and Methods

The present study was conducted in the University-based hospital in Denizli. The 400-bed hospital annually treats 14,000 patients. All new or acutely occurring OI are admitted through the ED of the hospital.

All patients with OI referred to the ED in the one-year period between 1st October 2005 and 30th September 2006 were investigated prospectively. The data sheets requested sociodemographic and injury-related information. The data was obtained via face to face interview in the ED.

Patients who did not give consent to the study, fatal accidents and patients younger than 15 years of age were excluded from the analysis.

Hospital cost estimates

The costs of OI were divided into three broad categories: direct costs, indirect costs, and quality-of-life costs. Direct costs included payments to hospital, physician, and allied health services, rehabilitation, nursing home care, home health care, medical equipment, burial costs, insurance administrative costs for medical claims, payments for mental health treatment, police, fire, emergency transport, coroner services, and property damage. Hospital costs of patients with OI were investigated and analyzed. All data were abstracted from the hospital computer information system and patients' hospital bills and charts.

Total hospital costs consisted of categories such as medications (MED), medical equipment (MEQ), treatment costs (TRT), physicians' fees for examinations and consultations (PHY), laboratory investigations (LAB), radiological investigations (RAD) and hospitalization costs (HOS). Treatment costs were composed of the prices of therapeutic procedures performed (casts, splints, sutures, operations etc.) in the hospital, excluding the prices of the medical equipment used.

The total mean cost charged in the ED for patients admitted and managed in and discharged from the ED

Received May 10, 2007; Accepted Oct 30, 2007
Correspondence to: M. Serinken, Department of Emergency Medicine, Pamukkale University Medical School, 20070, Denizli, Turkey (e-mail: mserinken@hotmail.com)

were calculated. Hospitalization costs were also included in the total costs of patients admitted to wards and/or intensive care units (ICU). Costs related to revisits following the primary admission with occupational injury were excluded from the analysis in accordance with Turkish regulations currently in use. Annually averaged USD currency were used to calculate costs recorded in new Turkish Liras (YTL) (1 YTL: 1.42 USD).

The number of lost working days due to OI was calculated by adding the number of days stay in the hospital to the working days off as reported by physicians. These reports were written and recorded by the physicians primarily responsible for the treatment upon completion of the hospitalization or ED care. Additional sick days off were also taken into account.

All data obtained in the study were analyzed using the Statistical Package for Social Sciences for Windows, Version 11. Numerical variables are given as mean and standard deviation (SD), while categorical variables are given as frequencies (n) and percentages. One-way ANOVA was preferred as the parametric test to investigate the relationship of the total mean costs and lost working days and sectors and age groups, since the former were measured variables. For the same reasons, the costs and lost working days were analyzed with regard to sex using independent samples *t*-test.

Results

A total of 397 patients were admitted to the ED due to OI within the one-year study period. They comprised 18.1% of all trauma cases and 2.8% of all ED admissions. Three male workers (0.7%) in the construction sector died from OI. Six cases (1.6%) refused to participate in the study.

Four fifths of the study sample were males (79.8%, n=310). Their mean age (±SD) was 27.2 ± 6.4 (range:15 and 46). More than two fifths, 42.5% (n=165), were between 25 and 34 yr of age [15 to 24 yr of age constituted 40.2% (n=156), while 34> yr of age 17.3% (n=67)].

The majority of registered OI victims were employed in the metal and machinery industry (23.5%), followed by textile (16.8%), construction (14.2%), mining, stone and soil industry (12.4%), and transportation (11.6%) workers.

Emergency care and management were deemed sufficient for 78% (n=303) of the cases discharged from the ED, while 21.9% (n=85) were admitted to the hospital. The mean length of stay in hospital was 5.11 ± 2.7 d. The highest rate of hospitalization was recorded for the construction industry (29.4%) followed by the mining (21.2%) and metal and machinery (20%) industries.

Causes of injuries (self-reported)

Of the injuries, 79.2% (n=336) were attributed by the workers themselves to worker error, while the remaining 20% (n=88) were reported to have occurred due to problems in the workplace. "Inattention"or "carelessness" was the most common cause of injury and represented 40.3% of the whole sample and 50.8% (n=171) of the worker-related injuries. Lack of protective equipment such as gloves, goggles and gowns in the work environment was indicated in 57.9% (n=51) of the workplace-related causes.

One hundred and forty-nine patients (38.4%) reported lack or inadequacy of protective equipment such as gloves, goggles and gowns in the workplace, 46.8% (n=181) noted the presence and regular use of these equipment, and 14.9% (n=58) remarked the equipment was available in the workplace but not used in every instance.

Table 1. Physical characteristics of occupational injuries

Bodily location of the injury	n	%
Head	64	16.4
Neck	4	1.0
Trunk	15	3.8
Upper limb	209	53.8
Lower limb	74	19.0
Multiple locations	21	5.4
General injuries	1	0.3
Total	388	100.0
Type of injury		
Laceration/puncture/amputation/ avulsion	147	37.9
Contusion/abrasion/haematoma/ crush	108	27.8
Sprain/strain	63	16.2
Dislocation/fracture	61	15.7
Burn	8	2.0
Inhalation	1	0.2
Total	388	100.0

Physical properties of injuries

Table 3 depicts the distribution of OI to body parts. Trauma to the upper extremities comprised 53.8% (n=209) of the cases. Isolated finger injuries made up 37.8% (n=79) of upper extremity injuries (Table 1).

Hospital costs

Total mean hospital costs of patients treated and discharged from ED and admitted to hospital were $116.88 ± 67.59 and $1,653.81 ± 1,333.71, respectively ($p<0.01$). Total mean costs and subdivisions are demonstrated in Table 2. Treatment costs were the biggest portion in both patients discharged from the ED and also in those admitted to the hospital (45.3% and 44.3%, respectively).

Table 2. Total hospital costs (2006 US$)

Treatment location	Total cost				
	Mean	SD	Median	Min	Max
Emergency department					
MED	4.32	4.64	2.77	0.00	15.97
MEQ	12.27	6.27	11.11	0.00	27.78
TRT	52.98	29.89	48.61	5.56	135.42
PHY	13.03	3.2	11.11	9.72	21.53
LAB	6.91	10.56	0.00	0.00	60.42
RAD	21.6	17.88	15.97	0.00	69.44
HOS	2.61	2.55	3.47	0.00	11.11
Other	2.68	1.69	2.77	0.00	6.25
TOTAL	116.88	67.59	97.22	20.14	325.69
Hospitalized (ward or ICU)					
MED	46.2	27.81	31.25	13.89	90.28
MEQ	244.2	524.09	69.44	27.78	2112.11
TRT	733.19	553.12	555.55	159.72	1909.72
PHY	538.06	392.50	456.94	40.28	1319.44
LAB	69.28	39.10	62.50	3.47	142.36
RAD	85.04	45.69	68.05	34.72	187.50
HOS	22.48	6.24	22.22	9.72	34.72
Other	8.48	2.45	7.63	3.47	13.19
TOTAL	1653.81	1333.71	1109.02	352.08	5414.58

Table 3. Comparison of total hospital costs with regard to demographic variables and industry sector involved (2006 US$)

Variable	Total cost					*p* value
	Mean	Std.	Median	Min	Max	
Sex						
Male	510.90	951.85	138.19	25.00	5,414.58	<0.01
Female	225.75	541.37	94.09	20.14	3,604.86	
Age						
15–24	511.48	937.82	129.86	20.14	5,275.69	0.54
25–34	389.86	784.80	131.94	25.00	5,414.58	
34 >	472.62	1,017.76	126.38	25.00	5,345.14	
Sector						
Metal and machinery	357.98	749.72	126.38	25.00	5,275.69	<0.001*
Textile	208.97	391.34	100.00	20.14	2,363.19	
Construction	823.49	1,229.58	210.41	25.00	5,414.58	
Mining	654.77	1,008.94	171.18	40.97	5,345.14	
Transportation	338.07	676.04	126.38	41.67	3,603.47	

*In binary comparisons, there were statistically significant differences between the metal and machinery and construction, the textile and construction, and the textile and mining sectors.

Table 3 shows a comparison of total hospital costs with regard to sex, age and the industry sectors involved. Male patients' hospital costs were significantly higher than those of females ($p<0.01$). Hospital costs in the construction industry were found to be significantly higher than in the metal and machinery and textile industries ($p<0.001$) (Table 3).

Working days lost

The mean number of lost working days due to occupational injury for the whole sample, for patients discharged from the ED and for patients admitted to the

Table 4. Loss of workdays depending on different variables

Variable	Working days lost					*p* value
	Mean	Std.	Median	Min	Max	
Sex						
Male	19.3	24.6	10.0	1.0	126	<0.001
Female	10.6	18.3	5.0	1.0	110	
Age						
15–24	18.8	25.0	10.0	1.0	120	0.29
25–34	16.8	21.6	8.0	1.0	115	
34>	16.6	25.6	6.0	1.0	126	
Work Days						
Weekday	16.5	22.1	7.0	1.0	120	0.50
Weekends	21.1	28.4	8.0	1.0	126	
Injury hours						
8–16	17.3	23.35	7.0	1.0	120	0.16
16–24	17.5	25.3	7.0	1.0	126	
24–08	18.6	20.0	10.0	1.0	69	
Sector						
Metal and machinery	16.3	22.6	7.0	1.0	111	<0.01*
Textile	10.9	17.5	5.0	1.0	110	
Construction	28.1	30.7	15.0	1.0	115	
Mining	23.5	26.0	10.0	1.0	112	
Transportation	13.3	17.0	7.0	1.0	87	

*In binary comparisons, there were statistically significant differences between the textile and construction, and the textile and mining sectors.

hospital were 17.6 ± 23.7, 7.2 ± 5.4 and 54.7 ± 26.4 d, respectively (p<0.001).

The mean length of stay in hospital was found to be 5.11 ± 2.7 d for hospitalized cases. Lost working days were listed with respect to other variables in Table 4. The mean number of lost working days due to OI of male workers were significantly higher than that of women (p<0.001). On the other hand, the mean number of working days lost in the construction and mining sectors were significantly higher than that in the textile sector (p<0.01) (Table 4).

Discussion

Deficiencies in record keeping hampers proper detection of incidences of OI throughout the country, similar to the situation in many other countries. Records overrepresent more serious injuries that mandate prompt referral to ED and those that require forensic registration.

The present study is unique in investigating financial losses and workdays lost due to OI in Turkey. A victim of an OI was found to have a total mean direct medical cost of US$1,653 and had a median cost of US$1,109. For those discharged from ED, the mean cost was US$117 and the median was US$97 at our university hospital. The total mean costs and mortality rates associated with OI in the construction sector were higher than in others. The injury costs of male workers were higher than those of female workers.

All prices and fees are determined centrally by The Ministry of Health for the whole country, thus similar costs are expected throughout Turkey. However, costs can differ depending on the nature of the sector and severity of the injury.

Regarding the loss of workdays, an average of 54 d were found to be lost by hospitalized patients, while only seven days were lost by those treated in the ED. The construction and mining sectors had the highest numbers of working days lost, and men lost more workdays due to OI than women.

Researchers have pointed out that indirect costs of OI are two to three times higher than the direct costs. While the direct cost can be estimated based on the severity and nature of the accident, the indirect cost is the biggest obstacle for a reliable prediction of the total cost of accidents[12, 13]. There is no data in the literature indicating a proportional relationship between medical costs and direct costs or total costs. Only one study of workplace-related injuries in the US estimated the total cost of accidents which was up to 3.5 times the medical costs. A major drawback of that study was that it combined the

costs of employers, workers and the government[14].

Major limitation of the present study was its reliance upon workers' reports to determine the causes of OI. This method is flawed by the possibility of pressures from employers and other social and/or economic and cultural factors. Ideally, detailed site inspection should underlie the method of recording the causes of these injuries.

Two elements are suggested as predictors of direct costs following OI, namely, the type of injury and the industry sector connected with the injury[15]. The results of the present study also support the notion that the sector of industry in which the occupational injury occurred has a direct impact on the costs. For example, the construction and mining sectors had a higher rate of major accidents. The high figures for male worker occupational injuries can be attributed to the fact that male workers predominate in fields such as mining and construction.

Developed countries have long recognized the importance inherent in the losses associated with OI and have promoted the preventive measures to prevent them against it to an advanced level. On the other hand, developing countries have limited and scarce data resources resulting in rough estimates regarding the extent of OI and corresponding losses.

High-risk areas of OI should be determined and due measures taken, especially in developing countries which have limited and scarce data resources regarding the extent of OI and their corresponding losses.

References

1) Takala J: Global estimates of fatal occupational accidents. Epidemiology 10, 640–646 (1999)
2) Santana VS, Araujo-Filho JB, Albuquerque-Oliveira PR and Barbosa-Branco A: Occupational accidents: social insurance costs and work days lost. Rev Saude Publica 40, 1004–1012 (2006)
3) Schoemaker MJ, Barreto SM, Swerdlow AJ, Higgins CD and Carpenter RG: Non-fatal work related injuries in a cohort of Brazilian steelworkers. Occup Environ Med 57, 555–562 (2000)
4) Rydlewska-Liszkowska I: Costs of occupational diseases and accidents at work in Poland. Med Pr 57, 317–324 (2006)
5) Arokiasamy JT and Krishnan R: Some epidemiological aspects and economic costs of injuries in Malaysia. Asia Pac J Public Health 7, 16–20 (1994)
6) Fayad R, Nuwayhid I, Tamim H, Kassak K and Khogali M: Cost of work-related injuries in insured workplaces in Lebanon. Bull World Health Organ 81, 509–516 (2003)
7) Liu YH, Lin MR and Wang JD: Cost and determinants of morbidity from work related disabling injuries in Taiwan. Occup Environ Med 52, 138–142 (1995)
8) Noe R, Rocha J, Clavel-Arcas C, Aleman C, Gonzales ME and Mock C: Occupational injuries identified by an emergency department based injury surveillance system in Nicaragua. Inj Prev 10, 227–232 (2004)
9) Perry MJ, Sun BX, Zhang HX, Wang X and Christiani D: Emergency department surveillance of occupational injuries in Shanghai's Putuo District, People's Republic of China. Ann Epidemiol 15, 351–357 (2005)
10) Wong TW: Occupational injuries among construction workers in Hong Kong. Occup Med (Lond) 44, 247–252 (1994)
11) Social Security Statistics, Turkish Statistical Institute (TURKSTAT). (online), available from <http://www.turkstat.gov.tr/VeriBilgi.do > (accessed 2007-07-07).
12) Leigh JP, Cone JE and Harrison R: Costs of occupational injuries and illnesses in California. Prev Med 32, 393–406 (2001)
13) Leigh JP, Markowitz SB, Fahs M, Shin C and Landrigan PJ: Occupational injury and illness in the United States. Estimates of costs, morbidity, and mortality. Arch Intern Med 28, 1557–1568 (1997)
14) Leigh J, Markowitz S, Fahs M, Landrigan P. Costs of Occupational Injuries and Illnesses. Michigan: The University of Michigan Press, 2000: 8–9.
15) Sun L, Paez O, Lee D, Salem S and Daraiseh N: Estimating the uninsured costs of work-related accidents, part I: a systematic review. Theoretical Issues in Ergonomics Science 7, 227–245 (2006)