Occupational Health / Safety in the World

A Significant Outcome of Work Life: Occupational Accidents in a Developing Country, Turkey

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Abstract: **A Significant Outcome of Work Life: Occupational Accidents in a Developing Country, Turkey: O. Alp ERGÖR, et al. Department of Public Health, School of Medicine, Dokuz Eylül University, Turkey**—Occupational accident rates are high in the developing world and they are among the crucial indicators of work life. The data on serious occupational accidents in three years from the Aegean Region of Turkey were analyzed in order to define the working life situation. The data for 1995–97 were obtained from The Social Insurance Institution. Variables were defined for workers, work environment and working conditions for descriptive analysis. The relationships between these variables and outcomes of the occupational accidents were analyzed. The fatality risk was 2.6 times higher for mining and construction than for the production sector ($p < 0.001$), and 1.6 times higher for evening and night shifts than for day shifts ($p < 0.01$). Mortality from being struck by something, falls, motor vehicle accidents and electrocutions were significantly higher than being cut or in, under or between objects (OR 3.5, 8.7, 23.1, 26.1 respectively and $p < 0.01$). As a conclusion, it was suggested that within the globalization picture, occupational health problems in the developing world should be explored intensively in order to establish effective prevention programs.

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Key words: Occupational accidents, Work environment, Working conditions, Occupational health, Turkey

International Labor Organization's (ILO) projections point out that nearly 1/3 of the occupational attributed deaths occur due to accidents¹⁾. According to ILO figures approximately 250 million occupational accidents occur

each year, with an overall fatality rate of 14.0 per hundred thousand. It is an important fact that this rate is underestimated as stressed in the same sources^{2,3)}. WHO and ILO have predicted significant worsening in occupational health indicators in the developing world. Technology transfer is thought to play a crucial role in this^{4–6)}. The developing world comprises 60% of the global workforce and 80% of this workforce is employed in small-scale enterprises and the informal sector which involve inherently heavy and dangerous work^{1,7)}. Only 5–15% of this population has access to any form of occupational health service. In this context it is possible to say that traditional occupational problems such as industrial accidents and occupational diseases would remain important in terms of priority in the contemporary era. Turkey's occupational health problems are quite similar to the picture drawn by ILO and WHO. According to the national statistics, the accident frequency rate is 14.3 per thousand, the fatal accident rate is 13.9 per hundred thousand and the accident fatality rate is 976.7 per hundred thousand; and from all causes the fatality rate was 22.3 per hundred thousand in 2000⁸⁾. But the denominator of these indicators (rates) is not the country's 23 million economically active population, but 6 million workers covered by the compulsory Social Insurance system for employees.

Industrial accidents are crucial in determining the indicators of work life^{9, 10)}. The objective of this study was to examine the notified occupational accidents in 3 years within the workforce, work environment and working conditions.

Methods

In Turkey data from The Social Insurance Institution (SII) provide the most reliable and complete information on industrial accidents. But workers who are in the informal sector, agriculture, white collar workers in government offices, seafarers and self employed are not covered in this surveillance system. Employers are

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Table 1. Occupational health indicators for Turkey and the Aegean Region of Turkey (*).

Location	Number of enterprises ($\times 1,000$)	Distribution of small scale enterprises** (%)	Number of employees under SII (1,000)	Percentage of employees (%) covered by SII in total population
Aegean Region	119.0	73.0	759.0	9.8
Turkey	753.0	98.0	5,254.1	7.8

Occupational Accident Indicators		
	Fatality Rate (10^{-5})	Deaths (no)
Aegean Region	46.6	351
Turkey	22.3	1,173

Unionization		
	Unionized workplaces %	Unionized workers%
Aegean Region	7.0	Unknown
Turkey	11.7	56.8***

*Source: Statistical Yearbook 2000, Turkish Republic Social Insurance Institution, 2001.

**Workplaces with less than 49 workers

***The unionization ratio was declared to be 16.6% according to the Yearbook For 97–99 of the Petroleum, Chemical and Rubber Workers' Union of Turkey.

Table 2. Variables used in the analysis

Employee	Age: (child workers 18 and less; old age 45 and over; young and middle age 19–44) Sex
Work Environment	Size of the enterprise: (employs 49 or fewer than 49 workers; employs 50 workers or more) Economic activity: Service, production, mining and quarrying, construction Type of accident: Struck by or against; cut in, under or between (CIUB); falls from or at any level; motor vehicle; explosions; all others
Working Conditions	Days : Weekdays, weekends Daily work hours: 8 h of work/d, overtime (9 h or more/d) Shift: Day 09.00–17.00, evening 18.00–24.00, night 00.00–08.00
Outcome	Death and all other injuries

obliged to report all accidents to the SII within 2 days. Labour Inspectors from the Ministry of Labour and Social Security (MLSS) have to conduct an investigation at the accident site. The Labour Inspectorate investigates only accidents that result in death, loss of an organ or long term hospitalization, which are classified as serious accidents. This study was conducted on the 1995–1997 data on serious accidents from the six provinces in the Aegean Region.

The Aegean Region is one of the leading areas of the country in terms of production and commerce, and is densely populated with 11.5% of Turkey's population. The workforce covered through the compulsory Social

Insurance System is 14.5% of the country's total. The Aegean Region's and Turkey's fundamental occupational health indicators are shown in accident analysis covered employees' age and sex, work environment (enterprise size-number of employees, economic activity or sector, type of accident), working conditions (days, hours of work and shift work) and outcomes (death or injury). The type of accident is an indicator of the risk that the workers are exposed to; therefore it was considered as a work environment variable (Table 2). Types of the accidents were classified according to the "International Labour Organization Bureau of Statistics Classification of Industrial Accidents According To Type of Accident"⁽¹¹⁾.

Table 3. Percent distribution of accidents during 1995–1997 in the Aegean Region according to the study variables, Turkey

Demographic Characteristics of Employees	%	n
Gender		
Female	6.0	101
Male	93.9	1,590
Unknown	0.1	3
Age Groups		
<= 18	8.8	149
19–44	78.3	1,327
45 +	12.9	218
Characteristics of Work Environment		
Numbers of Employees		
<50	63.2	1,071
>= 50	28.9	489
Unknown	7.9	134
Economic Activity		
Mining and quarrying	11.8	199
Production	52.0	882
Construction	23.1	391
Services	11.5	212
Unknown	1.6	10
Type Of Accident		
Caught in, under or between something	35.6	603
Fall at the same level or from an elevation	21.0	355
Struck by or struck against	15.3	259
Motor vehicle accidents	10.8	183
Electrocution	6.0	102
All others*	9.5	161
Unknown	1.8	31
Characteristics of Working Conditions		
Accident Day		
Week Days	79.5	1,345
Weekends	16.8	286
Unknown	3.7	63
Daily Working Hours		
8 hours work/day	90.5	1,533
Overtime	5.0	84
Unknown	4.5	77
Shift Work		
Day shift	61.1	1,035
Evening	15.6	265
Night	11.1	188
Unknown	12.2	206
Outcomes		
Fatal accidents	20.7	351
Injuries	79.3	1,343
TOTAL	100.0	1,694

*Includes explosions, contact with chemical or physical agents, drowning.

Table 4. Percent distribution of fatal and nonfatal accidents during 1995–1997 in the Aegean Region according to the study variables, Turkey.

Variables	Fatal accidents* n: 351	Non-fatal accidents* n: 1343
Age Groups ^a		
<= 18	7.7	9.1
19–44	78.6	78.2
>= 45	13.7	12.7
Enterprise Size ^a		
<50	27.6	32.3
>= 50	72.4	67.7
Type of Accident ^b		
Struck by	7.5	17.7
CIUB	5.2	44.4
Falls	29.2	19.3
Motor vehicle	26.3	7.0
All others	31.8	11.6
Economic Activity ^b		
Production	25.0	59.5
Service	19.5	10.8
Mining and quarrying	18.4	10.1
Construction	37.1	19.6
Work Days ^a		
Weekdays	81.4	82.7
Weekends	18.6	17.3
Daily Working Hours ^b		
8 hours work/day	91.3	95.7
Overtime	8.7	4.3
Shift Work ^b		
Day shift	59.7	72.0
Evening and night shift	40.3	28.0

^a: $p > 0.05$, ^b: $p < 0.01$, *Column percentage

Accidents were classified as “struck by or against”, “cut in, under or between” (CIUB), “falls from or at any level”, “motor vehicle accidents”, “explosions” and “all others”. The MLSS’s List of Sectors of Industry was used to determine the sector. The SPSS 11.0 software package was used for analysis. Univariate analysis (chi-square test) was done to define statistical differences between fatal and non-fatal (serious) accidents according to study variables. As the next step in the analysis, logistic regression was used to define the risk of fatality, adjusting for all known risk factors which may effect as confounding variables.

Results

Total numbers of accidents were 1694 between 1995 and 1997. Among them 351 (20.7%) were fatal. The average occupational accident rate was 79.2 per hundred thousand, and the fatality rate was 16.4 per hundred thousand for the 3 year period (1995–1997). As seen in Table 3, of the workers involved in the accidents 93.9 % were male. Mean age was 32.3 (SD 10.7). Approximately 30% of the child worker cases were reported from construction, mining and quarrying sectors. Age groups which were considered under the high risk for occupational accidents, such as child workers and aged workers, constituted 21.7% of all cases.

Among the enterprises 63.0% employed less than 50 workers (small scale enterprises). Approximately half of those in the study group (43.0%) were from workplaces with less than 9 employees. Reported occupational accidents mainly came from three sectors, production 52.0%, construction 23.1% and mining and quarrying 11.8%. The majority (35.6%) of the accidents were in the “CIUB” category and 21.0% were falls. Of all accidents, 16.8% occurred during the weekends, 5.0% during overtime work and 26.7% during evening and night shifts.

The distribution of fatal accidents and injuries did not show any significant differences according to age group, size of the enterprise or working days ($p > 0.05$), but working in the evening and night shift, overtime work, and sectors other than production resulted in significantly higher fatal accidents ($p < 0.05$). Fatal accidents were seen more frequently in accident types other than CIUB and struck by something ($p < 0.01$).

Although univariate analysis revealed statistical differences for only four variable groups (type of accident, economic activity, daily working hours and shift work–Table 4) other variables considered as having a confounding effect were included in the logistic regression model in order to define the risk of a fatality. Only the type of accident, economic activity and shift work were present in the reduced model (Table 5). When CIUB was defined as a reference category, the odds ratios were 3.5 for struck by something (95% CI 1.7–7.1), 8.7 for falls (95% CI 4.5–16.6), 23.1 for motor vehicle accidents (95% CI 11.8–45.3), 26.1 for electrocution (95% CI 12.3–55.4) and 9.9 for all others (95% CI 5.0–19.6) including explosions, drowning, or contact with chemical agents. Under the economic activity category, the odds ratio for mining was 2.5 (95% CI 1.6–4.1) and for construction 2.6 (95% CI 1.6–4.0) compared to the production sector. Night and evening shifts were grouped together for logistic regression, and the odds ratio was 1.6 (95% CI 1.1–2.3) when day shift was taken as the reference.

Table 5. Risk factors related to fatal injuries: Results of logistic regression

	Categories	p	Odds Ratio	95% CI
Full model				
Sex	Male	0.164	1.60	0.82 – 3.11
Age group		0.198		
	19–44		Ref.	
	18 & less	0.245	1.43	0.78 – 2.60
	45 +	0.218	0.75	0.47 – 1.18
Enterprise Size	<50	0.642	1.10	0.75 – 1.58
Economic Activity		0.000		
	Production		Ref.	
	Mining	0.000	2.50	1.55 – 4.01
	Construction	0.000	2.41	1.53 – 3.79
	Service	0.155	1.46	0.86 – 2.44
Type of Accident		0.000		
	CIUB		Ref.	
	Struck	0.000	3.62	1.79 – 7.29
	Falls	0.000	9.05	4.72 – 17.32
	Motor v.	0.000	24.56	12.40 – 48.61
	Electrocutions	0.000	26.10	12.26 – 55.47
	Others	0.000	10.60	5.31 – 21.04
Work Days	Weekends	0.425	1.20	0.78 – 1.78
Daily Working Hours	Overtime work	0.935	0.97	0.43 – 2.13
Shift Work	Evening and night	0.010	1.65	1.13 – 2.41
Reduced model				
Economic Activity		0.000		
	Production		Ref.	
	Mining	0.000	2.58	1.61 – 4.11
	Construction	0.000	2.61	1.68 – 4.03
	Service	0.140	1.46	0.88 – 2.42
Type of Accident		0.000		
	CIUB		Ref.	
	Struck	0.000	3.58	1.78 – 7.17
	Falls	0.000	8.71	4.56 – 16.62
	Motor v.	0.000	23.15	11.83 – 45.30
	Electrocutions	0.000	26.17	12.35 – 55.43
	Others	0.000	9.91	5.00 – 19.61
Shift Work	Evening and night	0.005	1.67	1.16 – 2.39

Discussion

The study database consisted of industrial accidents reported with an outcome defined as death or serious injury during 1995–1997 in the Aegean Region of Turkey. Accident surveillance system and inspections of accidents

are restricted to serious accidents which result in death, loss of an organ or a long period of hospitalization. Nonetheless, the main constraint about this system is that reporting is carried out mainly by considerably bigger enterprises which operate in the formal sector. Even though, almost 2/3 of cases in the data reported from

small scale enterprises, loss of near misses and small accidents indicate a serious limitation to the interpretations. Despite the restrictions inherent to the data base, as Lortie and Rizzo point out in their comprehensive article, accident information “deserves closer attention” that might give some useful clues to define priorities and strategies for prevention^{2, 10, 12}.

High risk groups consisted of 1/5 of the study population, and among them almost 1/3 of the child worker cases were reported from high risk sectors (construction, mining and quarrying sectors)^{13, 14}. These findings underline an important priority situation from the national protection programs perspective.

Although half of the cases were from workplaces with less than 9 employees, distribution of fatal accidents according to the size of the enterprise was not significantly different (Table 4, $p > 0.05$). Most of the small scale enterprises carry on their activities in the informal economic sector, and underreporting is more frequent in these enterprises. Therefore, the differences in fatal accidents could be diminished.

The fatal accident distribution according to working time was a significant finding. Working time was discussed under three categories: the hours of work during the working days, shift work and the day of the week. 8.7% of fatal accidents occurred during overtime work (9 or more work hours per day) ($p < 0.01$), 40.3% during evening or night shifts ($p < 0.01$), but distribution was not significantly different on weekdays from that on weekends. Overtime work or night work is an important risk factor for getting injured at work¹⁵. With the increased labour flexibility and deregulation, it is possible to see more employees working overtime or at evening and on night shifts^{16, 17}. Multivariate analyses reveal that night and evening shifts have a 1.6 times greater fatality risk than day shifts. This fact indicates that prevention strategies should be studied for the changes of working conditions.

High odds ratios with solid confidence intervals showed that accident types with well known universal precaution procedures, such as falls, motor vehicle accidents and electrocutions were among the leading causes of death, which is consistent with the literature^{18–20}.

Contrary to reports in the literature^{19, 20} CIUB cases were only 5.2% of fatal accidents. This could be explained by the fact that CIUB accidents are quite different in developing countries than reported for the developed world. Small scale workplaces, which were mainly in the production sector, reported most of the CIUB cases. In small enterprises, the extremities were caught in, under or between machinery parts or operation points, which would result in a serious accident such as amputation rather than death. Due to the nature of CIUB cases in Turkey, they are considered as a reference category for fatal accidents in logistic regression. Motor

vehicle accidents and electrocutions have a tremendously high risk of fatality (OR 24.5 and 26.1).

The construction sector continues to be an important risk factor for fatal accidents^{2, 8}. Lack of effective prevention procedures could cause a higher fatality rate in this sector. Half of the accidents were reported from production (52.0%) and almost 1/4 from the construction sector. Construction and mining cases were almost 2.5 times as fatal as the production sector (95% CI: 1.6–4.1 and 1.6–4.0). Considering the distribution of small scale enterprises, it is consistent to find more fatal accidents in these labour intensive sectors^{4, 20, 21}.

In developing countries, despite the limitations to the data quality, analysis of routine data may still reveal important information²². Exploration of three years of serious industrial accidents, in the context of worker, work environment and working conditions, emphasized some important key points. Most of the accidents were preventable with the implementation of existing regulations and rational utilization of resources. In the context of globalization it is expected that the share of small size enterprises will be growing and flexible production will be more common. Therefore, if precautions were not considered immediately, the effect will be seen as worsening of occupational accident indicators.

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